

STUDY OF THE TECHNOLOGICAL APTITUDE OF FIBERS FROM NEW VARIETIES OF COTTON (*Gossypium hirsutum* L.) IN CAMEROON

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ABSTRACT

In the Sudanese–Sahelian zone of Cameroon, cotton farming is a major driver of rural agricultural development and plays a key role in poverty alleviation. However, numerous environmental, technical, and economic constraints underscore the need for cotton varieties with high yield potential, strong resilience, good local adaptability, superior fiber quality, and above all, better compliance with international technological standards. This study aimed to evaluate the technological performance of four new cotton (*Gossypium hirsutum* L.) fiber varieties (L2026, L2033, L2146 and L2168) under the agro-climatic conditions of the Sudanian–Sahelian zone of Cameroon. These genotypes were compared to two reference varieties, IRMA Q302 and IRMA A2249. Field experiments were conducted during the 2023/2024 and 2024/2025 seasons at the, Maroua and Garoua sites. The varieties L2026, L2030, L2033 and L2146 were tested using a Fisher block design with six repetitions. The harvested cotton was ginned using a continental-type 20-saw gin and Technological properties of the fibers were measured using a USTER HVI 1000 system, focusing on upper-half mean length (UHML), uniformity index, strength, elongation, maturity, fineness, micronaire and color parameters (Rd and +b). The results show that all four varieties meet or exceed the minimum standards for African cotton quality. However, the technological properties of the fiber vary significantly between varieties but do not vary according to growing regions or years. New variety L2168 stands out for its fiber length (29.3 mm) and regular uniformity (85.2%), while L2146 has short fibers (25.4 mm) but the finest quality (115.5 mtex). L2033 and the control Q302 have the strongest fibers, thus very resistant (31.5 and 31.2 g/tex), and L2026, L2033, and L2146 show the best reflectance (75.8 to 76.7%). For intermediate values and other characteristics, the varieties are similar. Adaptability of these varieties are observed in both growing regions, except for L2146, which remains limited by its short fiber length

and provided that the recommended agronomic and post-harvest practices are followed. The greatest variations are due to the influence of agroecological conditions on the characteristics of the fibers. These findings highlight the potential of these varieties to improve the competitiveness of Cameroonian cotton fiber on international markets, while emphasizing the need for continuous monitoring of technological parameters and appropriate seed management. It is nonetheless recommended to confirm these results under real conditions in farming environments through multifocal trials, while further studying the technological characteristics of the seeds.

Keywords: Quality, technological characteristics, fibers, varieties, Cameroon

1. INTRODUCTION

The current dynamics of agricultural development, both globally and in sub-Saharan Africa, are marked by the search for production systems that are at once productive, resilient and economically viable. In this context, cotton cultivation occupies a strategic position in many African rural economies, particularly in Cameroon, where it represents a major cash crop for smallholder farmers and a key source of export earnings (PR-PICA, 2024).

Cotton is an essential source of monetary income for millions of small-scale farmers. Its fiber is used in the textile industry for the production of clothing fabrics, household linen, ropes, fishing nets, medical supplies, tarpaulins, shoes, as well as industrial products such as paper, explosives, and even plastics (Mosiniac, 2005). Furthermore, the seeds resulting from ginning are processed in oil mills or used as seeds and are involved in the production of edible oils, margarines, cosmetics, soaps, and even biofuels (Courtant *et al.*, 1991; Estur, 2006). The cake, a residue from oil extraction, is an important source of protein for animal feed, placing cotton second worldwide after soy as a plant-based protein resource (Estur, 2006).

The Cameroonian cotton sector operates in an international context characterized by fluctuating prices, variable demand and increasingly stringent quality requirements. In recent years, the sector has faced a combination of challenges, including downward pressure on world prices, rising production costs and heightened competition from synthetic fibers. These constraints tend to limit the profitability of cotton production and reduce producers' incomes, despite slight increases in production volumes. In the first quarter of 2025, exports of raw Cameroonian cotton generated 47 billion CFA francs (\$83.5 millions) for a volume of 42,000 tons (+2.4%), according to the National Institute of Statistics (INS). During the same period in 2024, revenues were already 47 billion CFA francs for 41,000 tons, indicating stable income despite a slight increase in volumes. (SODECOTON 2024).

Over the past decade, cotton cultivation in Cameroon has also been confronted with numerous agro-climatic constraints, including irregular rainfall, recurrent dry spells, high temperatures and

progressive soil degradation. In addition, harvest and post-harvest practices (picking, sorting, storage and ginning) can significantly affect the technological quality of fibers and, consequently, the selling price on international markets

Over the past ten years, this crop has faced enormous problems such as stagnating production and declining fiber quality. Agronomic efforts have helped increase production to address this, and research has proposed *Gossypium hirsutum* cotton varieties that are more productive and perform better in ginning (Amma Talba *et al.*, 2025). The sustainable intensification of cotton production in Cameroon thus implies not only maintaining or improving yields, but also ensuring consistent and competitive fiber quality. The technological properties of cotton fiber (length, strength, uniformity, fineness, maturity, color, etc.) are now central to the evaluation of new varieties and to the positioning of African cotton on the world market. However, ensuring cotton quality, particularly of marketed fibers, is a major concern for sector stakeholders. Cotton quality depends on the variety, intrinsic and extrinsic factors related to agro-climatic conditions, and post-harvest treatments.

