

RELATIONSHIP BETWEEN COTTON-SEED SITE INSIDE BOLL WITH SEED AND FIBER CHARACTERS UNDER SOME LOCATIONS OF TWO EGYPTIAN COTTON CULTIVARS

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Abstract

Two commercial Egyptian cotton cultivars used in this study namely ; Giza 70 and Giza 75. Seed cotton samples of the studied cultivars were taken from 13 locations in Egypt, during the two successive seasons 1995 and 1996. 50 bolls of seed cotton of each replicate were picked, every loculi of each boll was divided to three parts i.e., top, middle and base to study germination percentage, lint cotton %, seed index, fiber length parameters, micronaire reading and fiber colour. The base site gave the highest values of germination percentage, lint percentage, seed index, micronaire reading and degree of reflectance (Rd %). Whereas, the middle site recorded the highest the 2.5 % and 50 % span lengths. The top site recorded the second or third order of the all characters under study. The results indicated that micronaire reading showed highly significant positive correlation with germination percentage, lint percentage and Rd %, and it showed significant positive correlation with seed index.

Introduction

Such that cotton-seed is the base of cotton cultivate, all contracted seed production should be test in "Seed Production Program". Testing continuous throughout the delinting, conditioning, treating and storage phases to assure that only the highest product reaches to the farmer. Abd El-Salam et al. 1985, found that cottons, cottons x years and cottons x subregions interactions had significant effect on micronaire value. However, the second order interaction "cottons x years x subregions" was significant for micronaire value only. El-Marakbyef al. 1986, stated that micronaire value affected significantly, whereas the 2.5% and 50% span lengths had highly significant differences due to genotype x environment interaction. Greef and Humman 1988, cleared that year effect on the 50 % SL, uniformity ratio and fiber maturity ratio was significant. Hake et al. 1990, reported that low micronaire cottons could be noticed when cotton plant sets more bolls than it has carbohydrate supply to fill low micronaire often results. Davidonis 1994, found that ovule culture revealed that conditions present in a boll at 2 days post anthesis have an impact on subsequent fiber quality.

Materials and Methods

Two commercial Egyptian cotton cultivars used in this study namely ; Giza 70 (extra -long staple) and Giza 75 (long -staple). Seed cotton samples of the studied cultivars were taken from the miniature experiments conducted by Regional Evaluation of Cotton Cultivars Research Department, Cotton Research Institute (CRI), Agricultural Research Center (ARC), Giza, Egypt, during the two successive seasons 1995 and 1996. The different growth regions were Damanhour, Belkkas, Met-Ghamr, Tanta, El-Fayoum, El-Menya and Sohag in 1995 season, as well as Damanhour, Met-Ghamr, Tanta, Kafr El-Sheikh, Kafr Sad and Mena El-Gamh in 1996 season. The routine cultivation was carried out in this study. Ridges were 60 cms apart and the hills were spaced at 20 cms. The stand was thinned to two plants per hill, land preparation, fertilizer application and cultural operations followed the normal practices of cotton cultivation in the vicinity. Complete insect and pathological control was maintained whenever required.

Data on four replicates from each location of the two Egyptian cotton cultivars were distributed in a Randomized Complete Block Design, in both seasons. 50 bolls of the middle rows of each replicate were picked, every loculi of each boll was divided to three parts i.e., top, middle and base. The parts of each site were mixed, weighted and ginned to obtain the lint and seeds of each part to study the following characters :

1. Germination percentage: Percentage of seed germinated after 12 days were estimated in the Seed Testing Department, according to the International Rules for Seed Testing Anon. 1985. Two hundred seed in four plates at rates of 50 seed per each were germinated at 30° C using sand substratum.
2. Percentage of lint cotton (ginning outturn): Ratio of lint weight to seed cotton weight expressed as percentage, calculated according to the following formula :

$$\text{Lint percentage (L \%)} = \frac{\text{weight of lint}}{\text{weight of seed cotton}} \times 100$$

3. Seed index (SI): Specific weight of seeds expressed the weight of 100 seeds in grams.
4. Fiber length: A Digital Fibrogaph was used to determine the fiber length at 2.5 and 50 % span lengths (SL). The procedure was performed according to the standards of ASTM : D 1447 - 83. Uniformity ratio % (LUR %) was calculated using the following equation Sundarum, 1979.

$$\text{LUR \%} = \frac{50\% \text{SL}}{2.5 \% \text{SL}} \times 100$$

5. Micronaire reading (Mic): Micronaire instrument was used to determining micronaire reading according to the standards of ASTM : D 1448 - 90.
6. Fiber colour: High volume Instrument (HVI 900) was used to determining degree of reflectance (Rd %) and degree of yellowness in units of Hunter's (+b) according to ASTM : D 2253 - 76.

All fiber test were carried out at the Cotton Fiber Res. Depart., CRI, ARC, Giza, Egypt, at a constant relative humidity of 65 % \pm 2 and temperature of 20 \pm 2° C.

Data were subjected to the analysis of variance Snedecor and Cochran, 1982. The main characters were tested by Duncan method, but the interactions were tested by the Least Significance Differences (L.S.D.). Simple correlation coefficients were computed between the studied characters.

