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Research Article

Determine the Technological Value of Cotton Fiber Using Decision Making Criteria

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Abstract

This paper presents a study of indices of technological value that assemble cotton fiber quality properties. Four commercial Egyptian cotton varieties namely; Giza 92, Giza 96, Giza 94 and Giza 95 were used through 2022 season at Cotton Research Institute (CRI), Agricultural Research Center (ARC), Giza, Egypt. Four lint grades of each variety; Fully Good (FG), Good (G), Fully Good Fair (FGF) and Good Fair (GF) were selected. The studied indices were three Fiber Quality Indices (FQ_1, FQ_2 and FQ_3), Spinning Consistency Index (SCI), Count Strength Product (CSP), Premium Discount Index (PDI), Multiplicative Analysis Hierarchy Process (MAHP) and Geometric Properties Index (GPI). Varieties and grades showed high diversity for Upper Half Mean Length, Mean Length, Uniformity Index, Micronaire Reading, Maturity Ratio, Strength, Reflectance Percentage, Yellowness Degree, Trash, and the three fiber quality Indices, SCI, CSP, PDI, MAHP and GPI. The obtained results showed that the combination of cotton fiber properties data allows us to determine quite accurately technological values for commercial cotton varieties. To make a decision of how well is the technological value indices reliable. Reliability clarified the measurements quality of the technological values indices and illustrated that SCI, FQI_1, FQI_2 and FQI_3 gave the highest reliability cronbach coefficient for G 96, G 92, G 94 and G 95. It is indispensable for calculating one or more technological value criteria which are formulated for giving a sufficient prediction of obtaining quality and process ability. Thus will save efforts and money in spinning processes of yarn into different counts with twist and all industrial processes.

Keywords: Egyptian cotton Varieties; Cotton fiber properties; Fiber Quality Index (FQI); Spinning Consistency Index (SCI); Count Strength Product (CSP); Reliability Cronbach Coefficient

Introduction

Cotton is one of the strategically agricultural products that have various utilization areas in agricultural, industrial and trade sectors. Egyptian cotton has prevailed as one of Egypt's biggest competitive advantages with an established reputation of being the best cotton in the world.

Manual and instrumental grading are complementary to each other to get more accurate and preferable cotton fiber properties such as length, strength, fineness, maturity, color and trash. These properties with their criteria affect market value and mixed or blending cotton process. All forms of cotton quality values depend on grade of cotton whether the different or the same of cotton area [1-5].

Cotton grading or cotton classing is a system of standardized procedures for calculating the technological value whether both of fiber classified by classers and tested by instruments.

Quality is used for expression maintainability, reliability or economy of production especially in the textile branch is necessary to define quality very tightly because textile products (e.g., weaven) can be used for a lot of various applications (ranged from clothing to wipes). The interrelationships among cotton fiber properties such as strength, length, length uniformity index, fineness and short fibers may explain all yarn characteristics. As such a cotton with low uniformity index has a high short fiber content that induces a higher hairiness and higher evenness (worse yarn quality) usually leading to a lower yarn strength at least. All details of cotton fiber properties interactions were presented by Foulk., *et al*. (2006) [6], Ebaido and Mebed (2019) [7] and Gourlot., *et al*. (2020) [5].

The market value of cotton is determined largely by a subjective evaluation of a limited number of quality parameters e. g., grade, fiber length, strength and fineness. The market value of cotton should correspond to its technological value in a particular manufacturing system; that is the value of a bale of cotton should be determined based on its expected performance in the textile mill and the yarn quality obtained from it. Hence, calculating technological value indices becomes a decision making to all subsequence processes.

The combination of cotton fiber attributes which is reliably indicated using several quantification method indices are evaluated depending on the quality of cotton fiber attributes for each variety. Whether using technological value calculated before all practical estimated values. There are some of the technological value methods namely; Spinning Consistency Index (SCI), Fiber Quality Index (FQI), Premium Discount Index (PDI), Multiplicative Properties Index (MI) and Geometric Properties Index (GPI). All details of basics of cotton fiber properties discussed by Lord (1961) [8], Tesema and Subramanian (2018) [9], Khamraeva., *et al*. (2020) [10], Majundar., *et al*. (2005) [11], Atambayev (2020) [12], Khamraeva., *et al*. (2020) [13], Mirxojaev., *et al*. (2021) [14] and Ebaido (2023) [15].

