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Research Article

EVALUATION OF TRASH CONTENT CHARACTERISTICS OF EGYPTIAN COTTON GRADES USING CCS

Mona El-Sayed Shalaby, Yasser Shokry Abd-El-Rahman, Nasser Sayed Nasser

Cotton Grading Section, Cotton Research Institute at Agricultural Research Center (ARC), Egypt

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ABSTRACT

Four lint cotton grades; Fully Good (FG), Good (G), Fully Good Fair (FGF) and Good Fair (GF) of Egyptian cotton varieties; Giza 92, Giza 94 and Giza 95. The aim is to study the relation of cotton trash properties with cotton fiber and yarn strength properties using CCS. The results showed that there is high association between cotton trash attributes with lint cotton grades. Approximately, most of cotton fiber properties were the best for Giza 92 followed by Giza 94 and Giza 95 in terms of values of mean, least significant difference and coefficient of variation. There were highly strong correlation between trash properties and both of fiber properties and yarn strength; such as upper half mean. Yellowness and elongation gave no noticeable differences towards increasing or decreasing of trash properties. Cotton grade factor (GF) for each grade for Giza 92, Giza 94 and Giza 95 was calculated. Giza 92 had the highest value of calculated cotton grade factor followed by Giza 94 and the last one was Giza 95. Hence the grade factor could be a good rank of lint cotton grades, but the rank of cotton varieties would be unreal.

INTRODUCTION

Cotton is one of the most important natural plant fibers. Whether is treated with or without organic practices. Mainly, different treatments in or out farm affect on cotton yield variability. In terms of variability, variation will be obvious from bale to bale and from sample to sample for the same cotton variety. Consequently, different range of fiber properties measurements will be appeared.

A typical ginning practice in removing trash from lint can result in over drying of cotton. This practice can cause fiber damage and excess loss of good fiber. Production of good quality yarn demands high degree of opening and cleaning at the spinning stage, but how this opening occurs is also equally important. Trash in spinning influences end breaks affecting yarn quality due to piecing and defect. Additionally, higher and breaks which result in lower spinning efficiencies, affect productivity and financial performance (Istiaque and Chaudhari (2003) and Shaikh and Pujara (2016)).

Cotton classing is the art of describing the quality of cotton in terms of grade and staple length. Classification is based on appearance and is accomplished chiefly through the sense of sight by integration of three factors of grade; color, trash and preparation during ginning process (Shofner and Shofner, 2000). The current practices in measuring cotton trash ranged from human judgement calls to inherently slow and often inaccurate mechanical instruments which are influenced greatly by the operator. The reasons for rapid change from manual to instrument classing are a greater number of properties with much higher degree of accuracy, and higher testing throughput.

Corresponding author:* **Mona El-Sayed Shalaby
Cotton Grading Section, Cotton Research Institute at Agricultural Research Center (ARC), Egypt

Presence of trash in commercial cotton at varying amounts may bring down the end use and further influences the market values qualities. Therefore, many techniques have been undertaken to develop a number of physical and optical instruments for measuring trash content referring to Gordon (2007), Venkatakrishnan et al. (2014) and Ute et al. (2019).
Leaf and other trash includes such as material as leaf, stems, hulls, grass can be cleaned by harvesting handling, meanwhile after ginning there are several amount of contamination or trash such as dust, fiber fragment, trash particles, seed coat particles and neps. It is difficult to control all trash generated from harvesting to all other following processes to obtain final product. So it is important to know the trash content of cotton for commercial and technical reasons. Textile processes are influenced by trash components; amount and size. These details were reported by Steadman (1997) and Foulk et al. (2006).

Bales of raw cotton always contain a certain amount of foreign matter, commonly termed as trash. In high qualities, the proportion is small (around 1%) but in poor quantities, it may amount to as much as 15%. The constitution of trash varies according to the type of cotton, conditions of growth, method of picking and efficiency of ginning process (Basu, 1999) and (Siddaiah, et al. 2005).

The type and amount of trash affect direct and indirect for both fiber characteristics and textile processing with all details detected by Herbert et al. (1986), Deussen (1993), Furter and Schneiter (1993) and Foulk et al. (2006). Counting and sizing cotton trash by hand would be a very tedious, time consuming and subjective process. So the propensity for using software programs gives fast and more accurate results. Shaikh and Pujara (2016).

The ASTM reference method for trash measurement is based on separating and direct weighing of the trash content. The ancient used instruments are generally based on antiquated technologies.

The instruments work on two principles both of gravimetric and geometric (surface scanner). Mainly, instruments separate the trash components by mechanical means and then collect information by weighing; the geometric group includes the current CCS and HVI instruments lines and imaging devices (Xu et al. 1997), which perform optical surface scanning.

The cotton fiber measurements have progressed from a subjective human classer to the objective High Volume Instrument (HVITM). Development of a faster instrument which measures the trash content by gravimetric method may be a good proposition. The HVITM provides a rapid trash measurement at a low cost using a video camera at one set of conditions. (Venkatakrishnan et al. (2014)) revealed the comparison of AFIS with HVITM cotton trash parameters using software development.