Results and Discussion

Effect of Cultivars on Seed and Fiber Characters

Data in Table 1 represent the germination percentage, lint percentage, seed index, the 2.5 % SL, 50 % SL, length uniformity ratio %, micronaire reading, degree of reflectance and yellowness as affected by the two cultivars i.e., Giza 70 and Giza 75. The results of analysis of variance indicated that differences in the two cultivars were significant for all characters, except length uniformity ratio %.

The result showed that Giza 70 c.v. gave the higher germination percentage (84.03 %), 2.5 % SL (33.70 mm), 50 % SL (16.96 mm) and yellowness (10.42). Whereas, Giza 75 c.v. gave the highest lint percentage (37.76 %), seed index (10.3 gms), micronaire reading (4.38 unit) and degree of reflectance (73.83 %).

Effect of Seed Site on the Seed and Fiber Characters

Data pertaining to the germination percentage, lint percentage, SI, 2.5 % SL, 50 % SL, LUR %, Mic, Rd % and +b of the three sites were statistically analyzed represented as shown in Table 1. It is evident that the differences were significant for all characters under study except LUR % was insignificant. The base site gave the highest values of germination percentage (90.73 %), lint percentage (37.97 %), SI (10.58 gm), Mic (4.59 unit) and Rd % (73.06 %). whereas, the middle site recorded the highest 2.5 % SL (32.40 mm.), and 50 % SL (16.32 mm.). On another hand, the top site recorded the second or third order of the all characters under study.

In conclusion, the seeds of the base or middle sites of the loculi recorded the highest values of the all characters under study, this result means that the top site of the loculi gave the lowest values of germination percentage(73.86 %), lint percentage (36.75 %), SI (8.73 gm), Mic (3.60 unit) and Rd % (71.65 %). Also it has more immature seeds as well as fiber. This result is very important and should be in our mind in seed production.

Effect of Locations on Seed and Fiber Characters

Data in Table 2 represent the germination percentage, lint percentage, SI, 2.5 % SL, 50 % SL, LUR %, Mic, Rd % and +b as affected by the different growth regions i.e., Damanhour, Belkkas, Met-Ghamr, Tanta, EI-Fayoum, EI-Menyaand Sohag in 1995 season, as well as Damanhour, Met-Ghamr, Tanta, Kafr El-Sheikh, Kafr Sad and Mena EI-Gamh in 1996 season.

Regarding these locations, it could be noticed that Damanhour recorded the highest values of germination percentage (96.71 %), SI (11.04 gm), 2.5 % SL (33.25), 50 % SL (16.74), LUR % (50.32 %), Mic (4.87 unit) and Rd % (74.99 %) in 1995 season. The results of analysis of variance indicate that differences between the above locations were significant for all characters.

Effect of (Cultivars X Sites) Interaction on Seed and Fiber Characters

Data in Table 3 as well as figures from 1 to 9 show the cultivars x sites interaction for the germination percentage, lint percentage, SI, 2.5 % SL, 50 % SL, LUR %, Mic, Rd % and +b. The results of analysis of variance indicate that the differences were insignificant for all the characters under this study, except +b which was significant. Also, it could be noticed that Giza 70

recorded the highest values of germination percentage, and +b in the base site, as well as the 2.5 % SL and 50 % SL in the middle site. On the other hand, Giza 75 recorded the highest values of lint percentage, SI, Mic and Rd % in the base site.

Data in Table 4 represent the mean values of the germination percentage, lint percentage, SI, 2.5 % SL, 50 % SL, LUR, Mic, Rd % and +b. of the (cultivars x locations) interaction. The results of analysis of variance indicated that differences were highly significant for all characters under study. It could be noticed that Giza 70 at Damanshour (1995) recorded the highest values of germination percentage, 2.5 % SL and 50 % SL which gave 96.15 %, 35.06 mm., and 17.69 mm. respectively, and it recorded the highest value of +b (11.10) at Met Ghamsr (1995). With respect to Giza 75, it has the highest value of lint percentage (38.87 %) at Damanshour 1996, seed index (11.68 gms) at EI-Fayoum 1995, Mic (5.06 unit) and Rd % (76.32 %) at Damanshour 1995.

Effect of (Sites X Locations) Interaction on Seed and Fiber Characters

Data in Table 5 represent the mean values of the germination percentage, lint percentage, SI, 2.5 % SL, 50 % SL, LUR %, Mic, Rd % and +b. of the (sites x locations) interaction. The results of analysis of variance indicated that differences were highly significant for all characters under study.

The base site recorded the highest values at Damanshour (1995), for the germination percentage and Mic (100 % and 5.22 unit respectively), at Kafr Sad (1996), for the lint percentage (39.93 %) and at EI-Fayoum (1995), for SI (12.43 gm). Meanwhile, the middle site showed the highest values of 2.5 % and 50 % SL (33.87 and 17.12 respectively) at EI-Fayoum (1995).

Relationship Between Seed and Fiber Characters

Simple correlation coefficient between the seed and fiber characters are shown in Table 6. The results showed highly significant positive correlation coefficients between micronaire reading and each of germination percentage (0.456), lint percentage (0.423) and Rd % (0.393); germination with each of Rd % and +b (0.438 and 0.266, respectively); lint percentage with Rd % (0.369); 50 % SL with each of 2.5 % SL and LUR % (0.965 and 0.249) and between +b with each of 2.5 % SL and 50 % SL (0.483 and 0.455, respectively). Also, significant positive correlation coefficient were calculated between Mic and SI (0.128).

