

STUDY TRASH ANALYSIS IN LINT GRADE OF SOME LONG-STAPLE COTTON VARIETIES AND ITS RELATIONSHIP BY FIBER QUALITY OF THESE GRADES.

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ABSTRACT

This work was carried out in the laboratories of Cotton Research Technology, Research Division, Cotton Research Institute, Agricultural Research Center, Giza, to investigate the effect of cleaning process (cleaning and without cleaning) and lint grades (six grades, G/FG, G, FGF/G, FGF, GF/FGF and GF) on fiber quality of some long-staple cotton varieties (Giza86, Giza90, and Giza80) and their interactions. Results indicated that the differences between cleaning treatments for reflectance degree (Rd%), yellowness (+b), 2.5% span length (mm), 50% span length (mm), fiber strength (gm/tex), micronaire value and uniformity (%) were significant. Cleaning treatment gave the best values for all studied traits. Results showed that differences between lint grades six were significant. G/FG and G grades gave the best values for all studied traits, while, GF gave the worst values for all these traits. Also, results indicated that the differences between varieties were significant of all studied traits. Giza86 var. gave the best values for all studied traits, while, Giza90 var. gave the worsen values for most studied traits. Results showed that, most of the interactions were insignificant for all studied traits except lint grades and varieties interaction in most studied traits of this study.

Keywords: Cotton Fiber, Trash Removal Important, Lint Grades, Cleaning Process, Fiber Quality.

INTRODUCTION

Cotton trash is known to the effect textile processing efficiency. Removal of cotton trash is a means to improve textile spinning. Trash particles originate from the cotton plant including different parts of the leaf, stem, bark, seed and hull or from the local environmental including grass, sand, dust and other contamination. Cotton contamination including large trash and small pepper trash is commonly referred to as visible foreign matter. Cotton contains trash with conflicting issues such as vs. seed coat, size vs. type and size vs. distribution. These issues are confounded because trash particles can be difficult to locate measure and describe since trash arises from many components and can be irregularly sized, erratically positioned partly covered in nature **Foulk et al. (2006)**. As well as, grade is combining the three factors i.e. color, trash content and preparation or appearance of ginned lint. Consequently, there are significant associated between cleaning treatments, lint cotton grade and fiber quality of these grades. Several investigators have reported significant relationship between cleaning treatment, lint cotton grades and improvement of fiber quality to most Egyptian cotton varieties. **Kamal et al. (1983)** indicated that there is positively correlated and strongly between fiber physical properties and lint cotton grade in Egyptian cottons. **Ahmed et al. (1984)** showed that trash content, fiber 2.5% span length, micronair reading, reflectance percent (Rd%) and lint grade were significantly affected by cleaning machinery. Also, **Kamal (1995)** found that in all studied varieties are positively and significantly correlated between fiber 2.5% span length, uniformity ratio with both lint cotton grade and yarn appearance grade, correlated inversely and significantly with either short fiber index, consequently, with lint grade or yarn appearance. **Foulk et al. (2004)** reported that increase the level of cleaning to extract more trash improve the cotton grade, reduces the fiber length, while, strength, reflectance percent (Rd %) increase with increase cleaning process. **Anthony (1982 and 1994)** showed that cleaning process practices significantly effect on fiber length, uniformity, content of seed coat fragments, trash, short fibers and neps. **Columbus and Robert (1990)** found that cleaning process generally significantly effect on reflectance degree (Rd%), yellowness (+b), fiber length, short fiber content, neps, seed coat

fragment, appearance and reduces the amount of usable fiber. Allen *et al.* (2007) concluded that removal of cotton trash during ginning process significantly effect on most fiber quality, yarn and fabric properties. Li *et al.* (2010) showed that cleaning treatments had more significant effect on fiber trash content, fiber length and short fiber content. Chanel *et al.* (2011) indicated that removal of trash from cotton fiber improved most fiber properties. Therefore, the current investigation was initiated to shed light on the effect of cleaning, lint grade on fiber quality of Egyptian cotton varieties.

MATERIALS AND METHODS

The present work was carried out to investigate:

1. Differences in foreign matter content, trash in raw cotton, fiber and yarn quality due to cotton varieties, lint grade and their interaction.
2. The relationship of foreign matter content, trash in raw cotton, fiber and yarn quality characteristics.
3. The relative importance of foreign matter content, trash in raw cotton fiber properties to yarn quality.