Using Cotton Classifying system (CCS) aid in evaluating the trash content and the behavior of cotton during several following process. For cotton merchants, loss in the value of raw cotton can be estimated by using the measurements of trash, fiber fragments and dust .It is useful for analyzing cotton trash content for production control in preventing possible processing difficulties in spinning yarn. It is important to know the trash content of cotton for commercial and technical reasons. Therefore, the main objective of this work was to study the relation of cotton trash properties with cotton fiber and yarn strength using data screened from cotton of classifying system (CCS).

MATERIALS AND METHODS

The three Egyptian cotton varieties namely; Giza 92 (G 92) (belonging to extra-long staple), Giza 94 (G 94) (belonging to long staple- Delta) and Giza 95 (G 95) (belonging to long staple-upper Egypt) were used through the two seasons 2019 and 2020. Cotton fiber samples of the four studied grades were Fully Good (FG), Good (G), Fully Good Fair (FGF) and Good Fair (GF).

All studied samples were tested by Cotton Classifying System (CCS) in Cotton Grading Section, Egyptian & International Cotton Classification Center (EICCC), Cotton Research Institute (CRI), Agricultural Research Center (ARC). Twenty samples of each grade were tested.

Cotton Classifying System (CCS) consists of four testing stations, i.e. Fibrotest for length and strength, Wira for fineness and maturity, FMT for trash and Opotest for color and grade attributes. The advantage of this structure is that if the need is one station in process or in case one station damaged the other stations still can be used (Zandarov 2018 and TEXTECNO manual).

In CCS trash partition; trash particles can be analyzed individually, particularly their size distribution, with a view to determining the impact of pepper trash (i.e. trash which falls between the categories of cotton trash particules and dust) on spinning performance. Impurities are automatically classified into neps, seed coat neps and trash parts, and into three size classes, i.e. > 0.5g > 0.75g and > 1.0g. within these size classes the number of impurities is counted and reported as Trash, Dust, Fiber Fragment (FF), Number of neps content per gram (NpCnt/g), Number of seed coat neps per gram (ScnCnt/g), Number of trash content particles per gram (TrCnt/g) and Total trash, (TEXTECNO manual).

The determined CCS fiber properties were; Upper Half Mean (UHM)(mm), Mean Length (ML)(mm), Uniformity Index (UI)(%), Short Fiber Index (SFI), Fiber Strength (FS) (g/tex), Elongation (E_{max}) (%), Micronaire (Mike), Maturity Ratio (MR)(%), Linear Density (LD), Reflectance percentage (Rd)(%) and Yellowness degree (+b). on the other run, yarn strength was measured at Yarn strength is the pound X count using the Good Brand Lea Tester.

All tests were conducted under standard testing conditions of 21 ± 2º C and 65 ± 2 % Rh. .To achieve this it requires humidification in Binder equipment at least 24 hours, according to the standard method ASTM 2016 (D1776/D1776M-16).

To facilitate statistical analysis, grades were converted into numerical codes referring to cotton grading section; Hossam *et al*. (1986).

Coding of Egyptian cotton

Grade	Code
FG	33
G	25
FGF	17
GF	9
FF	1

Grade Factor (GF) = Rd%*Micronaire/Total Trash (Ahmed and Kamal,1981).

Descriptive statistics analyses were calculated and Least significant difference ($LSD_{0.05}$) of Completely randomized design (CRD) according to Steel and Torrie (1980) and Foulk *et al*. (2006).

Correlation matrix was computed among cotton fiber properties studied according to the methods described by Snedecor and Cochran (1980).

Genstat (2000) and SPSS (2012) were used for statistical analyses.

RESULT

The trash content of cotton samples is determined physically by separating trash from cotton. Cotton trash properties such as; trash, dust, fiber fragment, number of neps per gram, number of seed coat neps per gram, number of trash content per gram and total trash were showed in Tables (1, 3 and 5).

All trash properties increased as the cotton grade decreased (from first grade (FG) to last grade (GF) followed by other grades. The same results were in accordance with (Liu *et al*. (2014).

For first and second seasons, there were highly significant differences in terms of $LSD_{0.05}$ values for each trait compared to other grade differences.

The measurements of trash properties were the highest for G 95 and the lowest value for G 92. Consequently, G 92 had the lowest coefficient of variation (C.V.) compared to G 94 and G95 for all trash properties in 2019 and 2020 seasons.

Color grade is determined by percent of reflectance (Rd) and yellowness degree (+b). Rd indicates how bright or dull a sample is, and +b indicates the degree of pigmentation. The measure of Rd decreased from FG through G, FGF and finally GF. Reflectance degree (Rd) recorded the highest obvious influences towards trash properties more than other fiber properties for each grade. The same results were obtained by Basu (1999) and Taylor *et al*. (1995).