The quality of final yarn is largely influenced by all cotton fiber properties in different percentages in addition to all manufacturing technology according to Lord (1981) [16] and Murthy and Samanta (2000) [17].

Practically, using any technological quantification index would provide more accurate and reliable method of overall quality attributes of each cotton variety. The main feature is its flexibility in accommodating different fiber properties and yarns of different counts produced on different spinning system.

All utmost efforts are done by the staff of Cotton Research Institute, Agricultural Research Center, Egypt from cotton growing to manufacturing skills to gain all superiority of yield and quality cotton attributes for all subsequences stages beginning from farm to get high quality, early maturity and resistance to lots of diseases and pests. In addition for trader to possess high lint percentage and finally spinner who needs acceptable fiber quality to get the required final yarn. All these development will increase the demand and the price for Egyptian cotton in the domestic and international markets and are expected to continue.

It is a must to apply evaluation methods such as reliability which is the main task for all cotton processes from farm to factory whether for yield or lint are essential to both of scientific and engineers to reach the acceptable quality with reasonable cost. All sophisticated details were elaborated by Mona Shalaby., *et al*. (2021) [18] and Zhu., *et al*. (2023) [19].

Decision making is broadly random, intuitive or analytical. An analytical approach can lead to inform decisions which are more likely to improve real business value. There are many techniques on this point. Herein, using scientific method is the target of explanation which helps depth and complex decisions.

The scientific method is the process of objectivity establishing facts through testing and experimentation. The basic process involves making an observation, forming a hypothesis, making a prediction, conducting an experiment and finally analyzing the results (Hwang and Yoon; 1981 [20] and Montgomery., *et al*.; 2022) [21].

Decision making plays an important role as it determines both organizational and managerial activities from cotton seed to final clothes or sheets products as seen with Scott and Bruce (1995) [22], Shapira (2002) [23] and Mona shalaby (2019) [24]. Concerning decision making; it can be assumed that decisions are made at each level of cotton management to achieve the cotton organizational or business goals.

The objective of this study was to assess the technological value of cotton using fiber quality indices and multiple decision making criteria to determine the variety that exhibits superior quality for improve processing.

Materials and Methods

The four commercial Egyptian cotton varieties namely; Giza 92 (G 92, belonging to Extra-strength) and Giza 96 (G 96, belonging to Extra-long), Super Giza 94 (G 94, belonging to long staple- Delta) and Giza 95 (G 95, belonging to long staple-upper Egypt) were used through 2022 season. Cotton fiber samples of the four lint grades; Fully Good (FG), Good (G), Fully Good Fair (FGF) and Good Fair (GF) were selected for each variety.

All studied samples were tested by Fiber Classifying System (FCS) in Egyptian and International Cotton Classification Center (EICCC), Cotton Research Institute (CRI), Agricultural Research

Center (ARC), Giza, Egypt. Five samples of each grade were tested.

The technological value of cotton was determined by traditional quality indices namely, Fiber Quality Index 1, 2 and 3 ($FQI_{1,2 \text{ and } 3}$), Spinning Consistency Index (SCI), Count Strength Product (CSP), Premium Discount Index (PDI), Multiplicative Analysis Hierarchy Process (MAHP) and Geometric Properties Index (GPI). These methods were expressed by cotton fiber properties as follows; Upper Half Mean Length (UHML), Mean Length (ML), Uniformity Index (UI), Short Fiber Content (SFC), 2.5 Span Length (2.5 SL), Uniformity Ratio (UR), Strength (FS), Elongation (E%), Micronaire Reading (Mic), Reflectance Percentage (Rd%) and Degree of Yellowness (+b).