For this purpose, three of the commercial varieties of Egyptian cotton were chosen to represent long staple (LS) categories. The (LS) cottons were, Giza86, Giza80, and Giza90.

The cotton samples obtained from the commercial late of (2011-2012) harvest which delivered to the Cotton Grade Research Section of the Cotton Research Institute to be graded by expert classers. From the graded samples, six lint cotton grades were chosen to represent each of the chosen six varieties. Designation of the chosen grades were similar in all varieties being, good to fully good (G/FG), good (G), Fully good (FG), Fair to good (FGF/G), Fully Good fair (FGF), good fair to fully good fair (GF/FGF) and good fair (GF).

Sample Preparation:

From the raw cotton of each lint grade, three replicates were drawn. The lint of each replicate was mixed carefully by hand blending into a representative-sample which was used in determining, foreign matter content and fiber properties.

Prior to testing the lint cotton sample was stored and tested in a controlled atmosphere of 65% relative humidity and 20°C at the labs of Cotton Research Institute, Agricultural Research Center, Giza, Egypt.

Characters Studied:

1. Lint grade:

The lint cotton of each sample was determined after ginning. Grading was accomplished by comparing the samples with the official cotton grade standards established every year by Cotton Arbitration and Testing Organization of Egypt.

For statistical purposes the grades were converted to an index **Sallauma (1970)** as shown in the following tabulation:

Grade	Abbreviation	Index
Fully Good	FG	48
Good	G	40
Fully Good Fair	FGF	32
Good Fair	GF	24
Fully Fair	FF	16
Fair	F	8

According to the above indices, the grade index of each of the six chosen was calculated as follows:

Grade	Abbreviation	Index
Fully Good	FG	48
Good	G	40
Fully Good/Fair	GF	36
Fully Good Fair	FGF	32
Good Fair to Fully Good Fair	GF/FGF	28
Good Fair	GF	24

2. Foreign Matter Content:

The micro-dust and trash monitor (MTM) was used to determine the foreign matter content in the lint samples obtained from ginning. The micro-dust and trash monitor method is based on aeromechanics separation processes where in the separations are made according to rigid scientific definitions and thoroughly proven machine design principles. The (MTM) separates a nominally 20 gram sample of fiber into cleaned fiber and non-lint content (trash, micro-dust and fiber fragments). The standard (MTM) method consists of two 1.5 minute passes of the fiber. The material which passes through the (M.T.M) is subjected to forces similar to those encountered in normal textile processing. The tests were done according to Uster Instruction Manual.

3 – Color of Raw Cotton:

HVI 900A was used to determine the color measurements of raw cotton. The 900A uses an automatic pneumatic powered pressure plate to compress the sample against the inspection window with a constant amount of pressure, ensuring consistent sample presentation and simplifying the testing procedure. Reflectance (Rd %) and yellowness (+b) were measured according to ASTM-D2253-66, 1998.

4- Fiber Length:

Fibro-graph 630 which is a computerized type was used to determine fiber length parameters, it provides automatically brushing each sample, vacuuming the sample beard straight, moving the sample into an optical sensor, and taking readings of the optical density of the sample. The 2.5 and 50% span lengths; length uniformity % and short fiber index were determined directly by apparatus. The tests were carried out according to the Uster Instruction Manual.

5- Micronaire reading:

Micronaire reading that is a measurement for the combination of fiber fineness and maturity was measured by Uster Micronaire 675. In this method the fiber sample is weighted on an electronic balance. This mass is accepted if its weight is between 9.5 and 10.5 grams from the measured values of mass and pressure, the microprocessor calculates specific surface from which the fineness and maturity value were derived. The tests were done according to Uster Instruction Manual.

6- Pressley:

Pressley was used to determine the fiber strength at 0 inch gauge length according to standard procedure designated by the ASTM, Designation D-1445-1967.

Experimental design and statistical analysis:

Completely randomized design with three replicates was used to carry out the analysis of variance in foreign matter content, fiber and yarn properties due to cotton varieties, lint grades and their interactions. The data obtained were subject to statistical analysis according to the procedure outline by **Sendecor, G.W. and Cochran (1967)**, the least significant difference (L.S.D) was used for comparing the different means. Simple correlation was used to study the relationship of foreign matter content.