Table 1 Mean, Least Significant Difference (LSD) and Coefficient of Variation (C.V.) for two seasons (F1 and F2) in Giza 92

Trash criteria	Trash		Dust		FF		Total trash		NpCnt/g		ScnCnt/g		TrCnt/g		Rd		+b	
	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2
FG	1.33	1.76	0.05	0.07	0.03	0.05	1.40	1.88	132	145	24	17	99	95	73.63	74.47	8.81	8.56
G	4.53	3.98	0.13	0.17	0.11	0.13	4.78	4.28	222	232	31	36	168	148	71.13	73.50	8.55	8.23
FGF	7.58	6.88	0.26	0.23	0.16	0.17	7.28	7.28	331	376	46	56	225	200	69.00	66.33	8.29	8.88
GF	12.67	11.89	0.34	0.37	0.21	0.23	14.49	12.49	456	547	62	79	294	267	65.70	63.20	8.11	8.21
mean	6.53	6.13	0.19	0.21	0.13	0.15	6.99	6.48	285.25	325.00	40.75	47.00	196.50	177.50	69.87	69.38	8.54	8.40
LSD	1.59	1.82	0.07	0.05	0.009	0.03	1.59	1.84	5.44	32.11	9.79	6.75	12.74	29.12	1.55	0.70	2.05	1.45
C.V.	4.59	10.98	19.47	13.98	4.41	12.04	11.02	21.40	1.24	5.42	16.74	6.60	3.21	4.98	0.82	0.54	6.26	2.67

F1 and F2 refer to first season (2019) and second season (2020), respectively.

Table 2 Mean, Least Significant Difference (LSD) and Coefficient of Variation (C.V.) for two seasons (F1 and F2) in Giza 92

Fiber criteria	UHM		ML		UI		SFI		FS_{CCS}		FS_{HVI}		E_{max}		Mike		MR		LD		YS-40s		YS-60s	
	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2
FG	34.59	33.33	30.78	29.01	88.99	87.03	5.63	5.96	24.63	24.53	46.90	45.20	5.57	5.43	3.81	3.68	0.89	0.91	138.50	135.00	3560	3552	3420	3406
G	33.33	33.00	29.26	28.49	87.80	86.03	6.17	7.23	21.80	22.06	45.70	44.80	5.40	5.30	3.55	3.45	0.83	0.80	133.13	129.38	3423	3413	3226	3214
FGF	32.49	32.06	27.24	26.63	83.93	83.03	7.33	8.60	18.33	19.40	43.88	42.77	5.33	5.13	2.99	2.77	0.76	0.78	113.13	111.88	3320	3309	3066	3055
GF	31.88	31.14	26.46	25.86	83.17	83.00	8.67	9.17	16.97	16.70	40.99	39.99	5.33	5.07	2.77	2.69	0.73	0.63	105.88	103.88	3160	3152	3933	2924
Mean	33.07	32.38	28.45	27.49	85.97	84.52	6.95	7.74	20.43	20.67	44.37	43.19	5.39	5.23	3.28	3.15	0.80	0.78	122.66	119.79	3366	3357	3411	3150
LSD	0.47	0.73	0.85	0.49	0.80	0.47	1.11	0.85	2.58	1.07	1.75	1.41	0.11	0.26	4.05	1.09	2.45	0.58	1.09	1.85	35.64	49.68	63.85	81.63
C.V.	0.77	1.32	1.82	1.06	0.50	0.29	8.72	9.42	1.70	2.75	2.34	1.86	7.71	10.44	0.23	3.49	0.04	3.93	2.16	2.90	4.56	4.88	6.07	6.15

F1 and F2 refer to first season (2019) and second season (2020), respectively.

Table 3 Mean, Least Significant Difference (LSD) and Coefficient of Variation (C.V.) for two seasons (F1 and F2) in Giza 94

Trash criteria	**Trash**		**Dust**		**FF**		**Total trash**		**NpCnt/g**		**ScnCnt/g**		**TrCnt/g**		**Rd**		**+b**	
	F1	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**
FG	2.90	1.97	0.25	0.35	0.13	0.23	3.28	2.55	107	140	29	26	137	117	80.21	79.23	8.73	8.27
G	5.91	4.10	0.36	0.43	0.27	0.46	6.54	5.04	165	152	35	33	187	190	72.77	72.13	8.93	8.50
FGF	11.83	9.10	0.49	0.68	0.52	0.68	12.84	10.46	198	181	40	45	201	197	69.00	69.63	9.37	9.37
GF	14.97	13.47	0.98	0.92	0.89	0.95	16.84	15.43	413	394	47	56	231	202	66.95	67.88	8.20	9.93
mean	8.90	7.16	0.52	0.59	0.45	0.58	9.85	8.37	220.75	216.75	37.75	40.00	189.00	176.50	72.24	72.23	9.31	9.51
LSD	1.07	1.70	0.51	0.06	0.13	0.08	1.14	1.76	73.05	7.93	2.98	4.64	12.65	5.52	2.56	2.57	1.23	2.36
C.V.	6.04	14.10	23.78	16.66	12.86	17.31	15.75	29.34	4.29	8.53	24.07	8.20	3.53	6.66	1.89	1.91	7.02	2.03

F1 and F2 refer to first season (2019) and second season (2020), respectively.