The technological value equations derived from cotton fiber properties as follows

- Fiber ($\frac{FS\ X\ UHML}{Mic}$ ndex (FQI):

$FQI_1 = \frac{FS\ X\ UHML\ X\ UI\ X\ MR}{Mic}$ Murthy and Samanta (2000) [17]

$FQI_2 = \frac{UHM\ X\ UI\ X\ fs}{Mic}$ Majundar., *et al*. (2005) [11]

$FQI_3 =$ El-Messiry and Abd- Ellatif (2013) [25]

- Spinning Consistency Index (SCI):

SCI = - 414.67 + 2.9 FS + 49.1 UHML+ 4.74 UI – 9.32 Mic + 0.95 Rd + 0.36 (+b) Uster (1999) [26]

- Count Strength Product (CSP): is the product of the breaking load (strength) in pounds of a lea of yarn by the skein method and its count (cotton count). CSP = 13383.3 – 326.9 Trash% + 1766.1 2.5 SL + 27.4 UR + 56.4 Str. + 89.2 Mic + 13.2 Rd + 17.8 +b Anonymus (1982) [27]

  Premium Discount Index (PDI):

  PDI= 22.15*FS-4.75*E%-4.37*UHML+11.9*UI-20.78*SFC-7.8*MIC Majundar., *et al*. (2005) [11]

- Multiplicative Analysis Hierarchy Process (MAHP):

  MAHP= $FS^{0.27}$ *$E\%^{0.039}$ * $UHML^{0.291}$ * $UI^{0.145}$/$MIC^{0.11}$ * $SFC^{0.145}$ Majundar., *et al*. (2005) [11]

- Geometric Properties Index (GPI):

  GPI= UHML * UI * (100- SFC)/10000 * √MIC Korickij (1983) [28]

Descriptive statistics analyses were calculated and Least significant difference ($LSD_{0.05}$) of Completely randomized design (CRD) was according to Steel and Torrie (1980) [29].

SPSS (2012) [30] was used for statistical analyses.

Reliability analysis or internal consistency reliability is used to measure the reliability of a summated scale where several items are summed to form a total score (Cronbach,1951) [30]. Cronbach ranges from 0 to 1 for providing this overall assessment of a measure's reliability. Cronbach equals 0 indicates no reliability, meanwhile cronbach equals 1 indicates perfect reliability.

Scientific method of decision making is the process of making choices by identifying a decision, gathering information and assessing alternative resolutions (Ackoff, 1962) [31] and Montgomery., *et al*., 2022) [21].

SPSS (2012) [32] was used for statistical analyses.

Results and Discussions

Tables 1 and 2 showed the average values of Upper Half Mean length (UHML), Mean Length (ML), Uniformity Index (UI), Short Fiber Content (SFC), Micronaire Reading (Mic), Maturity Ratio (MR), Elongation (E%), Strength (FS), Reflectance Percentage (Rd%), Degree of Yellowness (+b) and Trash.

The highest mean values of UHML, ML, MR, FS and Rd% were for G 96 followed by G 92, G 94 and finally G 95. Meanwhile the least mean values of +b and trash were for G 96, G 92, G 94 and finally G 95. Regarding those studied varieties provided a wide diversity in their fiber quality properties. Table 1 showed the homogeneity of G 94 compared to G 92 in both of ML and UI.

It is worthy to mention that the lowest grade value of G 96 were higher than the highest grade value of G 95. For instance; UHML gave 33.4mm (GF) which is the lowest grade for G 96 meanwhile the highest grade value of G 95 gave 31.5mm (FG).

In general, the lint cotton grade Fully Good (FG) recorded the highest mean values followed by Good (G), Fully Good Fair (FGF) and finally Good Fair (GF) for all studied properties except for SFC and Trash were in the opposite trend.

The obtained results in tables 3 and 4 demonstrated the combination of all cotton fiber attributes data allowed to predict quite accurate technological value indices. G 96 gave the highest technological values followed by G 92, G 94 and G 95, respectively. To emphasize the accuracy of each quantification method the Least Significant Difference ($LSD_{0.05}$) was calculated and the higher significant mean difference were for FG followed by G, FGF then GF for each studied cotton variety. A same trend of results was reported by Mona Shalaby *et. al.* (2021) [18] and Ebaido (2023) [15].

Using LSD for the quantification technological values gave the direction trend to compare each grade with the others. The technological value indices of different cotton varieties depended

Table 1. Means and Coefficient of Variation for G 96, G 92, G 94 and G 95.