RESULTS AND DISCUSSION

Effect of cleaning process, lint grades, cotton varieties and their interactions on fiber properties:

1- Effect of cleaning process on fiber properties:

Results in Tables (1, 2, 3,4,5,6 and 7) show that the differences between cleaning treatments for reflectance degree (Rd %), yellowness (+b), 2.5% span length, 50% span length, fiber strength, micronaire reading and uniformity (%) were significant. Cleaning treatment gave the best values for all studied traits. These results may be attributed to because removal of cotton trash is a means to improve most fiber properties, as reflectance degree (Rd %), yellowness (+b), fiber strength, micronaire reading and uniformity (%). These results confirm the findings of *Ahmed et al. (1984)*, *Anthony (1990)*, *Columbus and Robert (1990)*, *Foulk and David (2003)*, *Allen et al. (2007)* and *Chanel et al. (2011)*.

2- Effect of lint grade on fiber properties:

Results in Tables from 1 to 7 indicated that these traits were significantly affected by lint grade. Most studied traits decreased with decreased lint grade. The maximum values for these traits were obtained from G/FG and G, while, the minimum values were obtained from GF/FGF and GF. The differences in lint grade could be attributed to strongly correlated between lint cotton grade and fiber physical properties, also, because lint grade is combining the three factors i.e. color, trash content and appearance of lint, consequently, there are significant associated between lint cotton grade and fiber quality. Those results were in agreement with *Kamal et al. (1983)* and *Ahmed et al. (1984)*.

3- Effect of cotton varieties on fiber quality:

Results in Tables (1, 2, 3,4,5,6 and 7) reveal that the differences between varieties for reflectance degree (Rd %), yellowness (+b), 2.5% span length, 50% span length, fiber strength, micronaire reading and uniformity (%) were significant. Giza 86 var. gave the best value for most studied traits,

while, Giza 90 var. gave the worsen values for most traits. These results confirm the findings of Hassan and Mesbah (2011).

4- Effect of the interaction between cleaning treatments and lint cotton grade on fiber quality:

The interaction between cleaning process and lint grade were significant effect on 2.5% span length, 50% span length and fiber strength, while, effect of the interaction was insignificant on reflectance degree (Rd%), yellowness (+b), micronaire reading and uniformity (%).

5- Effect of the interaction between cleaning treatments and cotton varieties on fiber quality:

The interaction between cleaning treatment and cotton varieties were insignificant effect on all studied traits.

6- Effect of the interaction between lint grade and varieties of fiber quality:

The interaction between lint grade and varieties were significant effect on reflectance degree (Rd %), 2>5% span length, 50% span length, fiber strength and micronaire value, while, were insignificant effect on yellowness and uniformity. The highest values were obtained from G/FG grade and Giza 86 var., while, the lowest values were obtained from GF grade with Giza 90 var. in all traits.

With regard the second order interaction of cleaning process, lint grade and cotton varieties, the results in tables from 1 to 7 showed that the interaction between these factors were insignificant effect on all studied traits.

دراسة تحليل الشوائب في رتب بعض الأصناف الطويلة للقطن المصري وعلاقتها بصفات جودة التيلة لهذه الرتب

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أجريت هذه الدراسة بمعامل تكنولوجيا القطن التابعة لمعهد بحوث القطن . مركز البحوث الزراعية بالجيزة على عينات محصول ٢٠١٢/٢٠١١ بهدف دراسة تأثير عمليات التنظيف ورتب القطن على صفات جودة بعض أصناف القطن المصري واستخدم في هذه الدراسة معاملات تنظيف القطن الشعر وبدون تنظيف وست رتب وأنصاف رتب (جود/ فولي جود، جود، فولي جود فير/جود، فولي جود فير، جود فير/ فولي جود فير وجود فير) وثلاثة أصناف من طبقة الأصناف الطويلة (جيزة ٨٦ ، جيزة ٩٠ وجيزة ٨٠) وقد أجريت الاختبارات بالطرق القياسية التابعة لـ (American Society for Testing and Material ASTM) وتحت جو قياسي طول فترة الاختبارات (رطوبة نسبية ٦٥% ± 2 ودرجة حرارة ٢١ ± 2 م°).

