COTTON LINT GRADE COMPONENTS AS RELATED TO YARN PHYSICAL PROPERTIES

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Abstract

The present investigation was carried out on six Egyptian cotton varieties namely; Giza 45, Giza 76, Giza 70 (Extra - long staple) , Giza 81, Giza 75 and Dendara (Long - staple) to study the relative contribution of grade components to grade index and the relationship between trash cottont %, percent reflectance (Rd%), degree of yellowness (+b), microniare reading, grade index and yarn physical properties i. e, yarn irregularity (c. v. %), thin places , thick places , nep count and yarn appearance grade.

The results showed that , (1) Rd% was the most contributer to lint grade in all varieties except in Giza 45 and Giza 70 varieties where the best contributer was +b and trash content % respectivly . (2) The relationship between yarn physical properties and each of lint grade index and grade components were highly significant in all the studied varieties.

INTRODUCTION

Evaluation of cotton grade has aimed to evaluate its spinning quality . Yarn properties are the most important factor influencing weaving performance. Eveness, thin places, thick places, degree of nepiness and yarn appearance grade are the basic physical properties of yarns . The existence of neps in appreciable number decreas-

es the general appearance of yarn and cloth products and lowers their quality.

Cotton grade is based on the sight integration of three factors of grade i.e, (a) the visible trash content of the sample , (b) the bloom, luster and freedon from neps which give an indication of fiber maturity and conditions of growth of the crop in addition to cotton preparation through ginning processing, (c) the colour, including the absence or degree of stain which results from microbial or insect damage , (Nickeson 1960).

Lord (1961) reported that briliance changes largely from the highest to the lowest grade mainly because of the alteration in trash content and partly because of small concomitant changes in colour of the actual fiber. The high lint grades characterized by low trash content and high bariliance , whereas low lint grades are of high trash content and high brialiance, whereas low lint grades are of high trash content and low briliance.

Elsourady *et al.* (1969), found that 89% - 93% of the variation in grad of Giza 45, Giza 69 and Giza 67 could be attributed to non - lint content , micronaire value and Rd% . Kamal *et al* . (1983) and Mahgoub *et al.* (1984), found that trash content was the factor that exerted the greatest influence on lint cotton grade. Micronaire reading was of moderate effect while, percent reflectance (RD%) was of minor effect on lint cotton grade.

Marth *et al.* (1952) reported that micronaire reading was an exellent index of the number of neps expected in yarn, Berkley 1962 and Sallouma (1970), found that number of neps incareased as the cotton grade decreased. Cotton Grading Research Section 1973, found a high relationship between lint grade index and yarn irregularity of Egyption cotton . Ahmed and youssef (1978) found possitive corelation between yarn appearance grade and lint grade index. Mansour (1984) found a negative correlation between lint grade and yarn irregularity . Sief (1984) found a possitive corelation between yarn appearance grade and lint grade and microniare value. Therefor the present investiagation was conducted to study;

1 - The relatrive contribution of lint grade components to lint grade index.
2 - The relationship between lint grade index, grade components and yarn physical properties.

MATERIALS AND METHODS

The present investigation was carried out on six Egyptian cotton varieties namely; Giza 45 , Giza 70, Giza 76 (Extra - long staple), Giza 75, Giza 81 and Dendara (Long staple) during 1991 season in laboratories of cotton technology Divisions of the Cotton Resarch Institute . Lint cotton samples of the six varieties were obtained from the commercial cotton samlpes of 1990 crop which were delivered to Cotton Research Institute from cotton export companies. Three replicated samples were drawn from each of six lint grades (Good/ Fully Good, Good, Fully Good Fair / Good , Fuly Good Fair, Good Fair / Fully Good Fair and Good Fair) for each of the six varieties involved. The High Volume Instrument (H. V. I.) was used for measuring; trash content % expressed in terms of the percent of the inspected area occupied by trash , lint colour as indicated to lightness and expressed as redflectance percent (RD%) while yellowness is expressed in Hunter's scale values (+b) and microniare value. Yarn irregularity (c.v.%) number of thin places . thick places and nep count were determined by Uster Evenness Tester, yarn appearance grade was determined by visual examination and comparison according to the standards (ASTM D-2255-1964). For purpose of statistical analysis, the yarn appearance grade index for grades A, B, C and D were calculated, also the lint cotton grades were converted to index according to Nickerson *et al.* (1962) and Cotton Grading Research Section 1973.

Stepwise regression analysis was used for estimationg the relative contrbution of grade components to grade index. Simple correlation coefficients were calculated for the different variables of lint grades , lint grade index. trash content %, RD%, +b and micronaire value on one hand and each of yarn irregularity (c.v. %) thin places, thick places and nep count on the other hand for each of the six cotton varieties.