Thus, it is with a view to the sustainable intensification of cotton cultivation that our study allows us to offer producers, ginners, and spinners the varieties best suited to the area, more efficient in quality, and better aligned with international technological standards. This research is situated within the perspective of tropical agronomy, closely linked to the agroecological and socio-economic issues of the Sudanian-Sahelian cotton-growing regions of Cameroon. In this perspective, the present study was undertaken to assess the technological aptitude of four new cotton fiber varieties developed for the Sudanian–Sahelian zones of Cameroon. More specifically, it aims to: characterize the main technological parameters of the fibers produced by these varieties, analyze their performance under different agro-climatic conditions and production years, and identify varieties with the best potential for enhancing the quality and competitiveness of Cameroonian cotton.

2. MATERIALS AND METHOD

2.1 Study Area

The study was conducted during the 2023/2024 and 2024/2025 rainy seasons in two representative cotton-growing locations of the Sudanian–Sahelian zone of Cameroon: Sanguéré (Garoua, North region), and Djarengol-Kodek (Maroua, Far North region). These sites are characterized by a dry tropical climate with unimodal rainfall, marked inter-annual variability, and mean seasonal temperatures ranging between 21–38 °C. Altitudes range from 295 to 378 m Soils are predominantly ferruginous and sandy clay, weakly structured, and susceptible to nutrient depletion (INS, 2023). (Figure 1) rainfall data are presented in Table 1 (SODECOTON, 2025).

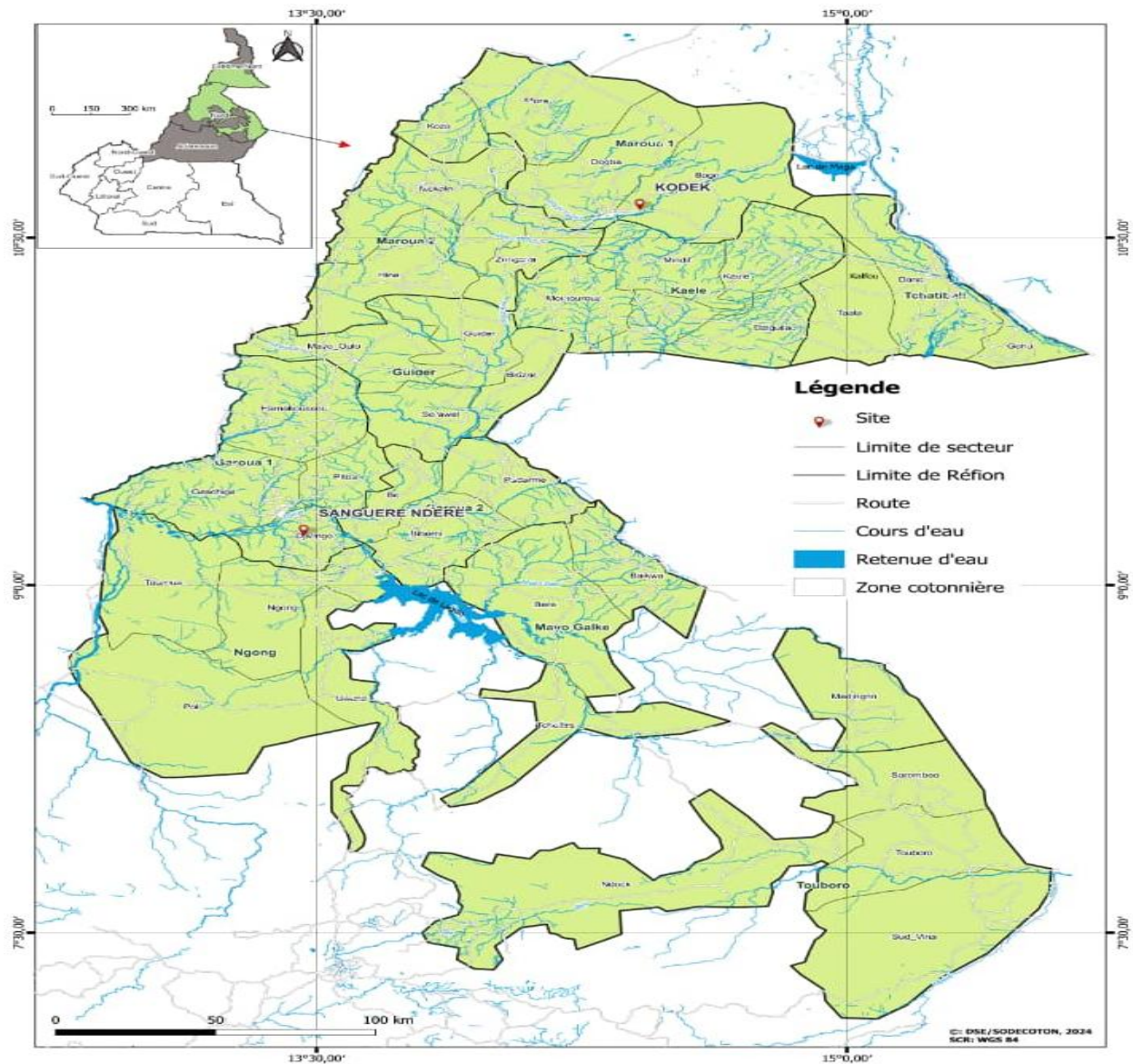


Figure 1: Map of the study area

2.2 Rainfall Monitoring and Climatic Data

Total seasonal rainfall for both cropping seasons were used to characterize the climatic context and compare inter-site variability. Detailed rainfall values appear in Table 1.