▪ استخدم التصميم التام العشوائية في ثلاث تكرارات وتم تحليل البيانات المتحصل عليها فيما يلي:

١. أظهرت النتائج تأثيرًا معنويًا لعمليات التنظيف على درجة الانعكاس، الاصفرار، طول أطول الشعيرات، متوسط الطول، المتانة، قراءة الميكرونير والانتظامية كنسبة مئوية/ على الترتيب. وكانت المتوسطات ٦٣.٧%، ١١.٩، ٢٩.٣٣، ٢٥.١٥مم، ١٠.١٧، ٣.٩٩ و ٨٣.٣٣%.
٢. أظهرت النتائج أيضًا تأثيرًا معنويًا لرتب القطن الشعر على كل الصفات المدروسة، حيث أعطت رتبة جود/فولي جود أحسن القيم بالنسبة لدرجة الانعكاس والاصفرار، طول أطول الشعيرات، متوسط الطول، المتانة، قراءة الميكرونير والانتظامية ٦٧.٥٧%، ١٠.٦٦، ٣٢.٣٤، ٢٧.٩٢مم، ١١.١٥، ٤.٤٧ و ٨٧.٠٦ على الترتيب، بينما أعطت رتبة جود فير

- أسوأ القيم بالنسبة لكل الصفات المدروسة على الترتيب ٥٧.٢١%، ١١.٨٩، ٢٧.١٢، ٢٣.٤٢م، ٨.٥٤، ٣.١٣ و ٨٠.٩٤ على الترتيب.
٣. كما أظهرت النتائج تأثيرًا معنويًا لأصناف القطن على كل الصفات المدروسة. أعطى الصنف جيزة ٨٦ أعلى القيم بالنسبة لكل الصفات المدروسة، بينما أعطى الصنف جيزة ٩٠ أقل القيم بالنسبة لكل تلك الصفات.
٤. كانت لكل التفاعلات الممكنة بين عمليات التنظيف ورتب القطن وأصنافه تأثيرًا غير معنوي لكل الصفات المدروسة، باستثناء التفاعل بين رتب القطن وأصنافه في معظم الصفات المدروسة لهذه الدراسة.
٥. كما أكدت النتائج أن نسبة التحسين في صفات درجة الانعكاس والاصفرار والمتانة وقراءة الميكرونيير كانت ٢.٠١%، ٢.٩٧%، ٨.٤٥، ٤.٧٦%، بينما نسبة الانخفاض في طول أطوال الشعيرات ومتوسط الطول والانتظامية كانت ٣.٤٢%، ٣.٥٦% و ٢.٣٢% على الترتيب.

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Table (1): Effect of cleaning process on reflectance degree (Rd %) for some lint grade in long cotton varieties.

Cleaning	Variety	G86	G80	G90	Mean
	Grade				
WITHOUT CLEANING	G/FG	77.03	62.50	61.63	67.05
	GOOD	76.83	61.03	59.63	65.83
	FGF/G	76.57	57.13	52.40	62.03
	FGF	75.67	56.50	51.03	61.07
	GF/FGF	75.63	51.93	48.40	58.65
	GF	75.20	46.83	46.53	56.19
	MEAN		76.16	55.99	53.27
CLEANING	G/FG	78.07	63.80	62.57	68.15
	GOOD	77.17	61.63	60.77	66.52
	FGF/G	76.97	58.53	53.80	63.10
	FGF	76.80	57.93	52.60	62.44
	GF/FGF	76.53	53.87	50.17	60.19
	GF	76.50	48.77	48.70	57.99
	MEAN		77.00	57.42	54.77
V X G	G/FG	77.40	63.15	62.10	67.57
	GOOD	77.10	61.33	60.20	66.21
	FGF/G	76.77	57.83	53.10	62.57
	FGF	76.60	57.22	51.82	61.88
	GF/FGF	76.37	52.90	49.28	59.52
	GF	76.22	47.80	47.62	57.21
	MEAN		76.75	56.71	54.02

L.S.D. at 5%		AXG	N.S
Cleaning (A)	0.36	AXV	N.S
Grade (G)	0.63	GXV	1.09
Varieties (V)	0.45	AXGXV	N.S

Table (2): Effect of cleaning process on yellowness for some lint grade in long cotton varieties

Cleaning	Variety grade	G86	G80	G90	Mean
	WITHOUT CLEANING	G/FG	9.53	11.53	11.40
GOOD		9.70	11.77	11.60	11.02
FGF/G		9.90	12.27	11.83	11.33
FGF		10.17	12.40	12.17	11.58
GF/FGF		10.20	12.60	12.50	11.77
GF		10.63	12.83	12.70	12.06
MEAN		10.02	12.023	12.03	11.43
CLEANING	G/FG	9.23	11.03	11.23	10.50
	GOOD	9.30	11.27	11.40	10.66
	FGF/G	9.70	11.90	11.53	11.04
	FGF	9.80	11.80	11.67	11.09
	GF/FGF	9.87	12.40	12.27	11.51
	GF	10.07	12.60	12.53	11.73
	MEAN	9.66	11.83	11.77	11.09
V X G	G/FG	9.38	11.28	11.32	10.66
	GOOD	9.50	11.52	11.50	10.84
	FGF/G	9.80	12.08	11.68	11.19
	FGF	9.98	12.10	11.92	11.33
	GF/FGF	10.03	12.50	12.38	11.64
	GF	10.35	12.72	12.62	11.89
	MEAN	9.84	12.03	11.90	11.26