Table 4 Mean, Least Significant Difference (LSD) and Coefficient of Variation (C.V.) for two seasons (F1 and F2) in Giza 94

Fiber criteria	**UHM**		**ML**		**UI**		**SFI**		**FS_{CCS}**		**FS_{HVI}**		**E_{max}**		**Mike**		**MR**		**LD**		**YS-40s**		**YS-60s**	
	F1	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**
FG	33.11	32.94	29.98	28.68	87.90	86.95	6.20	6.07	22.99	21.81	42.19	41.95	6.77	6.51	4.77	4.72	0.95	0.96	143.88	141.00	2850	2840	2630	2622
G	32.19	31.59	27.59	26.99	85.70	85.70	7.23	8.06	20.18	19.90	40.20	39.18	7.44	7.21	3.55	3.41	0.76	0.84	133.13	129.89	2720	2718	2511	2505
FGF	31.18	30.85	26.00	26.22	84.91	83.80	8.91	9.03	17.88	17.87	38.91	37.19	7.75	6.91	3.20	3.07	0.64	0.73	120.00	115.13	2666	2650	2406	2401
GF	30.90	28.88	25.71	24.00	83.99	83.03	9.17	10.07	15.77	14.14	36.99	36.00	7.11	6.99	2.66	2.60	0.60	0.55	113.20	111.13	2586	2572	2333	2323
Mean	31.85	31.08	27.32	26.47	85.63	84.81	7.88	8.31	19.21	18.43	39.57	38.58	7.27	6.91	3.55	3.45	0.74	0.77	127.80	124.29	2706	2695	2470	2463
LSD	1.09	0.71	1.39	1.33	0.45	0.72	7.23	5.98	2.89	2.95	1.95	2.58	3.65	4.56	10.96	5.32	2.92	2.95	3.18	4.80	73.06	82.69	72.72	91.11
C.V.	0.88	1.42	2.01	2.88	0.72	1.15	10.06	11.78	1.02	3.29	3.35	1.94	0.58	1.87	0.57	0.29	0.04	0.04	5.11	6.80	5.28	5.51	5.93	5.95

F1 and F2 refer to first season (2019) and second season (2020), respectively.

Table 5 Mean, Least Significant Difference (LSD) and Coefficient of Variation (C.V.) for two seasons (F1 and F2) in Giza 95

Trash criteria	Trash		Dust		FF		Total trash		NpCnt/g		ScnCnt/g		TrCnt/g		Rd		+b	
	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2
FG	3.28	3.30	0.13	0.14	0.17	0.14	3.58	3.58	292	265	28	27	180	141	70.66	69.90	10.11	10.90
G	5.74	6.60	0.30	0.44	0.25	0.23	6.29	7.28	303	314	39	40	188	182	65.70	66.17	10.99	11.53
FGF	7.27	8.77	0.51	0.67	0.43	0.41	8.21	9.85	313	331	48	47	195	196	59.72	60.90	11.55	11.80
GF	10.38	11.53	0.93	1.14	0.63	0.91	11.94	13.58	324	363	55	52	211	221	54.67	58.37	14.90	15.85
mean	6.67	7.55	0.47	0.59	0.37	0.42	7.51	8.57	308.00	318.25	42.50	41.50	193.50	185.00	62.69	63.84	11.89	12.52
LSD	2.82	0.86	0.03	0.49	0.06	0.46	1.41	1.21	4.64	31.65	2.88	3.99	2.82	9.74	1.39	1.30	4.19	5.20
C.V.	10.84	17.17	28.90	20.70	15.67	26.44	19.84	26.49	7.81	11.89	24.07	10.66	8.78	8.80	1.22	1.07	7.00	0.93

F1 and F2 refer to first season (2019) and second season (2020), respectively.

Table 6 Mean, Least Significant Difference (LSD) and Coefficient of Variation (C.V.) for two seasons (F1 and F2) in Giza 95