Table 1: Rainfall for the 23/24 and 24/25 campaigns (SODECOTON, 2025)

Campagne	Site	Region	Total Rainfall	Total Days
23/24	Kodek	Far North	560.17 mm	32
	Sanguéré	North	1228.7 mm	57
24/25	Kodek	Far North	1032 mm	45
	Sanguéré	North	1203 mm	62

2.3 Plant Material

The study evaluated four new cotton varieties developed by IRAD, IRMA L2026, L2033, L2146, and L2168 and compared them with two reference cultivars: IRMA Q302 (widely cultivated) and IRMA A2249 (in the scaling phase). The characteristics of the newly developed lines are presented in Table 2. These varieties were selected through genealogical breeding carried out under the improvement program (SODECOTON, 2022).

Table 2: Characteristics of new varieties (SODECOTON, 2022)

New Varieties	Characteristics
1. IRMA L2026	It is early maturing and has a good seed cotton yield. At ginning, its fiber yield is higher than the controls.
2. IRMA L2033	It is early maturing, has a good field yield, and a high fiber rate at ginning.
3. IRMA L2146	It is productive and has large seeds with good fiber
4. IRMA L2168	It is early maturing with good field yield and high fiber content at ginning.

2.4 Experimental Design

Trials were established using Fisher block design with six varieties and six replications per site. Each plot consisted of four rows, with standardized spacing between and within rows. Border rows were included to minimize edge effects. Treatments were fully randomized within each block.

2.5 Equipment and Inputs

Standard field equipment was used for crop establishment and data collection, including tractors, sprayers, hygrometers, rulers, ginning devices, and laboratory tools. Fertilizers (NPK and urea), herbicides, and insecticides were provided by SODECOTON following recommended commercial

formulations. The 20-saw continental-type ginner for ginning samples, the hygrometer for moisture control and the chronometer for measuring ginning speed, the USTER HVI 1000 high-capacity measuring chain with fibre passage through the 'System Testing' consisting of three modules (the micronaire module, the colorimetry module and the length module), compartments that made it possible to determine: fibre length, uniformity, tenacity, elongation, micronaire index, fibre maturity, fineness, reflectance and yellow index in accordance with standards, under controlled temperature and humidity conditions (21 ± 1 °C, humidit  relative 65 ± 2 %). Trolleys for fibre conditioning.



Figure 2: Gin continental 20-saw.



Figure 3: Sample packaging

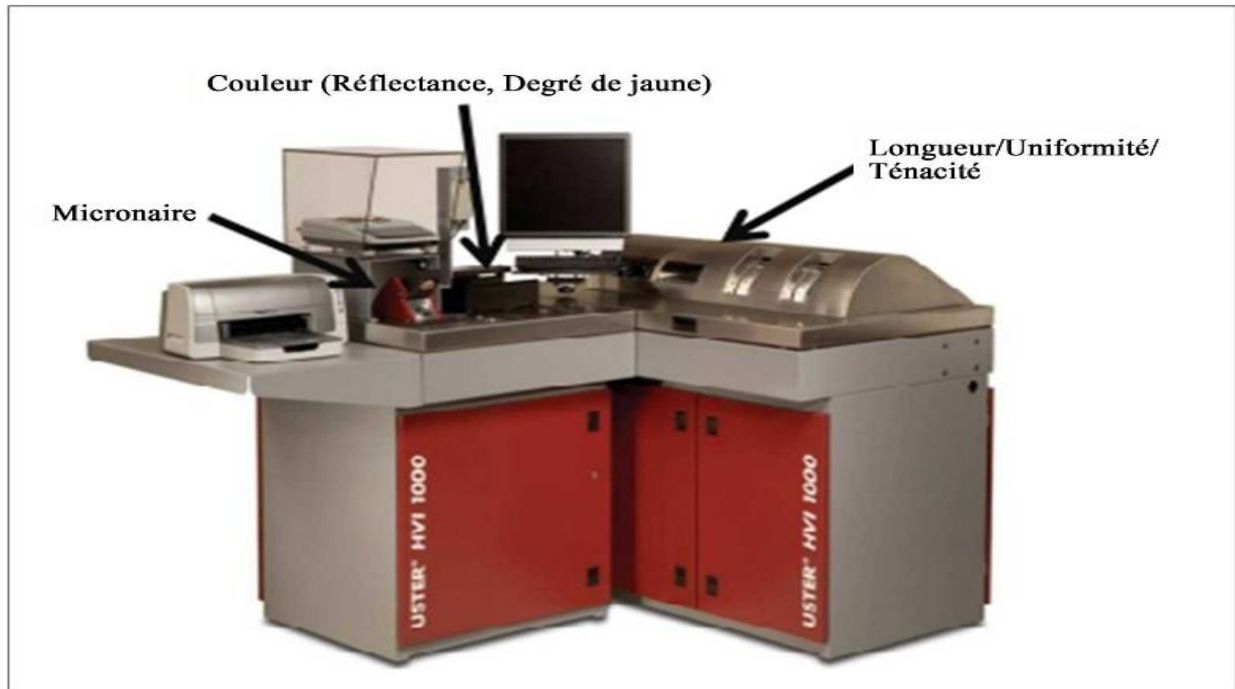


Figure 4: HVI Model 1000/1000.