L.S.D. at 5%	AXG	N.S
Cleaning (A) 0.12	AXV	N.S
Grade (G) 0.20	GXV	N.S
Varieties (V) 0.14	AXGXV	N.S

Table (3): Effect of cleaning process on upper half mean length for some lint grade in long cotton varieties

Cleaning	Variety	G86	G80	G90	Mean
	grade				
WITHOUT CLEANING	G/FG	34.23	32.83	30.82	32.63
	GOOD	33.57	31.87	30.20	31.88
	FGF/G	33.13	31.06	28.53	30.91
	FGF	32.20	30.03	27.17	29.80
	GF/FGF	31.00	29.30	26.53	28.94
	GF	29.80	28.37	25.97	28.04
	MEAN	32.32	30.58	28.21	30.37
CLEANING	G/FG	33.33	32.37	30.47	32.06
	GOOD	32.90	31.27	29.63	31.27
	FGF/G	32.43	30.27	27.90	30.20
	FGF	31.67	28.90	25.97	28.84
	GF/FGF	29.80	27.37	25.07	27.41
	GF	27.93	26.47	24.20	26.20
	MEAN	31.34	29.44	27.21	29.33
V X G	G/FG	22.78	32.60	30.65	32.34
	GOOD	33.23	31.57	29.92	31.57
	FGF/G	32.78	30.67	28.22	30.56
	FGF	31.93	29.47	26.57	29.32
	GF/FGF	30.40	28.33	25.80	28.18
	GF	28.87	27.42	25.08	27.12
	MEAN	31.83	30.00	27.71	29.84

L.S.D. at 5%	AXG	0.63
Cleaning (A) 0.26	AXV	N.S
Grade (G) 0.44	GXV	0.77
Varieties (V) 0.31	AXGXV	N.S

Table (4): Effect of cleaning process on mean length for some lint grade in long cotton varieties

Cleaning	Variety	G86	G80	G90	Mean of long
	grade				
WITHOUT CLEANING	G/FG	31.53	28.03	24.70	28.09
	GOOD	30.87	27.27	24.53	27.56
	FGF/G	28.87	25.50	24.47	26.28
	FGF	28.10	25.33	23.03	25.49
	GF/FGF	27.60	24.80	22.27	24.89
	GF	26.90	23.83	21.80	24.18
	MEAN	28.98	25.79	23.47	26.08
CLEANING	G/FG	31.30	27.77	24.20	27.76
	GOOD	30.40	26.90	23.93	27.08
	FGF/G	27.97	24.97	23.67	25.53
	FGF	27.00	24.13	21.87	24.33
	GF/FGF	26.27	23.43	20.90	23.53
	GF	25.43	22.30	20.27	22.67
	MEAN	28.06	24.92	22.47	25.15
V X G	G/FG	31.42	27.90	24.45	27.92
	GOOD	30.63	27.08	24.23	27.32
	FGF/G	28.42	25.23	24.07	25.91
	FGF	27.55	24.73	22.45	24.91
	GF/FGF	26.93	24.12	21.58	24.21
	GF	26.17	23.07	21.03	23.42
	MEAN	28.52	25.36	22.97	25.62

L.S.D. at 5%	AXG	0.57
Cleaning (A) 0.23	AXV	N.S
Grade (G) 0.41	GXV	0.70
Varieties (V) 0.29	AXGXV	N.S

Table (5): Effect of cleaning process on lint strength for some lint grade in long cotton varieties