Fiber criteria	UHM F1	UHM F2	ML F1	ML F2	UI F1	UI F2	SFI F1	SFI F2	FS_{CCS} F1	FS_{CCS} F2	FS_{HVI} F1	FS_{HVI} F2	E_{max} F1	E_{max} F2	Mike F1	Mike F2	MR F1	MR F2	LD F1	LD F2	YS-40s F1	YS-40s F2	YS-60s F1	YS-60s F2
FG	29.83	29.31	25.16	24.65	84.17	84.10	7.60	7.11	20.99	19.19	38.88	37.95	6.55	6.47	3.95	3.88	0.86	0.87	153.33	150.50	2340	2333	2113	2170
G	29.43	29.17	24.53	24.36	83.33	83.33	8.80	9.77	18.59	18.01	37.45	35.99	7.44	7.40	3.41	3.22	0.77	0.78	137.88	130.75	2300	2129	2060	1910
FGF	28.53	29.38	23.02	22.82	80.67	80.40	8.66	10.65	16.15	16.52	34.88	33.55	6.99	6.77	3.18	3.09	0.70	0.71	129.25	125.88	2186	2145	1923	1870
GF	27.23	27.06	21.25	21.13	78.03	78.00	12.00	11.29	14.42	13.38	31.65	30.30	6.00	6.57	2.88	2.38	0.66	0.65	118.00	111.01	2066	2027	1843	1719
mean	28.78	28.73	23.49	23.24	81.55	81.46	9.52	9.71	17.54	16.78	35.72	34.45	6.75	6.80	3.36	3.14	0.75	0.75	134.62	129.79	2223	2159	1985	1917
LSD	0.46	0.93	0.72	0.84	0.82	0.55	0.72	1.07	1.02	1.48	1.35	1.93	0.58	1.63	0.09	0.16	0.02	0.05	3.48	3.33	62.92	84.85	61.73	106.81
C.V.	0.99	1.91	2.58	3.94	0.52	0.35	13.22	12.54	2.89	4.21	1.95	2.93	3.63	5.11	0.51	0.59	1.09	3.40	6.77	8.11	5.17	5.78	5.28	5.44

F1 and F2 refer to first season (2019) and second season (2020), respectively.

On the other hand, yellowness (+b) had no noticeable differences from one grade to other for each of G 92, G 94 and G 95 in Tables (1, 3 and 5).

Fiber length is measured by passing a beard of parallel fibers through an optical sensing point. The beard is formed when fibers from a sample of cotton are automatically grasped by a clamp, then combed and brushed into parallel orientation. Fiber length is largely influenced by variety as seen in Tables (2, 4 and 6). The highest mean value was for FG grade followed by G, FGF and GF for each cotton variety.

Cotton with a low uniformity index is likely to have a high percentage of short fibers. As Such cotton maybe difficult to process and is likely to produce low yarn quality.

In Tables 2, 4 and 6; All length criteria; Upper half mean (UHM), Mean length (ML), Uniformity index (UI) and Short fiber index (SFI) represented all studied variety. Where G 92 had the highest mean values of UHM, ML and UI followed by G 94 then G 95. Meanwhile the highest value of SFI was for G 95 followed by G 94 and G 92.

Strength measurements are made on the same beards of cotton that are used for measuring fiber length at fibrotest module. Strength values of G 92 for the four grades were the highest compared to G 94 and G 95. As seen in Tables (2, 4 and 6); the highest value of G 92 for both CCS strength (FSCCS) and HVI strength (FSHVI) followed by G 94 and G 95. On the contrary, there were no obvious differences for elongation Emax for the three studied varieties.

Micronaire is a measure of fiber fineness and maturity. An air permeability of a constant mass of cotton fibers compressed to a fixed volume. Micronaire values among different varieties give an indicator of fineness, whereas micronaire values within the same variety or between grades give an indicator of maturity.

Table (2) showed that G 92 was the highest fineness variety compared to G 94 and G 95 in Tables (2, 4 and 6). In addition, maturity (MR) and Linear Density (LD) were the highest mean values for G 92 compared to the other two varieties

The highest mean values of yarn strength-40 and 60s were for G 92 compared to G 94 and G 95. The first season gave higher mean values than second season as shown in Tables 2, 4 and 6. Correlation coefficients between cotton trash properties and both of cotton fiber properties and yarn strength for Giza 92, Giza 94 and Giza 95 are shown in Tables (7, 8 and 9). Highly positive correlation were found between trash properties and SFI, meanwhile, highly negative correlation were found for UHM, ML, UI, FSCCS, FSHVI, Mike, MR, LD and yarn strength for G 94 and G 95. Moreover, there were fluctuation between negative or positive and highly correlation or no correlation for +b and yarn strength for both the two seasons in G 92. Nearly the same results were in G 94 and G 95. That was in accordance with Kirschner (1982) and Deluca (1986).

Table 7 Correlation between trash properties and fiber properties of G 92 for first and second seasons (2019 and 2020)