Figure 5: Integrated measuring chain Model 1000/1000

2.6 Harvesting and sampling of cotton fibers

Cotton was harvested manually after full boll opening, following the usual practices of local producers. Harvesting was carried out by elementary plot and by variety. For each plot, a representative sample of seed cotton was taken and carefully labeled. These samples were then ginned using the 20-saw gin to obtain lint intended for technological analysis. For each variety and each plot, an approximately 100 g lint sample was prepared and conditioned before measurement.

The main technological characteristics of the fibers were measured using the USTER HVI 1000 system, which provides standardized data on several properties. The principles governing the measurement of these characteristics are presented in Table 3 (SODEFITEX, 2012).

Table 3: Principles for Measuring Technological Characteristics. (SODEFITEX, 2012)

PULLING en Pouces	UHML en 1/10^{ème} de pouces	32^{ème} de Pouce	UHLM en mm
1"1/32	1,02 – 1,04	33	25,908 - 26,416
1"1/16	1,05 - 1,07	34	26,670 - 27,178
1"3/32	1,08 - 1,10	35	27,432 - 27,940
1"1/8	1,11 - 1,13	36	28,194 - 28,702
1"5/32	1,14 - 1,17	37	28,956 - 29,718
1"3/16	1,18 - 1,20	38	29,972 - 30,480

Source :CIRAD

2.7 Taking of parameters

-Fiber Length (UHML):

The upper-half mean length (UHML) is usually expressed in inches and converted into millimeters. It corresponds to the average length of the fibers in the longest half of the sample. This parameter is crucial for spinning, since longer fibers generally allow higher yarn counts and better mechanical properties. Fiber elongation during testing must be controlled to avoid distortions that may affect the accuracy of length measurements. Classification thresholds for fiber length are given in Table 4 (SODEFITEX, 2012).

Table 4: Fiber length classification (Source SODEFITEX, 2012)

Length classification	Length (mm)	Length (pouces)
Silk. Short	< 25	15/16 - 1
Silk. Medium	25 – 28	1''1/32 - 1''3/32
Long silk	28 – 32	1''1/8 - 1''1/4
Extra long silk	33 – 40	<1''1/4

-Uniformity

Fiber length uniformity reflects the distribution of fiber lengths within the sample. It is expressed as a percentage and provides an indication of the homogeneity of the fiber bundle. A high uniformity index indicates a narrow length distribution and is associated with more regular yarns and fewer imperfections. Uniformity assessment classes are given in Table 5 (SODEFITEX, 2012).

Table 5: Uniformity Assessment (Source SODEFITEX, 2012)

Uniformity (UI, %)	Appreciation
>85	Very regular
83-85	Regular
80-82	Average
77-79	Irregular
<77	Very irregular
Source SODEFITEX, 2012	

-Fiber Tenacity: Fiber strength, often expressed in g/tex, reflects the resistance of fibers to breaking under tension. It is a key parameter for spinning performance, yarn strength and the durability of final textile products. Strength classes and their interpretation are presented in Table 6 (SODEFITEX, 2012).

Table 6: Appreciation of tenacity (Source SODEFITEX, 2012)

Tenacity HVI (Strengt g/tex)	Appreciation
>32	Highly resistant
28-32	Very resistant
26-28	Resistant
23-26	Medium
<23	Low
Source CIRAD	

-Elongation Elongation corresponds to the relative increase in fiber length at the moment of rupture during the tensile test, expressed as a percentage. It reflects the capacity of fibers to deform before breaking. Adequate elongation, combined with good strength, contributes to yarn flexibility and spinnability. Elongation assessment is presented in Table 7 (SODEFITEX, 2012).

Table 7: Appreciation of Elongation (Source SODEFITEX, 2012)

Elongation HVI (EI%)	Appreciation
7.6 and more	Very Good
6.8-7.5	Good
5.9-6.7	Quit good
5.0-5.8	Medium
<5.0	Low
Source CIRAD	

-Fiber Maturity:

Maturity depends on the degree of secondary wall thickening of the fibers. Immature fibers have a thin secondary wall and a relatively large lumen, whereas mature fibers show thicker walls and a smaller lumen. Maturity is influenced by environmental conditions (water availability, temperature, nutrition) and by the earliness of the variety. The relationship between the maturity ratio and the percentage of mature fibers is presented in Table 8 (SODEFITEX, 2012).