On the other side, highly significant negative correlation coefficients were showed between lint percentage with each of 2.5 % SL, 50 % SL and +b (-0.353, -0.372 and -0.279, respectively); Rd % with each of 2.5 % SL and 50 % SL (-0.436 and -0.458, respectively) and between Mic and +b (-0.199).

The aforementioned results are confirmed with Nawar 1975, in study of the relation between morphological and technological characters in some Egyptian cotton cultivars, he found a negative correlation between the 2.5 % and 12.5 % span lengths with lint percentage. Also, SI correlated positively with Mic. On the other hand, Nawar et al. 1995, cleared that while the average thickness of the outer wall of boll increased under saline treatments, the average width of either of boll and ovule decreased.

It could be cleared that this study do not search about locations effect on the studied characters, but the locations used to obtain a wide range of variation within each cultivar only, and the aim is the cotton-seed site inside loculi or boll. This study clear the importance of Mic within the cultivar "as expressed the fiber maturity" and its high correlation with germination percentage, lint percentage, SI and Rd %. Result clear that the seed production program should be include Mic value or fiber maturity beside the routine tests of seeds.

Also, the seed quality of the base and middle sites of loculi was higher than the top site, seed quality. This study clear the importance of dispart the top site seed of loculi or boll to improve the seed quality. But the study need the answer of the question: How are the seed production programs benefit from this study results?

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Table 1. Mean values of seed and fiber characters of the two cultivars and the three sites of seed in loculi.

Characters		Cultivars		Site of seed in loculi		
		Giza 70	Giza 75	Top	Middle	Base
Germination	%	84.03 A	81.37 b	73.86 C	83.51 b	90.73 a
Lint percentage		36.90 B	37.76 a	36.75 b	37.27 c	37.97 a
Seed index	gms	9.40 B	10.30 a	8.73 C	10.23 b	10.58 a
2.5 % span length		33.70 A	30.23 b	31.73 b	32.40 a	31.76 b
50 % span length		16.96 A	15.25 b	16.05 b	16.32 a	15.84 b
Length uniformity ratio	%	50.27 A	50.34 a	50.48 a	50.26 a	50.18 a
Micronaire reading		3.96 B	4.38 a	3.60 c	4.32 b	4.59 a
Reflectance (Rd %)		70.76 B	73.83 a	71.65 c	72.17 b	73.06 a
Yellowness (+b)		10.42 A	9.79 b	10.02 c	10.13 b	10.16 a

Means followed by the same letter are not significant for each character.

Table 2. Mean values of seed and fiber characters of the locations.

Environments	Germ. %	L%	Sl gm	2.5 % SL	50% SL	LUR %	Mic	Rd%	+b
1995 Damanhour	96.71 a	37.95 b	11.04 a	33.24 a	16.74 a	50.32 a	4.87 a	74.99 a	10.43cd
Belkkas	92.25 be	37.21 de	10.12c	32.58 be	16.42 be	50.33 a	4.30 de	74.26 ab	10.55 be
Met-Ghamr	91.63 be	38.72 a	9.69 d	32.12de	16.22de	50.58 a	4.21 ef	73.17cd	10.72ab
Tanta	83.63d	37.82 be	8.89 fg	31.81 ef	16.07d	50.44 a	3.63 h	71.09f	10.75 a
EI-Fayoum	93.92 ab	36.07 e	10.77ab	33.25 a	16.71 a	50.24 a	4.33d	73.07 cd	10.81 a
EI-Menya	49.54 g	36.83 e	9.26 e	32.82 b	16.51 ab	50.29 a	4.18 f	67.00 h	9.88 f
Souhage	80.21 e	35.13 g	9.19 ef	32.33 cd	16.58ab	50.54 a	3.91 g	68.29 g	10.30de
1996 Damanhour	84.75 d	38.70 a	9.74 d	29.81 i	14.98 f	50.20 a	4.61 b	73.77 be	9.58 g
Kafr El-sheikh	83.58 d	37.98 b	10.55 b	32.81 b	16.47 be	50.56 a	4.49 c	73.36 c	9.43 g
Met-Ghamr	77.92 e	37.05 de	9.82 cd	31.47 fg	15.74 e	49.97 ab	3.98 g	73.41 c	10.16 e
Tanta	77.25 e	35.71 f	8.83 g	30.26 h	15.11 f	49.60 b	3.19f	73.05 cd	10.21 e
Kafr Sad	89.13c	38.66 a	10.81 ab	31.14g	15.74 e	50.49 a	4.58 be	71.82 ef	8.97 h
Menya El-Kamh	74.58 f	37.44 cd	9.32 c	31.89e	16.07d	50.36 a	3.93d	73.54 de	9.58 g

Means followed by the same letter are not significant for each character.

Table 3. Mean values of seed and fiber characters of the “cultivars x sites” interaction.