Second season (2020) Trash properties								First season (2019) Trash properties						
Total Trash	**TrCnt/g**	**ScnCnt/g**	**NpCnt/g**	**Trash**	**FF**	**Dust**	**Fiber properties**	**Dust**	**FF**	**Trash**	**NpCnt/g**	**ScnCnt/g**	**TrCnt/g**	**Total Trash**
-0.89**	-0.93**	-0.92**	-0.77**	-0.76**	-0.89**	-0.92**	UHM	-0.92**	-0.87**	-0.93**	-0.99**	-0.91**	-0.96**	-0.88**
-0.92**	-0.97**	-0.97**	-0.89**	-0.86**	-0.93**	-0.97**	ML	-0.87**	-0.81**	-0.95**	-0.97**	-0.86**	-0.96**	-0.93**
-0.91**	-0.95**	-0.94**	-0.87**	-0.73**	-0.82**	-0.94**	UI	-0.83**	-0.67**	-0.96**	-0.93**	-0.83**	-0.93**	-0.89**
0.88**	0.88**	0.95**	0.84**	0.81**	0.92**	0.95**	SFI	0.90**	0.82**	0.96**	0.98**	0.89**	0.94**	0.93**
-0.87**	-0.91**	-0.85**	-0.77**	-0.67**	-0.82**	-0.85**	FC_{CCS}	-0.92**	-0.79**	-0.96**	-0.97**	-0.91**	-0.96**	-0.93**
-0.93**	-0.97**	-0.88**	-0.81**	-0.73**	-0.89**	-0.89**	FC_{HVI}	-0.92**	-0.69*	-0.98**	-0.95**	-0.91**	-0.94**	-0.94**
0.91**	0.95**	0.97**	0.93**	0.90**	0.88**	0.97**	E_{max}	-0.92**	0.73**	0.95**	0.95**	0.84**	0.91**	0.85**
-0.63**	-0.98*	-0.80*	-0.76*	-0.93**	-0.62*	-0.79**	RD	0.85**	-0.77**	-0.98**	-0.97**	-0.91**	-0.95**	-0.92**
0.63*	0.69*	0.70*	0.57	0.52	0.63*	0.70*	+b	0.75**	0.55	0.83**	0.79**	0.73**	0.82**	0.92**
0.90**	0.95**	0.95**	0.86**	0.85**	0.88**	0.95**	Mike	-0.92**	-0.86**	-0.94**	-0.99**	-0.92**	-0.94**	-0.89**
-0.89**	-0.95**	-0.88**	-0.79**	-0.75**	-0.92**	-0.88**	MR	-0.82**	-0.85**	-0.56**	-0.94**	-0.81**	-0.90**	-0.83**
-0.94**	-0.96**	-0.89**	-0.79**	-0.69*	-0.91**	-0.89**	LD	-0.90**	-0.97**	-0.94**	-0.96**	-0.98**	-0.96**	-0.93**
-0.92**	-0.83**	-0.94**	-0.99**	-0.83**	-0.95**	-0.91**	YS-40s	-0.92**	-0.98**	-0.88**	-0.82**	-0.82**	-0.88**	-0.94**
-0.63*	-0.64*	-0.48	0.61*	-0.64*	-0.55	-0.37	YS-60s	-0.91**	-0.97**	-0.88**	-0.85**	-0.85**	-0.91**	-0.95**

Second season (2020) Trash properties								First season (2019) Trash properties						
Total Trash	TrCnt/g	ScnCnt/g	NpCnt/g	Trash	FF	Dust	Fiber properties	Dust	FF	Trash	NpCnt/g	ScnCnt/g	TrCnt/g	Total Trash
-0.89**	-0.93**	-0.92**	-0.77**	-0.76**	-0.89**	-0.92**	UHM	-0.92**	-0.87**	-0.93**	-0.99**	-0.91**	-0.96**	-0.88**
-0.92**	-0.97**	-0.97**	-0.89**	-0.86**	-0.93**	-0.97**	ML	-0.87**	-0.81**	-0.95**	-0.97**	-0.86**	-0.96**	-0.93**
-0.91**	-0.95**	-0.94**	-0.87**	-0.73**	-0.82**	-0.94**	UI	-0.83**	-0.67**	-0.96**	-0.93**	-0.83**	-0.93**	-0.89**
0.88**	0.88**	0.95**	0.84**	0.81**	0.92**	0.95**	SFI	0.90**	0.82**	0.96**	0.98**	0.89**	0.94**	0.93**
-0.87**	-0.91**	-0.85**	-0.77**	-0.67**	-0.82**	-0.85**	FC_{CCS}	-0.92**	-0.79**	-0.96**	-0.97**	-0.91**	-0.96**	-0.93**
-0.93**	-0.97**	-0.88**	-0.81**	-0.73**	-0.89**	-0.89**	FC_{HVI}	-0.92**	-0.69*	-0.98**	-0.95**	-0.91**	-0.94**	-0.94**
0.91**	0.95**	0.97**	0.93**	0.90**	0.88**	0.97**	E_{max}	-0.92**	0.73**	0.95**	0.95**	0.84**	0.91**	0.85**
-0.63**	-0.98*	-0.80*	-0.76*	-0.93**	-0.62*	-0.79**	RD	0.85**	-0.77**	-0.98**	-0.97**	-0.91**	-0.95**	-0.92**
0.63*	0.69*	0.70*	0.57	0.52	0.63*	0.70*	+b	0.75**	0.55	0.83**	0.79**	0.73**	0.82**	0.92**
0.90**	0.95**	0.95**	0.86**	0.85**	0.88**	0.95**	Mike	-0.92**	-0.86**	-0.94**	-0.99**	-0.92**	-0.94**	-0.89**
-0.89**	-0.95**	-0.88**	-0.79**	-0.75**	-0.92**	-0.88**	MR	-0.82**	-0.85**	-0.56**	-0.94**	-0.81**	-0.90**	-0.83**
-0.94**	-0.96**	-0.89**	-0.79**	-0.69*	-0.91**	-0.89**	LD	-0.90**	-0.97**	-0.94**	-0.96**	-0.98**	-0.96**	-0.93**
-0.92**	-0.83**	-0.94**	-0.99**	-0.83**	-0.95**	-0.91**	YS-40s	-0.92**	-0.98**	-0.88**	-0.82**	-0.82**	-0.88**	-0.94**
-0.63*	-0.64*	-0.48	0.61*	-0.64*	-0.55	-0.37	YS-60s	-0.91**	-0.97**	-0.88**	-0.85**	-0.85**	-0.91**	-0.95**