Table 8: Relationship between Maturity Ratio and Percentage of Mature Fibers (SODEFITEX, 2012)

Maturity Ratio (MR: 0 - 1,2)	Percentage of Mature Fibers (PM% : 0 - 100)	Appreciation
0,95 and more	85, 0 and more	Very ripe
0,85 to 0,95	76,0 to 85,0	Ripe
0,80 to 0,85	66,0 to 75,0	Slightly ripe
0,70 to 0,80	65,0 and less	Unripe

-Fiber Fineness:

Fineness is defined as the mass per unit length of fiber (mtex). It influences yarn count, spinning performance and fabric handle. Very fine fibers allow the production of finer yarns but may be more fragile, whereas coarse fibers yield coarser yarns. Typical values range from about 3.5 mtex for very fine fibers to values above 5 mtex for coarse fibers. Fineness assessment classes are given in Table 9 (SODEFITEX, 2012).

Table 9: Fineness Assessment (Source SODEFITEX, 2012)

Linear Fineness (H)	Standard Finesse (Hs)	Appreciation
<130	<160	Very Fine
130 - 155	160 - 185	Fine
160 - 185	190 - 220	Medium
190 - 215	225 - 260	Medium-Large
220 - 245	265 - 305	Large
>250	>310	Very Large

-Micronaire:

The micronaire index combines the effects of fineness and maturity. It is based on measuring the air permeability of a compressed fiber sample and expresses the specific surface area of the fibers. High micronaire values may indicate coarse or overly mature fibers, whereas very low values may reflect immature fibers. Micronaire appreciation scale is given in Table 10 (SODEFITEX, 2012).

Table 10: Micronaire appreciation (Source SODEFITEX, 2012)

Micronaire (Mic)	Appreciation
<3.0	Very Good
3.6-3.6	Good
3.7-4.2	Quit good
4.3-4.9	Medium
5.0-5.9	Low
>6.0	

-Fiber Coloration: Fiber color is commonly characterized by two main parameters: reflectance (Rd), which expresses the brightness or whiteness of the fibers, and the yellowness index (+b). These parameters are determined by colorimetry. High Rd and moderate +b values indicate bright, slightly creamy fibers appreciated by the market. Very low Rd values (<10) denote poor color quality and strongly depreciated fibers (SODEFITEX, 2012).

2.8 Technological analyses of fibres

Technological analyses were carried out on conditioned fiber samples using the USTER HVI 1000, under standard laboratory conditions (temperature 21 ± 1 °C and relative humidity $65 \pm 2\%$). For each variety, site and year, a set of samples was analyzed in order to obtain representative mean values for the main fiber quality parameters (UHML, uniformity, strength, elongation, maturity, fineness, micronaire, Rd and +b).

The analytical procedure comprised the following steps:

- conditioning of samples in a controlled atmosphere (21 ± 1 °C; $65 \pm 2\%$ relative humidity);
- registration and identification of each sample;
- arrangement of samples on trolleys or racks according to the sequence of analyses;
- analysis on the USTER HVI 1000 according to recommended protocols and calibration standards;

- automatic recording of measurement results and export of data for statistical processing.

2.9 Statistical analysis

All the data collected was entered into Excel, and we also had to extract the tables. All the data was analysed and subjected to ANOVA using STATBOX version 6.5 and SAS version 9.2 software, and the averages were compared using the NEWMAN KHEUL and Ryan-Einot-Gabriel-Welsch tests at a 5% threshold.

3. RESULTS

3.1 Fiber Technology in 2023 (Garoua and Maroua)

The results presented in Tables 11.1 and 11.2 summarize the main technological parameters of the fibers produced by the four varieties in 2023 at the Garoua (Sanguéré) and Maroua (Kodek) sites. Overall, the four varieties complied with the minimum quality thresholds defined for African cotton, particularly in terms of length, strength and micronaire. However, significant differences were observed among varieties for certain traits, such as UHML, strength and fineness, as well as between sites. At Sanguéré, varieties L2026 and L2146 tended to exhibit slightly higher fiber lengths and better uniformity indices than L2030 and L2033. At Kodek, the differences among varieties were generally less marked, but some variations in elongation and micronaire were noted. Statistical analysis revealed no significant differences among varieties for certain parameters, reflecting a relatively homogeneous technological level in 2023.

The results shown in the tables 11.1 and 11.2, highlight fiber length (UHML), uniformity index (UI), strength (TREN), elongation, micronaire, maturity index (IM), standard fineness (Hs), brightness (Rd), and yellowness index (+b) of the varieties compared in 2023 across the two sites. The ANOVA results reveal that for parameters such as fiber length, uniformity, strength, fineness, and reflectance, there is a highly significant difference between the varieties tested at both sites. The varieties L2033 and L2168 exhibited the longest fibers on average (29.4 and 30.0 mm, respectively), while the variety L2146 showed the shortest fibers (25.5 mm). The L2026 variety, meanwhile, is close to the controls. On average, it reached 85%, while L2146 recorded 80.4%. The variety L2168 showed the most consistent uniformity at 85.2% on average, whereas L2146 recorded a uniformity on average and the lowest (80.5%) are noted, with the other varieties being similar. Regarding tenacity, the controls Q302 and variety L2033 stood out with very strong fibers and the highest average values (31.4 and 31.2 g/tex respectively). L2026 was the least tenacious at 27.7 g/tex, while the other varieties were comparable to each other. The fibers of varieties L2026 and L2146 were the finest (119.6 and 115.4 mtex respectively), and those of L2168 were the coarsest at 146.6 mtex, with the other varieties being similar. Finally, fibers of L2033 showed the best reflectance at 77.1%, while the control Q302 had the lowest reflectance, with the other

varieties showing similar values. Regarding elongation, micronaire, maturity, and the yellowing index, ANOVA results revealed no significant differences between the varieties.