Cleaning	Variety	G86	G80	G90	Mean
	grade				
WITHOUT CLEANING	G/FG	12.03	10.57	10.20	10.93
	GOOD	11.80	9.50	9.60	10.30
	FGF/G	11.30	8.37	9.13	9.60
	FGF	10.63	7.67	8.47	8.92
	GF/FGF	10.63	7.67	8.47	8.92
	GF	9.87	7.00	6.57	7.81
	MEAN		10.96	8.39	8.58
CLEANING	G/FG	12.30	11.07	10.73	11.37
	GOOD	12.33	10.13	10.17	10.88
	FGF/G	12.00	9.13	9.80	10.31
	FGF	11.50	8.53	9.27	9.77
	GF/FGF	11.27	8.33	8.73	9.44
	GF	11.33	8.43	8.03	9.27
	MEAN		11.79	9.27	9.46
V X G	G/FG	12.17	10.82	10.47	11.15
	GOOD	12.07	9.82	9.88	10.59
	FGF/G	11.65	8.75	9.47	9.96
	FGF	11.07	8.10	8.87	9.34
	GF/FGF	10.68	7.78	8.12	8.86
	GF	10.60	7.72	7.30	8.54
	MEAN		11.37	8.83	9.02

L.S.D. at 5%	AXG	0.23
Cleaning (A) 0.09	AXV	N.S
Grade (G) 0.16	GXV	0.28
Varieties (V) 0.12	AXGXV	N.S

Table (6): Effect of cleaning process on micronaire value for some lint grade in long cotton varieties

Cleaning	Variety	G86	G80	G90	Mean
	grade				
WITHOUT CLEANING	G/FG	4.50	4.53	4.17	4.40
	GOOD	4.43	4.40	3.93	4.26
	FGF/G	4.23	4.35	3.50	4.03
	FGF	3.93	3.91	3.40	3.75
	GF/FGF	3.57	3.50	3.03	3.37
	GF	3.23	3.10	2.67	3.00
	MEAN	3.98	3.97	3.45	3.80
CLEANING	G/FG	4.67	4.60	4.30	4.5
	GOOD	4.60	4.57	4.10	4.42
	FGF/G	4.40	4.50	3.67	4.19
	FGF	4.07	4.20	3.53	3.93
	GF/FGF	3.80	3.73	3.30	3.61
	GF	3.50	3.37	2.93	3.27
	MEAN	4.17	4.16	3.64	3.99
V X G	G/FG	4.58	4.60	4.23	4.47
	GOOD	4.52	4.48	4.02	4.34
	FGF/G	4.32	4.42	3.58	4.11
	FGF	4.00	4.07	3.47	3.84
	GF/FGF	3.68	3.62	3.17	3.49
	GF	3.37	3.23	2.80	3.13
	MEAN	4.08	4.07	3.54	3.89

L.S.D. at 5%	AXG	N.S
Cleaning (A) 0.06	AXV	N.S
Grade (G) 0.09	GXV	0.17
Varieties (V) 0.06	AXGXV	N.S

Table (7): Effect of cleaning process on uniformity index for some lint grade in long cotton varieties

Cleaning	Variety	G86	G80	G90	Mean
	grade				
WITHOUT CLEANING	<i>G/FG</i>	90.60	86.87	85.70	87.72
	<i>GOOD</i>	89.90	86.23	84.27	86.80
	<i>FGF/G</i>	88.80	85.67	82.47	85.64
	<i>FGF</i>	88.30	85.20	82.07	85.18
	<i>GF/FGF</i>	88.17	82.90	81.53	84.20
	<i>GF</i>	85.70	81.33	79.90	82.31
	MEAN	88.58	84.70	82.66	85.31
CLEANING	<i>G/FG</i>	89.20	85.53	84.13	86.28
	<i>GOOD</i>	88.67	84.83	83.03	85.51
	<i>FGF/G</i>	86.43	83.87	80.50	83.60
	<i>FGF</i>	86.30	83.20	80.13	83.21
	<i>GF/FGF</i>	85.90	80.47	79.17	81.84
	<i>GF</i>	83.10	78.60	77.00	79.57
	MEAN	86.60	82.75	80.66	83.33
V X G	<i>G/FG</i>	89.90	86.20	84.92	87.06
	<i>GOOD</i>	89.28	85.53	83.65	86.16
	<i>FGF/G</i>	87.55	84.77	81.48	84.60
	<i>FGF</i>	87.36	84.20	81.10	84.22
	<i>GF/FGF</i>	87.03	81.68	80.35	83.02
	<i>GF</i>	84.40	79.97	78.45	80.94
	MEAN	87.59	83.73	81.66	84.33

L.S.D. at 5% AXG N.S
 Cleaning (A) 0.40 AXV N.S
 Grade (G) 0.69 GXV N.S
 Varieties (V) 0.49 AXGXV N.S