Table 8 Correlation between trash properties and fiber properties of G 94 for first and second seasons (2019 and 2020)

Second season (2020) Trash properties								First season (2019) Trash properties						
Total Trash	**TrCnt/g**	**ScnCnt/g**	**NpCnt/g**	**Trash**	**FF**	**Dust**	**Fiber properties**	**Dust**	**FF**	**Trash**	**NpCnt/g**	**ScnCnt/g**	**TrCnt/g**	**Total Trash**
-0.77**	-0.85**	-0.94**	-0.92**	-0.93**	-0.94**	-0.95**	UHM	-0.98**	-0.61*	-0.88**	-0.84**	-0.98**	-0.91**	-0.93**
-0.77**	-0.84**	-0.98**	-0.90**	-0.95**	-0.93**	-0.98**	ML	-0.96**	-0.72**	-0.90**	-0.85**	-0.96**	-0.92**	-0.92**
-0.76**	-0.89**	-0.96**	-0.93**	-0.90**	-0.91**	-0.97**	UI	-0.75**	-0.89**	-0.87**	-0.89**	-0.72**	-0.89**	-0.79**
0.77**	0.83**	0.97**	0.89**	0.95**	0.94**	0.98**	SFI	0.97**	0.62*	0.91**	0.84**	0.97**	0.89**	0.92**
-0.75**	-0.82**	-0.93**	-0.88**	-0.94**	-0.98**	-0.94**	FC_{CCS}	-0.74**	-0.89**	-0.87**	-0.89**	-0.72**	-0.89**	-0.85**
-0.77**	-0.82**	-0.95**	-0.89**	-0.96**	-0.96**	-0.95**	FC_{HVI}	-0.97**	-0.72**	-0.94**	-0.91**	-0.97**	-0.95**	-0.96**
-0.02	0.01	0.55	0.28	0.58*	0.48	0.49	E_{max}	-0.91**	-0.72**	-0.87**	-0.83**	-0.91**	-0.92**	-0.90**
-0.65*	-0.68*	-0.90**	-0.79**	-0.92**	-0.92**	-0.89**	RD	-0.82**	-0.89**	-0.89**	-0.91**	-0.80**	-0.94**	-0.90**
0.57	0.69*	0.67*	0.70*	0.64*	0.61*	0.68*	+b	0.98**	0.59*	0.91**	0.86**	0.99**	0.92**	0.95**
0.78**	0.89**	0.69*	0.83**	0.66*	0.74**	0.74**	Mike	0.97**	0.73**	0.95**	0.92**	0.97**	0.96**	0.97**
-0.72**	-0.78**	-0.96**	-0.87**	-0.96**	-0.96**	-0.96**	MR	-0.96**	-0.80**	-0.97**	-0.95**	-0.95**	-0.98**	-0.97**
-0.85**	-0.92**	-0.94**	-0.94**	-0.91**	-0.93**	-0.96**	LD	-0.82**	-0.95**	-0.92**	-0.91**	-0.81**	-0.94**	-0.88**
-0.83**	-0.87**	-0.93**	-0.94**	-0.82**	-0.94**	-0.91**	YS-40s	-0.76**	-0.79**	-0.95**	-0.95**	-0.96**	-0.96 **	-0.95**
-0.82**	-0.92**	-0.91**	-0.93**	-0.81**	-0.93**	-0.88**	YS-60s	-0.72**	-0.73**	-0.95**	-0.79**	-0.96**	-0.95**	-0.92**

Table 9 Correlation between trash properties and fiber properties of G 95 for first and second seasons (2019 and 2020)