Characters	Giza 70 cv			Giza 75 cv		
	Top	Middle	Base	Top	Middle	Base
Germination %	75.10a	84.50a	92.40a	72.52a	82.52a	89.06a
Lint percentage %	36.38a	36.87a	37.46a	37.11a	37.68a	38.48a
Seed index gm	8.34a	9.81a	10.04a	9.13a	10.64a	11.12a
2.5 % span length	33.40a	34.12a	33.58a	30.07a	30.68a	29.93a
50 % span length	16.87a	17.15a	16.85a	15.48a	15.50a	15.04a
Length uniformity ratio %	50.47a	50.19a	50.14a	50.48a	50.32a	50.21a
Micronaire reading	3.42a	4.08a	4.39a	3.78a	4.57a	4.78a
Reflectance (Rd %)	70.17a	70.69a	71.42a	73.13a	73.65a	74.71a
Yellowness (+b)	10.40a	10.38a	10.46a	9.64c	9.88b	9.86b

Means followed by the same letter are not significant for each character.

Table 4. Mean values of seed and fiber characters of the “cultivars x locations” interaction.

varieties year Environ.	Germ. %	L% %	SI gm	2.5 % SL	50% SL	LUR %	Mic	Rd%	+b
Giza70 1995 Damanhour	96.75	37.17	10.59	35.06	17.69	50.44	4.69	73.66	10.59
Belkkas	95.83	36.94	10.02	34.33	17.32	50.43	4.27	72.80	10.80
Met-Ghamr	91.17	38.63	9.18	33.33	16.82	50.43	4.13	72.13	11.10
Tanta	88.17	37.43	8.40	33.20	16.63	49.94	3.37	70.29	10.98
El-Fayoum	95.83	35.95	9.87	34.66	17.34	50.03	4.09	71.58	11.03
El-Menya	63.25	36.78	8.49	33.90	17.10	50.42	4.10	64.40	9.92
Souhage	77.08	34.95	7.78	32.99	16.60	50.21	3.44	67.20	10.06
1996 Damanhour	84.00	38.53	9.61	32.33	16.31	50.41	4.38	72.73	9.77
Kafr El-Sheikh	82.75	37.22	9.85	34.64	17.39	50.16	4.09	70.97	9.83
Met-Ghamr	80.58	36.27	9.84	33.86	16.96	50.04	3.84	71.52	10.54
Tanta	78.25	35.28	8.48	32.78	16.46	50.17	3.01	71.47	10.84
Kafr Sad	89.67	37.70	10.85	33.57	16.94	50.44	4.31	69.66	9.46
Menya El-Kamh	69.08	36.87	9.21	33.44	16.86	50.34	3.81	71.47	9.93
Giza75 1995 Damanhour	96.67	38.74	11.49	31.42	15.79	50.20	5.06	76.32	10.27
Belkkas	88.67	37.47	10.22	30.81	15.52	50.23	4.33	75.72	10.30
Met-Ghamr	92.08	38.81	10.19	30.91	15.62	50.73	4.29	74.21	10.33
Tanta	79.63	38.21	9.38	30.42	15.50	50.94	3.90	71.89	10.52
El-Fayoum	92.00	36.18	11.68	31.84	16.07	50.46	4.58	74.57	10.59
El-Menya	35.83	36.88	10.02	31.73	15.92	50.16	4.27	69.60	9.84
Souhage	83.33	35.31	10.60	31.68	16.57	50.87	4.37	69.39	10.00
1996 Damanhour	85.05	38.87	9.88	27.28	13.66	49.99	4.84	74.80	9.40
Kafr El-Sheikh	84.42	38.75	11.25	30.97	15.54	50.97	4.89	75.76	9.03
Met-Ghamr	75.25	37.82	9.79	29.09	14.52	49.89	4.11	75.29	9.77
Tanta	76.25	36.13	9.18	27.73	13.77	49.03	3.38	74.63	9.57
Kafr Sad	88.58	39.63	10.77	28.71	14.53	50.54	4.84	73.99	8.49
Menya El-Kamh	80.08	38.02	9.42	30.34	15.29	50.37	4.06	73.62	9.22
L.S.,D.5%	4.39	0.63	0.45	0.55	0.35	0.74	0.15	1.02	0.24
L.S.D 1 %	5.77	0.82	0.59	0.72	0.46	0.98	0.20	1.34	0.32

Table 5. Mean values of seed and fiber characters of the "sites x locations" interaction.