RESULTS AND DISCUSSION

The data in Table 1 show that in all the studied varieties high lint grades were characterized with high RD%, high micronaire values , low trash content %, and +b values whereas the low lint grades were of low RD% and micronaire values, high trash content % and +b.

Data in Table 2 show that simple correlation coefficients bewteen lint grade index and each of RD% and micronier value were positive and significant , whereas they were negative and significant between lint grade index and each of trash content % and +b in all the six studied varieties. These results are in agreement with Nickerson (1960), Lord (1961), El sourady (1969), Kamal *et al.* (1973) Mahgoub *et al.* (1984).

The relative contribution of grade components to lint grade index

The data of the stepwise analysis shown in table 3 indicated that:

1 - In case of the variety Giza 45 , the best single contributer to lint grade index was +b (0.92) , whereas the contribution of the other four components was (0.98).

2 - with regard to Giaz 70 variety the best single contributer to lint grade index was trash content % (0.95), whereas the contribution of the other four components was (0.96) .

3 - Regarding Giza 76, Giza 75., Giza 81 and Dandara varieties, the best single contributer to lint grade index was RD% (0.96, 0.98, 0.98 and 0.95) for the four varieties respectively, whereas the contribution of the other four components was (0.98, 0.99 , 0.99 and 0.97) respectively .

Summing up data obtained from the six varieties studied it could be concluded that trash content % and RD% were the most contributors to lint grade index in all varieties excapt Giza 45 where +b was the most contributor to lint grade index. However, micronіare value was of low contribution in all varieties studied . These results are in agreement with Lord (1961) , El Sourady (1969), Kamal *et al.* (1973) and Mahgoub *et al.* (1984).

The relationship between grade components , lint grade index and yarn physical properties

The simple correlation coefficients between each of lint grade index , Rd%, +b, trash %, microniare value and each of yarn irregularity (c.v. %) , thin places, thick places, nep count and yarn appearance grade index are shown in Table 4.

The results could be summrized as follows:

Simple correlation coefficients between lint grade index and each of yarn ir-

Table 1. Lint grade , grade components and yarn physical properties .

Variety & Grade	Characters									
	Lint grade index	Rd%	+b	Trash %	Mic. value	Thick places	Thin places	(c.v. %)	Nep count	Yarn appeara -nce
Giza 45										
G/FG	44	71.4	9.4	.18	3.3	8	90	15	5	80
G	40	68.0	9.8	.45	3.1	10	105	18	8	70
FGF/G	36	67.4	10.7	.98.	3.0	14	110	20	14	60
FGF	32	66.2	11.0	1.20	2.9	16	115	23	16	50
GF/FGF	28	64.6	11.6	2.45	2.8	20	120	27	22	40
GF	24	63.5	11.8	3.80	2.7	24	125	29	24	30
Mean	34	66.9	10.8	1.51	3.0	15.3	110.8	22	14.3	35
Giza 70										
G/FG	44	74.6	9.2	.14	4.2	8	102	16	3	90
G	40	73.0	9.8	.40	4.0	10	108	20	8	70
FGF/G	36	69.6	10.7	.62	3.8	15	114	23	12	50
FGF	32	65.2	11.2	.89	3.6	24	118	25	15	40
GF/FGF	28	64.6	11.5	1.68	3.4	26	120	27	18	30
GF	24	64.0	11.6	2.12	3.3	28	124	29	20	20
Mean	34	68.5	10.7	.98	3.7	18.5	114.3	23.3	12.7	50
Giza 76										
G/FG	44	76.0	8.9	.14	3.6	6	100	14	3	90
G	40	74.8	9.2	.38	3.4	9	105	18	6	80
FGF/G	36	71.2	9.6	.58	3.3	12	110	20	10	60
FGF	32	67.4	10.4	.90	3.2	15	114	21	15	40
GF/FGF	28	64.9	10.8	1.98	3.1	16	116	23	17	30
GF	24	64.2	10.9	2.40	3.0	18	119	25	20	20
Mean	34	69.8	9.9	1.06	3.3	12.8	110.7	20.2	11.8	53.3
Giza 75										
G/FG	44	74.6	9.0	.19	4.2	9	108	22	8	90
G	40	73.3	9.04	.35	3.9	15	157	24	15	70
FGF/G	36	70.2	9.8	.66	3.7	20	174	25	20	50
FGF	32	67.6	10.4	.97	3.5	23	187	27	23	40
GF/FGF	28	65.5	10.9	1.60	3.2	25	192	28	25	30
GF	24	63.6	11.0	2.46	3.1	28	202	30	28	20
Mean	34	69.1	10.1	1.04	3.6	20.0	170	26	19.8	50
Giza 81										
G/FG	44	74.0	9.0	.18	3.7	12	108	18	7	70
G	40	72.5	9.3	.35	3.6	18	115	21	15	50
FGF/G	36	71.0	10.2	.50	3.4	25	117	28	17	40
FGF	32	68.4	10.8	.79	3.3	29	120	30	19	30
GF/FGF	28	66.0	11.0	1.15	3.2	31	124	31	23	20
GF	24	65.4	11.3	2.20	3.0	34	127	33	25	10
Mean	34	69.6	10.3	.86	3.4	24.8	118.5	26.8	17.8	36.7
Dandara										
G/FG	44	64.8	12.3	.28	3.8	33	150	20	10	80
G	40	63.6	12.5	.75	3.6	36	160	22	13	60
FGF/G	36	61.2	13.0	1.02	3.4	42	170	25	17	50
FGF	32	58.4	13.2	2.18	3.1	47	177	27	20	40
GF/FGF	28	55.2	13.6	2.98	3.0	58	185	28	22	30
GF	24	53.0	14.2	3.72	2.9	64	190	32	25	20
Mean	34	59.4	13.1	1.82	3.3	46.7	172	25.7	17.8	46.7