Var.	Grade	UHML		ML		UI		SFC		MIC		MR	
Giza 96		Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.
	FG	36.7	1.6	31.5	0.40	85.2	2.4	5.3	2.0	4.5	0.07	96.0	1.6
	G	35.7	2.0	28.7	0.77	80.4	5.2	7.9	2.7	4.3	0.78	91.2	3.7
	FGF	34.4	3.2	26.5	1.3	77.4	7.4	11.2	4.5	4.1	1.9	82.3	6.9
	GF	33.4	4.0	23.7	2.2	71.1	9.8	14.7	6.0	4.0	4.5	74.7	8.8
Mean		35.1		27.6		78.5		9.8		4.2		86.1	
Giza 92	FG	34.2	2.6	30.7	0.99	89.8	3.5	5.7	4.4	4.0	0.47	94.3	6.1
	G	33.9	4.3	25.3	1.5	74.6	4.2	7.6	6.3	3.9	0.92	88.0	11.3
	FGF	32.9	4.9	24.2	2.1	73.5	5.5	11.7	7.3	3.7	2.2	80.3	12.7
	GF	31.7	5.2	20.8	2.8	65.6	6.3	15.2	10.8	3.6	8.3	70.3	14.2
Mean		32.7		25.3		77.1		10.1		3.8		85.7	
Giza 94	FG	34.1	0.19	29.1	1.1	85.3	1.7	6.0	2.3	4.5	4.4	95.7	5.6
	G	33.1	4.8	28.1	1.9	84.9	3.6	8.2	5.6	4.4	5.3	90.3	6.5
	FGF	31.4	5.1	25.4	3.3	80.8	4.4	12.1	7.7	4.2	6.3	83.7	7.2
	GF	30.3	8.5	21.5	8.1	70.9	6.0	16.2	11.9	4.1	7.1	70.3	9.4
Mean		32.2		26.0		80.5		10.6		4.3		85.0	
Giza 95	FG	31.5	2.5	27.1	2.7	86.2	3.4	5.9	4.9	4.9	1.2	95.3	2.6
	G	30.2	3.9	25.3	2.9	83.2	4.2	8.2	6.2	4.5	4.6	89.7	5.6
	FGF	29.2	4.8	22.9	4.9	78.9	5.3	12.8	9.3	4.3	7.9	81.7	9.7
	GF	28.3	6.6	20.8	5.9	73.6	5.8	16.4	12.1	4.2	8.2	70.8	9.9
Mean		29.8		24.0		80.5		10.8		4.5		84.3	

Where, var. refers to variety, UHML refers to Upper Half Mean Length, ML refers to Mean Length, UI refers to Uniformity Index, SFC refers to Short Fiber Content, MIC refers to Micronaire Reading and MR refers to Maturity Ratio.

on the superiority of the quality attributes used in the formulation of each quantification method derived in the search.

Egyptian extra-long staple cotton variety; G 96 had noticeably higher values of technological value methods compared to both of other cotton varieties; G 92, G 94 and G 95. The same results trend and details of technological value indices were obtained by Beheary (2004) [33], El-Messiry and Abd- Ellatif (2013) [25] and Ebaido (2023) [15].

All quantification technological values are useful for predicting usefulness of cotton fibers in textile mills or for characterization of differences among various varieties. Therefore, utility these values generally reflect the aim of application as seen with producer who prefers high technological parameters of production, contractor who prefer easy measurable properties and stability of products properties and finally consumer who prefer parameters corresponding with product utilization such as durability and appearance. All of specialties of these methods are noted by Hequet and Kelly (2012) [34] and Haque and Iqbal (2021) [35].

According to tables 3 and 4; there were a noticeable increase from lower to higher grade for all technological value indices in G 96, G 92, G 94 and G 95.

Reliability refers to the consistency of a measure (whether the results can be reproduced under the same conditions). Reliability analysis is determined by obtaining the proportion of systematic variation in a scale, which can be done by determining the association between the scores obtained from different administrations of the scale. Thus, in Table (5); calculating reliability helped to understand which technological value criteria gave the highest proportion to be the selected one for each studied cotton variety; G 96, G 92, G 94 and G 95.

Cronbach's alpha is a measure used to assess the reliability

Table 2: Means and Coefficient of Variation for G 96, G 92, G 94 and G 95.