Table 11.1: Fiber Technology Settings (Sanguere) 2023

Varieties	UHML	UI	TREN	Elongation	Micronaire	I. Maturité	HS	RD	+b
A2249	28,4 ± 0,8 ^b	81,3 ± 1,6 ^c	30,7 ± 1,5 ^b	5,9 ± 0,2	4,0 ± 0,4	0,9 ± 0,01	129,7 ± 10,7 ^b	74,6 ± 1,9 ^c	11,2 ± 0,7
Q302	28,7 ± 0,9 ^b	81,3 ± 1,7 ^c	31,9 ± 1,6 ^a	5,9 ± 0,2	4,2 ± 0,3	0,9 ± 0,02	132,4 ± 12,1 ^b	73,8 ± 2,0 ^c	11,3 ± 0,8
L2168	29,5 ± 0,9 ^a	84,5 ± 1,7 ^a	30,9 ± 1,5 ^b	6,2 ± 0,3	4,6 ± 0,4	0,9 ± 0,01	145,8 ± 12,1 ^c	76,2 ± 2,0 ^a	11,6 ± 0,8
L2026	28,6 ± 0,8 ^b	81,7 ± 1,6 ^b	27,8 ± 1,4 ^c	5,8 ± 0,2	4,5 ± 0,4	0,9 ± 0,01	121,3 ± 10,1 ^a	74,3 ± 1,9 ^c	11,3 ± 0,7
L2033	30,1 ± 0,9 ^a	81,4 ± 1,6 ^c	31,1 ± 1,5 ^a	6,1 ± 0,3	4,3 ± 0,3	0,9 ± 0,01	124,5 ± 10,3 ^a	76,6 ± 2,0 ^a	11,2 ± 0,7
L2146	25,4 ± 0,7 ^c	80,5 ± 1,6 ^d	28,7 ± 1,4	6,4 ± 0,3	5,2 ± 0,5	0,8 ± 0,02	126,1 ± 10,5 ^a	75,2 ± 1,9 ^b	11,3 ± 0,7
Average	28,5 ± 0,9	81,9 ± 1,6	30 ± 1,5	6,0 ± 0,2	4,5 ± 0,4	0,9 ± 0,01	128,9 ± 10,7	74,9 ± 1,9	11,1 ± 0,7
Pvalue (Var)	**	***	***	ns	ns	ns	**	***	ns

In the same column, means followed by the same letter do not differ significantly at the 5% threshold. UHML: fiber length (mm); STR: strength (g/tex); ELG: elongation (%); MIC: micronaire; FIN: fineness (mtex); Rd: reflectance (%).

Table 11.2: paramètres Technologiques de la Fibre (Kodek) 2023

Variétés	UHML	UI	TREN	Élongation	Micronaire	I. Maturité	HS	RD	+b
A2249	28,2 ± 1,2 ^b	80,8 ± 1,7 ^d	30,8 ± 1,8 ^a	5,7 ± 0,2	4,1 ± 0,1	0,8 ± 0,01	125,8 ± 15,1 ^c	73,7 ± 1,9 ^d	12,4 ± 1,1
Q302	28,4 ± 1,1 ^b	80,8 ± 1,7 ^d	30,8 ± 1,7 ^a	5,7 ± 0,3	4,3 ± 0,2	0,8 ± 0,01	125,8 ± 15,1 ^c	73,7 ± 1,9 ^d	12,4 ± 1,0
L2168	29,2 ± 1,2 ^a	85,8 ± 1,8 ^a	30,7 ± 1,7 ^a	6,5 ± 0,3	4,6 ± 0,2	0,8 ± 0,01	147,5 ± 17,7 ^e	74,8 ± 1,9 ^c	11,7 ± 1,0
L2026	28,7 ± 1,2 ^b	81,5 ± 1,7 ^c	27,6 ± 1,6 ^c	6,0 ± 0,2	4,4 ± 0,2	0,9 ± 0,02	118,0 ± 14,2 ^b	77,9 ± 2,1 ^a	10,6 ± 0,9
L2033	30,0 ± 1,3 ^a	83,3 ± 1,7 ^b	31,2 ± 1,8 ^a	5,9 ± 0,2	4,2 ± 0,1	0,9 ± 0,02	144,0 ± 17,3 ^d	77,5 ± 2,1 ^a	11,3 ± 0,9
L2146	25,5 ± 1,0 ^c	80,6 ± 1,7 ^d	28,6 ± 1,6 ^b	6,3 ± 0,3	5,2 ± 0,2	0,9 ± 0,01	104,8 ± 12,6 ^a	75,5 ± 1,9 ^b	10,9 ± 0,9
Average	28,4 ± 1,2	82,4 ± 1,7	29,9 ± 1,7	6,0 ± 0,3	4,5 ± 0,2	0,8 ± 0,01	127,6 ± 15,3	74,7 ± 1,9	11,3 ± 1,0
Pvalue (Var)	***	***	***	ns	ns	ns	***	***	ns
Pvalue (Var*site)	ns	ns	ns	ns	ns	ns	ns	ns	ns