Table 2. Simple correlation coefficients between lint grade index and each of Rd%, +b, trash content % and micronaire value for the six cotton varieties.

Characters	Cotton variety					
	Giza 45	Giza 70	Giza 76	Giza 81	Giza 75	Dandara
Rd %	0.97	0.94	0.79	0.98	0.98	0.98
+b	- 0.90	-0.91	-0.91	-0.92	- 0.96	- 0.96
Trash %	- 0.98	-0.98	- 0.98	-0.98	- 0.98	- 0.98
Micronaire	0.86	0.97	0.92	0.94	0.79	0.95

r = 0.444 at 0.05 level
r = 0.561 at 0.01 level

Table 3. Coefficients of determination , R% and predicion equations for the six cotton varieties.

Varieties	Full model (the four variables)				
	The best variable	R%	Y	R%	Y
Giza 45	x 2	0.92	y = 111.56 - 21x2	0.98	y =120.45 -6.69 x 1-5.80 x 2 - 0.01 x 3 - 2.05 x 4
Giza 70	x4	0.95	y = 43.22 - 9.43x4	0.99	y = 11.67 + 1.71x1 - 1.04 x 2+ 0.47 x 2 - 5.04 x 4
Giza 76	x3	0.96	y= -68.4 + 1.47x3	0.98	y = -179.94 + 8.63 x 1 + 6.51 x2 + 1.77x3 - 26x4
Giza 75	x3	0.98	y=- 84.06+ 1.71x3	0.99	y = -125.12 + 5.22x1 + 3.05 2x 2 + 1.60x3 - 0.96 x4
Giza 81	x3	0.98	y = -111.9+2.01x3	0.99	y = 4.99 - 5.93 x1 - 2.89x2 + 1.17 x 3 - 3.22 x4
dendara	x3	0.95	y = -59.86+1.58x3	0.98	y = -78.41 +2.29 x1 + 0.96 x2+ 1.55x3 + 0.02x4

where:

x1 = micronaire value x2 = +b x3 = RD% x4 = Trash content %

Table 4. Simple correlation coefficients between lint grade index, grade components and yarn physical properties.

Characters	Cotton variety					
	G. 45	G. 70	G. 76	G. 81	G. 75	Dendara
	Lint grade index					
Yarn irregularity	- 0.962	- 0.971	- 0.950	- 0.945	- 0.957	- 0.959
Thin places	- 0.977	- 0.972	- 0.985	- 0.929	- 0.988	- 0.969
Tick places	- 0.962	- 0.973	- 0.973	- 0.971	- 0.982	- 0.985
Nep count	- 0.969	- 0.869	- 0.985	- 0.980	- 0.982	- 0.971
Yarn appearance	0.908	0.937	0.942	0.935	0.937	0.923
	RD%					
Yarn irregularity	- 0.971	- 0.896	- 0.955	- 0.973	- 0.988	- 0.981
Thin places	- 0.939	- 0.951	- 0.976	- 0.964	- 0.999	- 0.954
Tick places	- 0.923	- 0.917	- 0.976	- 0.989	- 0.999	- 0.992
Nep count	- 0.921	- 0.836	- 0.978	- 0.993	- 0.999	- 0.994
Yarn appearance	0.854	0.923	0.950	0.967	0.977	0.669
	+b					
Yarn irregularity	0.797	0.926	0.952	0.894	0.947	0.977
Thin places	0.923	0.961	0.931	0.888	0.965	0.941
Tick places	0.869	0.942	0.931	0.922	0.963	0.976
Nep count	0.936	0.868	0.915	0.921	0.963	0.982
Yarn appearance	- 0.918	- 0.934	- 0.903	- 0.886	- 0.927	- 0.975
	Trash content %					
Yarn irregularity	0.927	0.943	0.982	0.976	0.984	0.981
Thin places	0.995	0.969	0.997	0.966	0.996	0.954
Tick places	0.934	0.959	0.997	0.992	0.995	0.992
Nep count	0.993	0.863	0.999	0.996	0.995	0.994
Yarn appearance	- 0.962	- 0.938	- 0.980	- 0.972	- 0.970	- 0.969
	Micronaire value					
Yarn irregularity	- 0.839	- 0.955	- 0.989	- 0.987	- 0.989	- 0.975
Thin places	- 0.888	- 0.948	- 0.967	- 0.966	- 0.993	- 0.910
Tick places	- 0.764	- 0.952	- 0.980	- 0.986	- 0.994	- 0.973
Nep count	- 0.895	- 0.932	- 0.973	- 0.981	- 0.994	- 0.994
Yarn appearance	0.912	0.991	0.988	0.988	0.987	0.987