Sites	year	Environ.	Germ. %	L%	SI gm	2.5 % SL	50% SL	Mic	Rd%	+b
Top	1995	Damanhour	93.25	36.75	10.96	33.53	16.85	4.47	74.30	10.50
		Belkkas	81.25	35.76	9.83	32.65	16.63	3.83	72.55	10.50
		Met-Ghamr	80.50	38.90	7.33	31.20	15.88	3.25	72.30	10.90
		Tanta	72.63	37.25	7.59	31.33	15.88	2.95	70.20	10.55
		EI-Fayoum	87.38	37.10	8.53	32.55	16.28	3.60	72.65	10.50
		EI-Menya	34.8	37.08	7.84	31.90	16.15	3.60	65.90	9.95
		Souhage	65.63	36.18	6.51	31.55	15.97	2.90	67.60	10.30
	1996	Damanhour	84.50	37.74	8.19	29.57	14.85	4.20	73.80	9.60
		Kafr El-Sheikh	78.00	36.29	10.30	33.13	16.90	4.00	72.55	9.10
		Met-Ghamr	67.00	36.29	8.90	31.50	15.90	3.60	73.10	10.10
		Tanta	65.88	34.85	8.23	30.05	15.17	2.80	72.20	10.25
		Kafr Sad	82.25	37.16	10.60	31.25	15.85	4.10	72.05	8.75
		Menya EI-Kamh	67.00	36.35	8.76	32.32	16.33	3.50	71.23	9.27
Middle	1995	Damanhour	96.38	37.93	10.99	33.28	16.88	4.93	75.68	10.53
		Belkkas	96.88	37.46	10.23	33.10	16.53	4.43	74.42	10.63
		Met-Ghamr	96.25	38.11	10.76	33.12	16.67	4.47	72.78	10.60
		Tanta	83.87	37.68	9.55	32.35	16.28	3.95	70.73	10.85
		EI-Fayoum	96.88	35.18	11.36	33.87	17.12	4.55	73.10	10.95
		EI-Menya	46.25	36.94	9.74	33.15	16.60	4.27	66.60	9.48
		Souhage	78.75	34.86	10.18	32.50	16.98	4.25	67.87	10.45
	1996	Damanhour	72.75	38.59	10.31	30.50	15.27	4.70	73.68	9.67
		Kafr El-Sheikh	84.75	38.04	10.61	32.70	16.55	4.60	73.28	9.60
		Met-Ghamr	78.63	37.21	10.11	31.75	15.82	4.07	73.28	10.10
		Tanta	79.00	36.06	8.69	30.80	15.28	3.30	73.40	10.25
		Kafr Sad	90.00	38.90	10.75	31.72	15.97	4.57	70.70	8.95
		Menya EI-Kamh	74.75	37.58	9.40	32.35	16.25	4.13	72.62	9.65

Table 5. Cont.. Mean values of seed and fiber characters of the "sites x locations" interaction.

Sites year Environ.	Germ. %	L%	SI gm	2.5 % SL	50% SL	Mic	R	+b
Base 1995 Damanhour	100.00	39.19	11.18	32.90	16.48	5.22	74.78	10.25
Belkkas	98.63	38.40	10.31	31.97	16.10	4.63	74.82	10.52
Met-Ghamr	98.13	39.15	10.90	32.05	16.12	4.92	74.43	10.65
Tanta	94.37	38.54	9.53	31.75	16.03	4.00	72.33	10.85
EI-Fayoum	97.50	35.93	12.43	33.33	16.72	4.85	73.28	10.98
EI-Menya	67.50	36.49	10.20	33.40	16.78	4.68	68.50	10.22
Souhage	96.25	34.35	10.89	32.95	16.80	4.57	67.42	10.15
1996 Damanhour	87.00	39.79	10.73	39.35	14.83	4.93	73.82	9.48
Kafr El-Sheikh	88.00	39.63	10.74	32.58	15.95	4.87	74.25	9.60
Met-Ghamr	88.13	37.64	10.44	31.17	15.50	4.27	73.83	10.27
Tanta	86.88	36.21	9.30	29.92	14.88	3.48	73.55	10.12
Kafr Sad	95.13	39.93	11.09	30.45	15.40	5.07	72.72	9.22
Menya EI-Kamh	82.00	38.40	9.79	31.02	15.63	4.17	73.78	9.82
L.S.D. 5 %	5.38	0.77	0.55	0.67	0.43	0.18	N.S.	0.30
L.S.D. 1 %	7.07	1.01	0.72	0.88	0.56	0.24	N.S.	0.39

* N.S. = Not significant

Table 6. Simple correlation coefficients between studied characters.

Characters	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	
Germ %	X ₁	0.145*	0.101	0.126	0.106	0.456**	-0.028	0.498**	0.266**
L %	X ₂		-0.058	-0.353**	-0.372**	0.423**	-0.034	0.369**	-0.279**
SI	X ₃			0.032	0.059	0.128*	0.122	0.086	0.024
2.5%SL	X ₄				0.965**	-0.076	0.062	-0.436**	0.483**
50%SL	X ₅					-0.079	0.249**	-0.458**	0.455**
Mic	X ₆						0.32	0.393**	-0.199**
LUR %	X ₇							-0.074	-0.069
Rd %	X ₈								-0.105
+b	X ₉								1.000

*, ** Significant at 5% and 1% probability levels, respectively

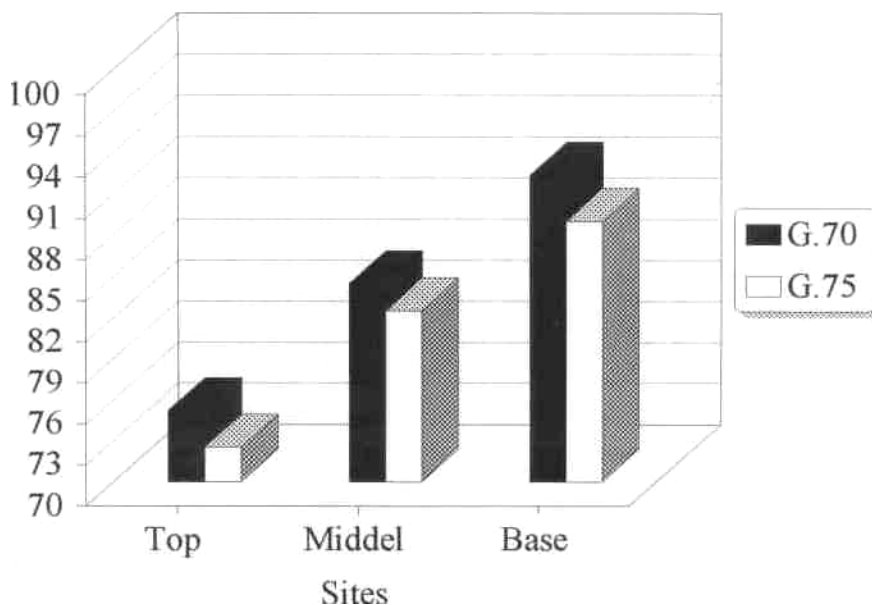


Figure 1. The relationship between sites of seeds in loculi with germination % in Giza 70 and Giza 75 cultivars.