In the same column, averages followed by the same letter do not show a significant difference according to the Newman-Keuls test at the 5% level. UHML: mean length of the upper half of the fibers (mm), UI: uniformity index (%), STREN: tenacity (g/tex), Hs: standard fineness (mtex), Rd: fiber reflectance (%), +b: yellowing index

3.2 Fiber Technology in 2024 (Maroua and Gagoua)

The technological data obtained in 2024 are presented in Table 11.3, which combines results from Sanguéré and Kodek. As in 2023, all four varieties showed fiber quality levels compatible with market requirements. Nevertheless, inter-annual and inter-site variability affected certain parameters. In 2024, varieties L2026 and L2146 again displayed a favorable balance between fiber length, strength and fineness, while L2033 and L2030 remained within acceptable ranges for most parameters. The maturity and micronaire values recorded suggest that environmental conditions were generally favorable to proper fiber development, without excessive immaturity or over-maturity. The best reflectance (Rd) values were observed in varieties L2026, L2033 and L2146, which produced brighter fibers.

ANOVA results reveal that for fiber length, strength, and reflectance parameters, there is a significant difference between the varieties tested across the two sites. The variety L2168 stood out, along with the variety L2026 and the control A2249 (29.2, 29.1, and 29.3 mm respectively). The variety L2146 had the shortest fibers (25.5 mm). Regarding strength, the control Q302 and variety L2033 were notable for the highest average values (31 and 31.3 g/tex, respectively), while L2026 was the least strong at 28.1 g/tex, with the other varieties being similar to each other. Finally, the fibers of L2033 and L2026 showed the best reflectances at 75.6 the witness Q302 showed the lowest value at 73.8%, and the other varieties showed similar values.

Table 11.3: Fiber Technological Parameters (Sanguere and Kodek)

Settings	UHML		STREN		Micronaire		Rd	
	Sanguere	Kodek	Sanguere	Kodek	Sanguere	Kodek	Sanguere	Kodek
Q302	25,4 ± 0,7 ^b	26,2 ± 0,6 ^b	31,5 ± 1,4 ^a	30,5 ± 1,1 ^b	3,9 ± 0,3	4,1 ± 0,4	74,2 ± 2,0 ^b	73,5 ± 1,3 ^c
L2026	29,2 ± 0,8 ^a	29,1 ± 0,7 ^a	28,0 ± 1,3 ^d	28,2 ± 0,9 ^b	3,0 ± 0,2	4,0 ± 0,3	75,0 ± 2,0 ^a	76,0 ± 1,4 ^a
L2033	25,4 ± 0,7 ^b	26,4 ± 0,6 ^b	31,2 ± 1,4 ^a	31,3 ± 1,1 ^a	3,0 ± 0,2	4,0 ± 0,3	75,5 ± 2,0 ^a	75,8 ± 1,4 ^a
L2146	25,4 ± 0,7 ^b	25,5 ± 0,6 ^c	29,0 ± 1,3 ^c	28,8 ± 1,0 ^c	3,1 ± 0,3	4,1 ± 0,4	75,8 ± 2,0 ^a	74,8 ± 1,3 ^b
L2168	29,2 ± 0,8 ^a	29,3 ± 0,7 ^a	30,1 ± 1,4 ^b	30,1 ± 1,1 ^b	4,0 ± 0,3	4,0 ± 0,3	74,3 ± 2,0 ^b	74,1 ± 1,3 ^b
A2249	29,2 ± 0,8 ^a	29,4 ± 0,7 ^a	30,1 ± 1,4 ^b	30,1 ± 1,1 ^b	3,7 ± 0,3	3,7 ± 0,3	74,4 ± 2,0 ^b	74,1 ± 1,3 ^b
Average	27,3 ± 0,8	27,7 ± 0,7	30,0 ± 1,3	29,8 ± 1,1	3,5 ± 0,3	4,0 ± 0,3	74,9 ± 2,0	74,7 ± 1,3
CV%	2,8	2,5	4,5	3,5	8,3	8,9	2,7	1,8
Pvalue (Var)	**	***	***	***	ns	ns	**	**
Pvalue (Var*site)	ns	ns	ns	ns	ns	ns	ns	ns

In the same column, averages followed by the same letter do not show a significant difference according to the Newman-Keuls test at the 5% level. UHML: mean length of the upper half of the fibers (mm), STREN: tenacity (g/tex), Rd: fiber reflectance (%)

4. DISCUSSION

The main objective of this study was to evaluate the technological performance of four new cotton fiber varieties (L2026, L2030, L2033 and L2146) under the agro-climatic conditions of northern Cameroon. The results show that all four varieties meet the main technological criteria required for fiber quality, in line with African standards (UEMOA, 2006) and with observations reported in similar environments (Bourgou *et al.*, 2013; N'doua *et al.*, 2022; Amangoua *et al.*, 2022).