regularity (c.v. %), thin places, thick places and nep count were negative and highly significat whereas, it was possitive and highly significant between lint grade index and yarn appearance grade in the six studied varieties. These results indicate that the better grades which are charcteriezed by good fiber quality - particularly fiber marturity and length uniformity - produced yarns with better regularity , low number of thin places, thick places , nep count and better appearance while the poorer grades resulted in yarns of high irregularity , high number of thin places, thick places and low appearance grade. These results are in line with those of Berkley 1961, Cotton Grading Research 1973 , Ahmed and Youssef 1978, Mansour 1984 and Sief 1884.

Percent reflectance (Rd%) and yarn physical properties relationship

Simple correlation coefficients between Rd% and yarn irrigularity , thin places , thick places and nep count were negative and highly significant whereas, it was possitive and highly significant between Rd% and yarn appearance grade. These results could be attributed to that high lint grades of a given cotton were usually characterized by high values of Rd%.

Yellowness degree (+b) and yarn physical properties relationship

The data show that simple correlation coefficients between +b and yarn irregularity, thin places , thick places and nep count were positive and higly significant whereas , it was negative and higly significant between +b and yarn appearance grade in the six varieties studied . These results indicate that wihtin a given variety, cotton of high +b values resulted in yarns of low quality, because of the existence of immature fibers and high trash content.

Trash content % and yarn physical properties relationship

Simple correlation coefficients between trash content % and yarn irregularity, thin places, thick places and nep count were positive and highly significant whereas it was negative and higly significant between trash content % and yarn appearance grade. It could be concluded that the higher the trash content in cotton the lower the grade and the quality of its yarns.

Micronaire value and yarn physical properties relationshhip

Simple correlation coefficients between micronaire value and yarn irregularity, thin places, thick places and nep count were negative and highly significant, whereas it was positive and highly signifacant between micronaire value and yarn appearance grade in the six varities studied . Low micronialire values may lead to the formation of higher number of neps in yarns due to the presence of relatively higher number of dead or thin walled immature fibers , also excessive number of neps detracts from the appearance of the yarn. These results agree with those of Marth *et al.* (1952) , Mansour (1984) and Sief (1984).

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مكونات رتبة القطن الشعر وعلاقتها بالخواص الطبيعية لخيوط الغزل

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أجري هذا البحث علي أصناف القطن المصري جيزة ٤٥ ، جيزة ٧٠ ، ٧٧ (فائقة الطول) ، جيزة ٧٥ ، جيزة ٨١ ، دندرة (طويلة)لدراسة الأهمية النسبية لمكونات رتبة القطن السعر . درجة الأنعكاس Rd%، درجة الأصفرار b+، نسبة المواد الغريبة وقراءة الميكرونير وعلاقة معامل رتبه القطن ومكوناتها بالخواص الطبيعية لخيوط غزل القطن درجة انتظام الخيوط ، عدد المناطق السمكية والرفيعة بالخيط، عدد العقد بالخيط ورتبة مظهرية الخيط. وذلك لخيوط غزل علي نمرة ٦٠ مسرح ويمكن تلخيص أهم النتائج فيما يلي :

أظهر تحليل الأنحدار المتعدد المراحل أن نسبة المواد الغريبة بالقطن ، درجة الانعكاس Rd% هما أهم مكونات رتبة القطن في الأصناف المدروسة فيما عدا في الصنف جيزة ٤٥ فكانت درجة الأصفرار b+هي أهم مكونات رتبه القطن بينما كانت قراءة الميكرونير أقل أهمية من باقي مكونات رتبه القطن .

كانت معاملات الأرتباط البسيط بين معامل رتبة القطن ومكوناتها من جهة والصفات الطبيعية لخيوط الغزل لكل صنف من الأصناف المدروسه من جهة أخري عالية المعنوية وقد أعطت الرتب العاليه دائما خيوط غزل ذات صفات جودة علي أعلي من الناتجة من الرتب المنخفضة في جميع الأصناف تحت الدراسة.