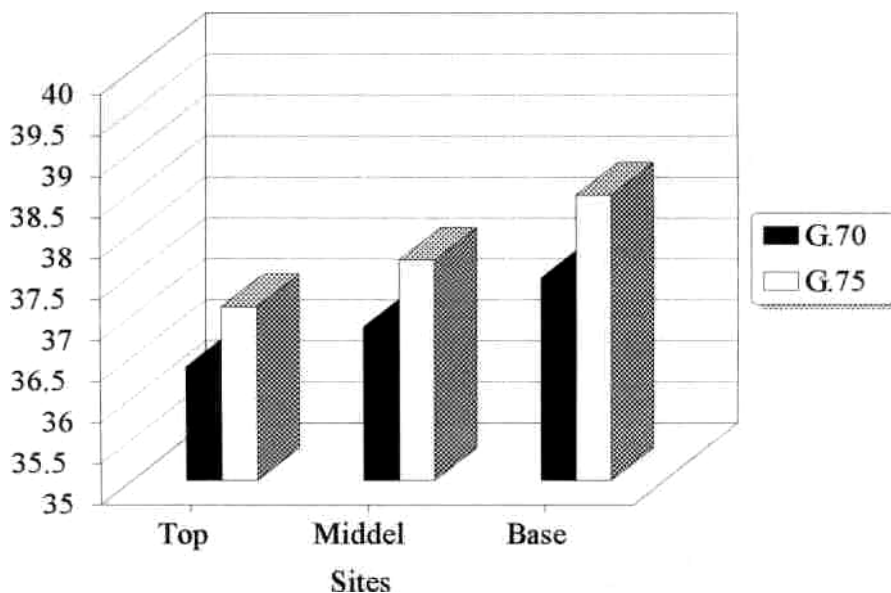


Figure 2. The relationship between sites of seeds in loculi with lint percentage in Giza 70 and Giza 75 cultivars.

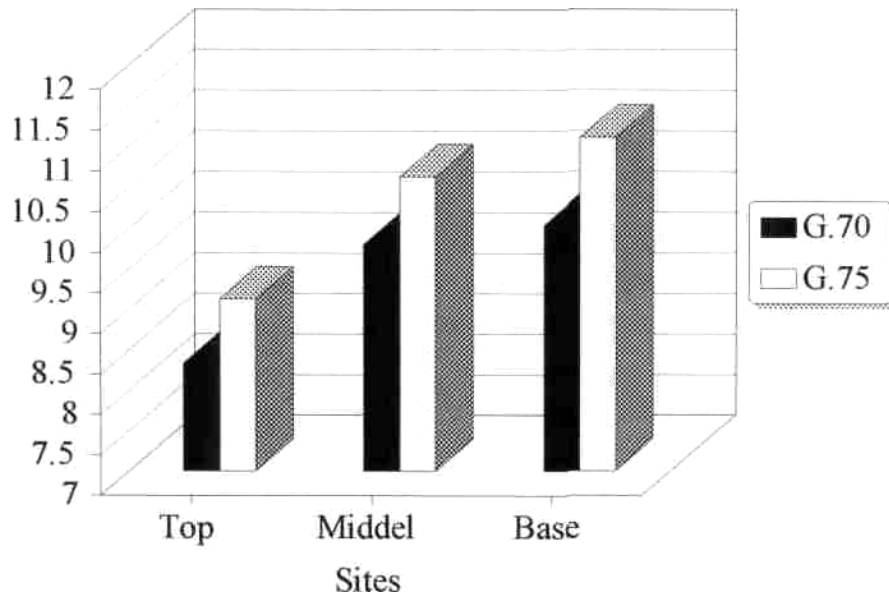


Figure 3. The relationship between sites of seeds in loculi with seed index in Giza 70 and Giza 75 cultivars.