The results of this study reveal that the sibling varieties present fairly balanced fiber technologies and allow an increase of +1 to 1.5 mm in fiber length. These traits are of great economic interest to spinners. The new variety L2168 showed the best length, while L2146 had the shortest. The fiber lengths observed place these varieties within the category of medium to relatively long fibers, which is suitable for the production of a wide range of yarn counts and textile products. The strength and elongation values are also consistent with expectations for modern varieties developed for African cotton sectors. These results confirm the progress achieved through breeding programs aimed at improving both yield and fiber quality (Crétenet, 2015; PR-PICA, 2024).

We also obtain a gain of +1 to 2% in uniformity, and reflectance compared to the popularized varieties. The L2168 variety was also the most uniform. The uniformity indices obtained indicate satisfactory homogeneity within fiber bundles, which contributes to better spinning behavior and fewer yarn defects. This is particularly important in a context where spinners demand increasingly regular fibers to optimize their production processes. (N'doua *et al.*, 2022)

L2033 and the control Q302 are the most resilient and L2146 the finest. Micronaire and fineness values remained within recommended ranges, suggesting that the studied varieties are well adapted to local growing conditions and that the cropping seasons did not induce major physiological stress likely to generate immature or overly coarse fibers. This coincides with the rainfall regimes recorded and with the overall performance of cotton in the region during the study years (SODECOTON, 2024).

Color parameters (Rd and +b) confirm that varieties L2026, L2033, and L2146 showed the best reflectance and tend to produce brighter fibers with acceptable yellowness, which is an additional advantage for marketing, given the importance of visual aspect in the appreciation of raw cotton. (Crétenet, 2015). The variability observed between sites and years underlines, however, the influence of agro-climatic conditions and cropping practices on fiber quality. These results are consistent with previous studies conducted in West and Central Africa, which have highlighted the

sensitivity of fiber technological characteristics to harvest practices, ginning conditions and local environments (Dagoko, 2023; Kone *et al.*, 2017; N'doua *et al.*, 2022).

All the varieties studied have technological characteristics that meet current fiber market standards, except for L2146 due to its short length. Indeed, these characteristics determine the fiber's performance and its behavior in spinning, in terms of losses and processing efficiency, including mechanical breakdowns and thread breakage, as well as the quality of the yarn and fabric. Fiber quality also determines both conversion costs, the final use of the product, and its market price (Zhou-Zheng, 2002). The comparative analysis of the four tested varieties showed that the technological characteristics of the fiber may depend on the variety, as also highlighted by authors such as Amangoua *et al.*, 2022, and N'doua *et al.*, 2022.

Additionally, for the same variety, technological parameters can change when moving from one growing environment to another, as fiber parameters are influenced by the environment. The Kodek site showed the best average fiber length, which could be explained by the better soil quality and the Sanguere site showed the highest average reflectance, which could also be explained by the better rainfall conditions (Table 1) In this case, variations can be attributed to various factors, including agroclimatic conditions. Indeed, under rainfall conditions such as late rains, fiber characteristics can change (Cretenet, 2015; Bourgou Larbouga *et al.*, 2013; and Nean, 2024).

These differences may be due to the level of pest infestations in the growing area (Kone *et al.*, 2017). The decrease in average length in 2024, by -1.2 at Sanguere and -0.7 at Kodek, could also be explained by the higher jassid infestations compared with the previous growing season. Certain sap-sucking pests, such as whiteflies (*Bemisia tabaci*), aphids (*Aphis gossypii*), and leafhoppers (*Amrasca biguttula*), degrade fiber quality when cotton is harvested late (Dagoko, 2023). Adherence to good agricultural practices regarding fertilization, pesticide treatments, and cotton harvesting is recommended for producers to optimize the potential of the tested varieties.

5. CONCLUSION

This study evaluated the technological performance of four new cotton (*Gossypium hirsutum* L.) fiber varieties (L2026, L2030, L2033 and L2146) in the Sudanian–Sahelian zone of Cameroon during the 2023/2024 and 2024/2025 campaigns. The results show that all four varieties produce fibers whose technological characteristics meet the requirements of African quality standards, particularly regarding length, strength, uniformity, fineness, maturity and color. Varieties L2026 and L2146 generally presented the best compromise between fiber length, strength and fineness, while L2030 and L2033 also performed satisfactorily, especially for color and maturity. These varieties thus constitute promising candidates for improving the quality and competitiveness of Cameroonian cotton on international markets. However, the variability observed between sites and years highlights the need to integrate fiber quality criteria more systematically into production,

harvest and post-harvest practices. Strengthening seed production systems, improving technical support for farmers and ensuring better control of ginning conditions remain essential to fully exploit the potential of these varieties. In conclusion, the new varieties evaluated in this study offer valuable opportunities to enhance the performance of the cotton sector in Cameroon. Nonetheless, efforts must be pursued, particularly in seed technology, to consolidate these gains and ensure the long-term sustainability of the sector.

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