Var.	Grade	E%		Strength		Rd		+b		Trash	
		Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.
Giza 96	FG	6.3	2.3	48.3	0.71	78.2	0.74	8.1	0.72	0.58	5.8
	G	6.3	3.4	44.8	1.1	75.7	1.3	8.2	1.1	2.7	7.8
	FGF	6.3	2.1	41.8	1.7	73.6	1.9	8.3	3.3	7.5	9.1
	GF	6.4	2.0	38.6	2.8	68.9	3.0	8.7	6.7	9.3	11.3
Mean		6.3		43.4		74.1		8.3		5.0	
Giza 92	FG	6.1	9.2	44.7	0.92	74.6	0.76	8.2	1.2	0.64	4.8
	G	6.2	9.8	42.8	1.5	71.9	1.6	8.5	2.6	1.9	7.8
	FGF	6.3	10.2	39.1	2.3	70.4	2.1	8.7	4.3	5.8	12.8
	GF	6.3	10.1	36.5	2.8	69.0	3.5	8.8	4.9	12.1	15.2
Mean		6.2		40.8		71.5		8.6		5.2	
Giza 94	FG	7.1	8.2	44.4	2.4	74.5	2.1	8.7	1.3	0.65	1.9
	G	7.2	8.1	42.5	6.7	72.1	3.4	8.9	3.2	3.9	3.1
	FGF	7.2	7.3	38.9	6.9	69.2	3.9	9.1	4.1	5.8	6.7
	GF	7.3	7.9	35.2	8.3	65.7	5.1	9.4	6.6	13.4	14.2
Mean		7.2		40.3		70.4		9.0		5.9	
Giza 95	FG	8.0	3.4	39.2	1.4	66.8	1.2	10.5	1.4	0.61	4.6
	G	8.1	2.3	36.2	2.5	64.2	2.8	10.8	2.3	3.1	8.3
	FGF	8.2	4.5	32.8	4.5	62.1	4.3	11.7	4.9	5.0	9.8
	GF	8.3	4.6	28.2	9.8	58.6	5.7	12.3	5.8	15.7	16.5
Mean		8.2		34.1		62.9		11.3		6.1	

Where; var. refers to variety, E% refers to Elongation, Rd refers to Percentage of Reflectance and +b refers to Degree of Yellowness.

Table 3: Means and Coefficient of Variation for G 96, G 92, G 94 and G 95.

Var.	Grade	FQI_1		FQI_2		FQI_3		SCI	
		Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.
Giza 96	FG	427.4	1.6	359.6	1.6	374.5	0.86	211.6	2.2
	G	419.6	4.1	303.8	2.2	333.8	1.5	198.6	5.6
	FGF	394.1	4.8	249.9	4.4	303.5	3.1	179.7	6.8
	GF	370.4	6.1	188.5	6.7	260.5	6.4	160.0	9.6
Mean		402.9		275.5		318.1		187.5	
$LSD_{0.01}$		2.06		0.91		1.45		3.72	
Giza 92	FG	417.8	1.2	336.4	1.6	356.6	1.4	205.1	1.3
	G	407.2	3.8	301.1	3.6	343.4	2.9	193.7	3.7
	FGF	373.9	3.7	249.3	3.7	310.3	4.1	175.6	4.9
	GF	358.8	4.1	206.9	5.6	294.2	4.5	161.7	7.9
Mean		389.4		273.4		326.1		184.0	
$LSD_{0.01}$		1.75		1.17		1.71		4.72	
Giza 94	FG	347.4	1.1	289.1	1.4	302.2	1.1	190.4	1.3
	G	333.1	1.9	254.8	2.4	282.1	2.6	181.4	3.2
	FGF	309.2	4.3	206.1	5.1	248.3	3.4	161.3	4.1
	GF	294.9	6.8	154.2	7.2	219.2	5.4	152.1	6.6
Mean		321.2		226.1		262.9		171.3	
$LSD_{0.01}$		1.43		1.05		1.24		4.25	
Giza 95	FG	265.8	2.1	217.9	2.2	228.6	2.6	164.1	3.2
	G	246.5	4.7	183.5	4.7	204.6	4.6	151.1	5.6
	FGF	226.1	6.2	144.6	5.9	177.1	5.9	134.6	6.9
	GF	197.4	8.3	101.8	9.3	144.1	8.8	121.4	10.2
Mean		234.0		161.9		188.6		142.8	
$LSD_{0.01}$		1.68		0.179		0.386		3.21	

Where; var. refers to variety, FQI_1 refers to Fiber Quality Index 1, FQI_2 refers to Fiber Quality Index 2, FQI_3 refers to Fiber Quality Index 3 and SCI refers to Spinning Consistency Index.