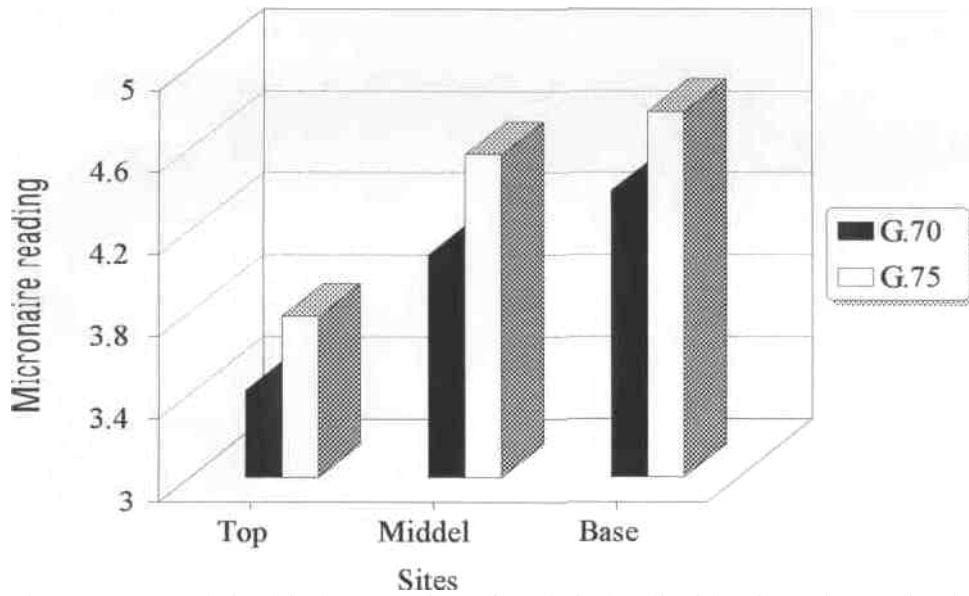


Figure 4. The relationship between sites of seeds in loculi with Micronaire reading in Giza 70 and Giza 75 cultivars.

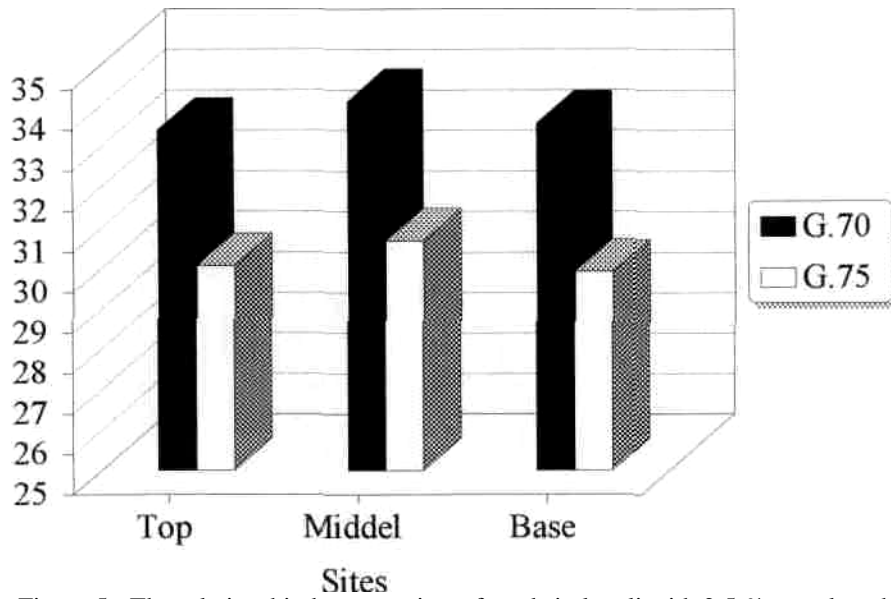


Figure 5. The relationship between sites of seeds in loculi with 2.5 % span length in Giza 70 and Giza 75 cultivars.

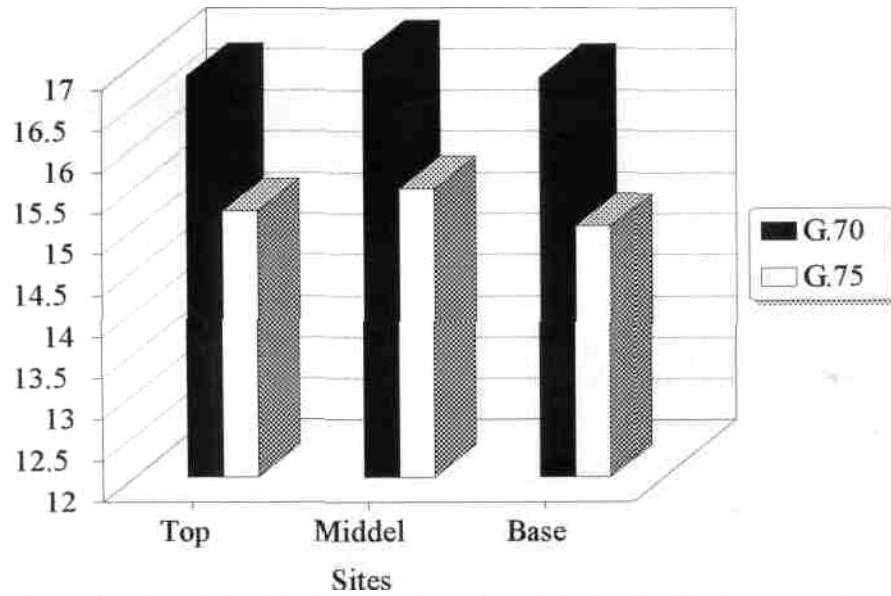


Figure 6. The relationship between sites of seeds in loculi with 50 % span length in Giza 70 and Giza 75 cultivars.