Second season (2020) Trash properties								First season (2019) Trash properties						
Total Trash	**TrCnt/g**	**ScnCnt/g**	**NpCnt/g**	**Trash**	**FF**	**Dust**	**Fiber properties**	**Dust**	**FF**	**Trash**	**NpCnt/g**	**ScnCnt/g**	**TrCnt/g**	**Total Trash**
-0.98**	-0.92**	-0.93**	-0.97**	-0.94**	-0.97**	-0.94**	UHM	-0.98**	-0.95**	-0.93**	-0.94**	-0.98**	-0.77**	-0.96**
-0.95**	-0.82**	-0.90**	-0.92**	-0.95**	-0.89**	-0.91**	ML	-0.96**	-0.92**	-0.93**	-0.91**	-0.95**	-0.75**	-0.98**
-0.91**	-0.85**	-0.89**	-0.90**	-0.88**	-0.90**	-0.89**	UI	-0.97**	-0.91**	-0.92**	-0.94**	-0.93**	-0.86**	-0.96**
0.94**	0.83**	0.84**	0.94**	0.91**	0.91**	0.85**	SFI	0.954**	0.87**	0.85**	0.98**	0.93**	0.77**	0.96**
-0.97**	-0.89**	-0.89**	-0.94**	-0.92**	-0.96**	-0.91**	FC_{CCS}	-0.93**	-0.89**	-0.90**	-0.83**	-0.93**	-0.80**	-0.79**
-0.98**	-0.92**	-0.93**	-0.96**	-0.92**	-0.97**	-0.93**	FC_{HVI}	-0.95**	-0.89**	-0.91**	-0.92**	-0.94**	-0.76**	-0.97**
0.53	0.25	0.39	0.64*	0.66*	0.41	0.39	E_{max}	0.86**	0.82**	0.74**	0.94**	0.86**	0.70**	0.79**
-0.97**	-0.96**	-0.95**	-0.91**	-0.89**	-0.99**	-0.95**	RD	-0.97**	-0.90**	-0.93**	-0.93**	-0.97**	-0.89**	-0.86**
0.26	0.19	0.97**	0.45	0.31	0.19	0.15	+b	0.93**	0.97**	0.93**	0.80**	0.94**	0.65*	0.89**
0.95**	0.98**	0.97**	0.89**	0.86**	0.95**	0.97**	Mike	0.98**	0.94**	0.93**	0.95**	0.98**	0.79**	0.91**
-0.98**	-0.87**	-0.90**	-0.97**	-0.97**	-0.96**	-0.91**	MR	-0.96**	-0.96**	-0.98**	-0.83**	-0.96**	-0.85**	-0.82**
-0.96**	-0.92**	-0.93**	-0.89**	-0.91**	-0.98**	-0.94**	LD	-0.97**	-0.92**	-0.93**	-0.94**	-0.96**	-0.81**	-0.91**
-0.92**	-0.89**	-0.91**	-0.83**	-0.93**	-0.78**	-0.82**	YS-40s	-0.93**	-0.93**	-0.96**	-0.87**	-0.91**	-0.96**	-0.93**
-0.85**	-0.77**	-0.86**	-0.73**	-0.84**	-0.78**	-0.79**	YS-60s	-0.95**	-0.90**	-0.92**	-0.93**	-0.93**	-0.95**	-0.92**

Grade standards are necessary in any grading system for maintaining the integrity of instruments classing with other cotton fiber properties. Egyptian cotton has been developed grade standards in order to more closely represent own cotton. One may be tempted to conclude in the given measured properties. Cotton grading factor is basically considered as a number value using fiber properties which is influenced cotton grade. Cotton grading factor uses in ranking grades not varieties. Table (10) showed that Giza 92 had the highest value of cotton grade factor followed by Giza 94 and the last one was Giza 95. The reason of differences between cotton varieties depends on; the value of grade factor is controlled by the denominator of total trash so that any change even if in slight change give an obvious difference. On the other hand the numerator of reflectance degree and micronaire give a slight difference not like the denominator.

Table 10 Grade factor (GF) of G 92, G 94 and G 95

Grade	G 92		G 94		G 95	
	2019	**2020**	**2019**	**2020**	**2019**	**2020**
FG	200.38	148.94	117.00	148.99	78.84	77.49
G	52.83	60.23	39.68	48.80	35.67	29.27
FGF	23.08	25.81	17.25	20.15	23.13	19.20
GF	13.76	13.71	10.59	11.52	13.23	10.24

It is worthy to mention that grade factor is calculated only from the fiber characteristics that affect lint cotton grade, i.e., micronaire, reflectance percentage and trash content, so the value of grade factor is dependable of these variables. Consequently, the other fiber properties such as fiber length and strength have no effect on the value of grade factor. Therefore, grade factor could be a good rank of lint cotton grades within each variety.

CONCLUSION

Trash content in cotton has significant impact on all phases of cotton chain. The amount and size of trash and trash particles depends mainly on the origin of cotton and its harvesting method and other following processes. The trash criteria obtained from CCS are strongly correlated with fiber properties such as length criteria; upper half mean, mean length, uniformity index and short fiber index, fiber strength, micronaire, maturity ratio and linear density. Details of trash criteria measurement by CCS required less time and more accuracy in measurements compared to other manual and electronic instruments. The trash measurement; count or size depend on the behavior of cotton practices, therefore, there is no base for studying cotton trash and generalize it in accordance to different conditions. Therefore any change in fiber properties or trash measurements depends on the grades and the differences between grades. Hence the grade factor could be a good rank of lint cotton grades within each variety, but the rank among cotton varieties would be unreal.

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