Table 4: Means and Coefficient of Variation for G 96, G 92, G 94 and G 95.

Var.	Grade	CSP		PDI		MAHP		GPI	
Giza 96		Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.
	FG	4268.3	3.1	747.9	2.8	19.6	0.78	59.3	1.6
	G	4040.3	3.9	620.4	4.4	19.1	1.0	53.1	2.7
	FGF	3676.2	4.9	492.8	5.8	18.7	1.9	44.3	2.9
	GF	3309.3	5.7	353.9	7.2	18.3	2.8	36.1	3.8
Mean		3823.5		553.8		18.9		48.2	
$LSD_{0.01}$		79.6		2.53		0.16		0.53	
Giza 92	FG	4011.7	2.9	674.9	1.1	19.2	1.1	52.9	1.4
	G	3805.7	4.2	595.1	2.2	18.9	2.6	50.2	2.0
	FGF	3438.0	6.2	432.7	3.1	18.3	3.8	45.2	2.8
	GF	3158.7	7.9	306.1	5.3	17.8	9.1	40.1	3.9
Mean		3603.5		502.2		18.6		47.1	
$LSD_{0.01}$		103.55		2.11		0.18		0.81	
Giza 94	FG	3669.7	2.6	650.2	1.1	18.5	1.1	54.9	1.9
	G	3504.3	4.3	567.7	2.7	18.4	2.8	48.6	2.5
	FGF	3103.7	6.9	418.2	3.5	18.1	4.7	41.3	6.2
	GF	2929.5	7.7	256.1	8.9	17.7	6.4	35.0	8.2
Mean		3301.8		473.1		18.2		45.0	
$LSD_{0.01}$		83.3		2.01		0.13		0.48	
Giza 95	FG	3003.0	3.6	541.6	2.6	17.3	2.1	52.4	1.4
	G	2705.7	5.1	436.5	4.2	16.9	3.4	46.9	4.2
	FGF	2443.3	7.3	271.7	5.3	16.6	4.6	37.1	5.2
	GF	2267.3	7.9	99.3	6.9	16.0	6.3	27.3	5.9
Mean		2604.8		337.3		16.7		40.9	
$LSD_{0.01}$		67.5		1.71		0.15		3.4	

Where, var. refers to variety, CSP refers to Count Strength Product, PDI refers to Premium Discount Index, MAHP refers to Multiplicative Analysis Hierarchy Process and GPI refers to Geometric Properties Index.

or internal consistency of a set of scales. The reliability of any given measurement refers to the extent to which it is a consistent measure of a concept, and cronbach's alpha is one way of measuring the strength of that consistency (Mona Shalaby., *et al*., 2019) [24].

The larger the reliability, the more repeatable or reliable test score. Reliability clarified the measurements quality of the technological values indices and illustrated that SCI, FQI_1, FQI_2 and FQI_3 gave the highest reliability cronbach coefficient (0.796, 0.513, 0.726 and 0.699), (0.804, 0.575, 0.739 and 0.771), (0.854, 0.714, 0.793 and 0.837) and (0.845, 0.590, 0.832 and 0.812) for G 96, G 92, G 94 and G 95, respectively.

In terms of results for table 5 and below figures (1, 2, 3 and 4); SCI**,** FQI_1, FQI_2 and FQI_3 gave the highest reliability coefficient for all the studied cotton varieties. They were the most effective in characterizing highest quality followed by CSP and PDI, and the lowest values were for MAHP and GPI for G 96, G 92, G 49 and G 95.

In so much as reliability coefficient; nearly the same trend of arrangement were found for SCI, FQ_1, FQ_2, FQ_3, CSP and PDI except for MAHP and GPI of G 92 and G 95.

Table 5. Reliability statistics of technological values for G 96, G 92, G 94 and G 95.