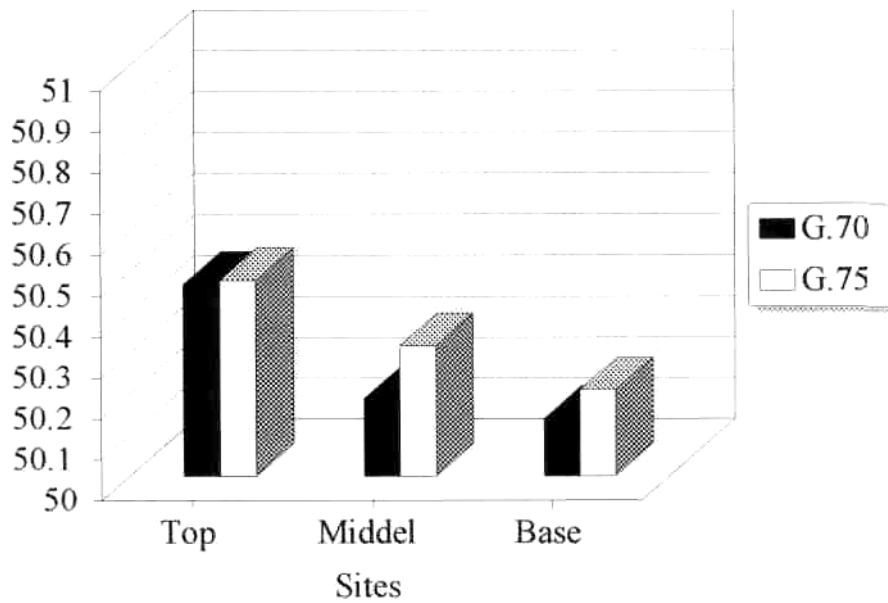


Figure 7. The relationship between sites of seeds in loculi with length uniformity ratio (LUR) in Giza 70 and Giza 75 cultivars.

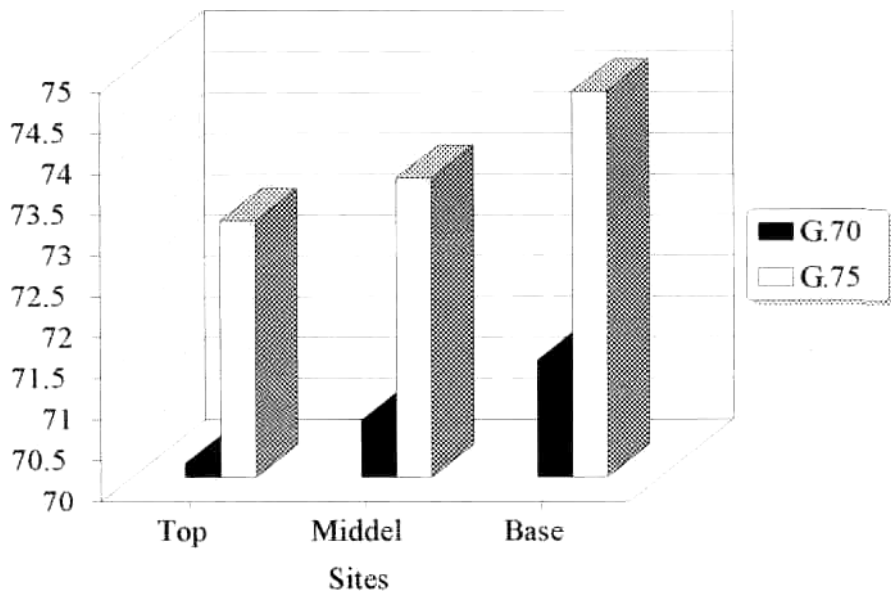


Figure 8. The relationship between sites of seeds in loculi with degree of reflectance (Rd %) in Giza 70 and Giza 75 cultivars.

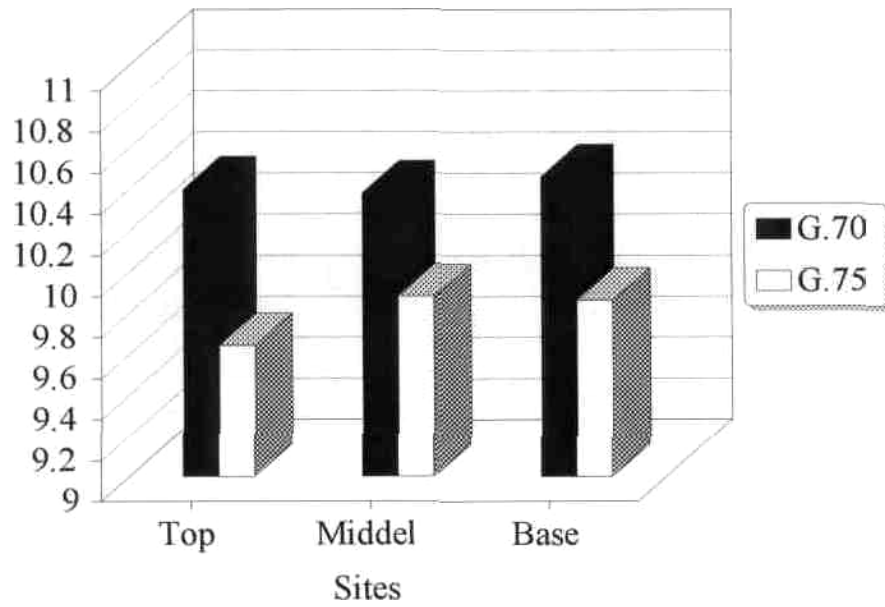


Figure 9. The relationship between sites of seeds in loculi with yellowness (+b) in Giza 70 and Giza 75 cultivars.