Technological Values	Cronbach Scale Statistics			
	G 96	G 92	G 94	G95
FQI_1	0.513	0.575	0.714	0.590
FQI_2	0.726	0.739	0.793	0.832
FQI_3	0.699	0.771	0.837	0.812
SCI	0.796	0.804	0.854	0.845
CSP	0.297	0.352	0.353	0.284
PDI	0.550	0.745	0.594	0.447
MAHP	0.450	0.402	0.414	0.406
GPI	0.307	0.412	0.241	0.405

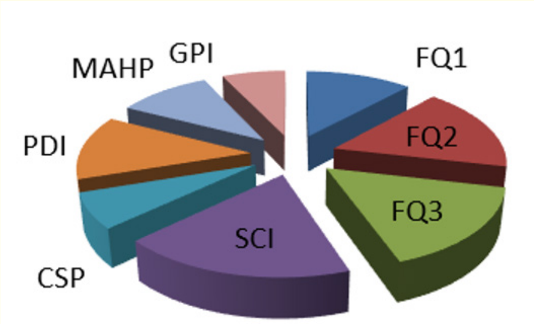

Figure 1: Reliability coefficient of technological value indices for G 96.

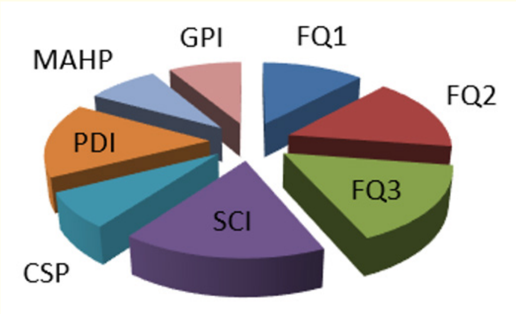

Figure 2: Reliability Coefficient of technological value indices for G 92.

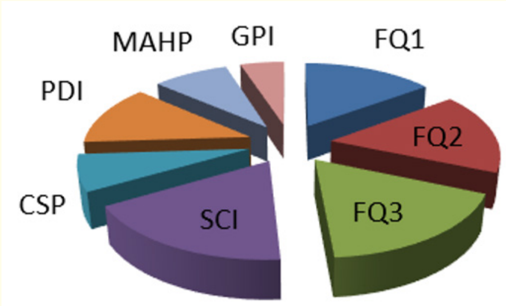

Figure 3: Reliability of coefficient of technological value indices for G 94.

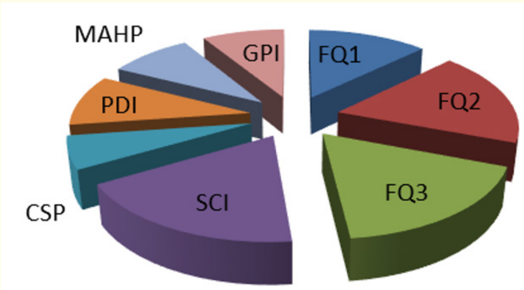

Figure 4: Reliability Coefficient of technological value indices for G 95.

The decision maker receives a clear idea of the influence of cotton fiber properties on cotton technological values which are used in marketing and certification of cotton. Therefore, studying any technological value criterion is a very flexible tool and can be used in any situation where the decision maker has some prior knowledge of the problem (Scott., *et al*. 1995 [22], Majundar and Singh, 2014 [36]) and Mirxojaev., *et al*. 2021 [14]), Sreenivasa and Samanta (2000) [37]. In so much that; there is no need to evaluate each cotton fiber property per se where technological values are calculated from combination of cotton fiber properties.

All calculated indices values can control possess and improve product performance. Then the decision making plays a key role in depth decision for determining the cotton technological values indices from cotton fiber quality properties. The equations are necessary in long run, only market can determine appropriate price premiums for higher lint grades tend to under reward the producer of high quality.

Meanwhile the producer of low quality was appraised with discount based on the technological values.

Conclusion

In the light of decision making of cotton technological value, the spinner has to calculate one or more of cotton fiber technological equations (by using appropriate cotton fiber sample sizes with well represent able of the source of sample i.e., bales or lots to have a panorama of the significant ability to complete spinning for high quality end product. In so much as calculation of cotton fiber properties indices are fundamental before fabric devices are operated. To know how small or large the error; if it falls within accepted range or not. Therefore; It is essential to determine technological value of Egyptian cotton fiber as quantitative criteria to improve spinning through the appropriate adjustment in processing which achieve high quality end product.

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