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Response of some Egyptian Cotton Varieties to Laser Irradiation

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ABSTRACT

The present study was carried out to study the effect of treatment with three doses (5,10 and 15 min) of laser irradiation and evaluate the induced variability on some quantitative characters of the two Egyptian cotton cultivars Giza 92 and Giza 94. The trial was conducted at Sakha Experimental Station, Agricultural Research Center, Kafr El-Sheikh, Egypt during three growing seasons from 2014 to 2016. The results indicated that the laser irradiation decreased the mean performance of yield and yield components for Giza 92, while the Giza 94 variety exhibited increase for yield and yield components. no effect was found for the fiber quality of Giza 92, while better fiber quality was obtained for Giza 94 except for fiber strength which was reduced with the mutagen treatments in M_1 generation. The treatment with laser irradiation increased the variability for most studied traits. The results of kurtosis indicated that most of cases were less than 3 indicated that the variability of plants were distributed as platykurtic so, the individual plants are unconcentrated around the means. Heritability estimated showed high values for boll weight (more than 50%) in M_1 5 and 10 min and M_2 15 min , as well as for number of bolls per plant , seed and lint cotton yield per plant, lint percentage and fiber fineness in M_1 of Giza 92, fiber length in all generations of Giza 94. Low values of broad senses heritability (less than 30%) were found for boll weight of Giza 94 in treatment 15 min of M_1 and M_2, as well as in treatment of 10 min in M_2 for Giza 92. The fiber fineness exhibited low heritability value for Giza 94, while Giza 92 exhibited high values of heritability. The relationship between the yield and boll weight was significantly positive for control treatment, and between the yield and lint percentage in M_2 and M_3 of treatment 10 min for Giza 92, while Giza 94 exhibited insignificant correlation between yield and lint percentage and fiber fineness. Giza 92 exhibited insignificant correlation between yield and both fiber strength and fiber length, while the cultivar Giza 94 revealed negative and significant correlation in M_1 for the treatment 5 and 10 min, as well as 15 min in M_1 and M_2 between the same traits.

INTRODUCTION

The programs deal with cotton improvement still took more consideration in the field of cotton production allover the cotton producing countries. The limited genotypic background of Egyptian cotton leads to continuous work to maintain its good technological traits, as well as increase its productivity. The Egyptian cotton breeder used some techniques to achieve these targets; a technique of using induced mutation was followed by many investigators which mainly used seed irradiation by many sources and different doses from each with the available cotton genotypes at the time of investigation.

Ibragimov and KovaI'Chuck (I986) stated that seeds of *G. hirsutum* varieties Tashkent-6 , S-2606 and F_3 hybrids with *G. barbadense* were irradiated using a laser. In the M_2 and M_3 there were changes in boll weight, yield and outturn and other traits. A number of mutant lines with useful traits were obtained from the M_2 of each variety. In the M_l of hybrid S-6209 x 05102, a line was obtained with bolls of 4.1 g (3.3g in the initial hybrid).

Ibragimov et *al.* (1989) irradiated varieties of *G. hirsutum, L.* and hybrids between these species and *G. barbadense L.* by Laser radiation for 60, 90 and 105mm with monochromatic red light. They obtained wider variation after treatment and depended on the duration of treatment and the source material. They also found that the widest range of variation was achieved with the longest treatments. From the breading point of view, it was useful to achieve wide variation in economic traits like boll size, fiber length and fiber out-turn. These traits were increased in the *G.hirsutum* varieties but little affected in the hybrids. As a result of this work,some mutants were obtained with large bolls, long fiber, high fiber out-turn and high yield.

Mustafaev and Stepanova (1989) treated the dry seeds of some varieties of *G. hirsutum, L.* and distant hybrids of *G. barbadense L.* for 60, 90 and 105mm with monochromatic red light from a Laser radiation (λ = 6328Å). They noted mutations with a fairly high frequency in the M_2 generation. The progeny of M_1 plants showed growth inhibition, the mutations mainly involved altered morphological traits and reduced values of quantitative traits predominated.

MATERIALS AND METHODES

The present study was carried out during the three growing seasons 2014, 2015 and 2016 at Sakha Agricultural Experimental Station, Agricultural Research Center, Egypt. Two Egyptian cotton varieties Giza 92 and Giza 94 belong to *G. barbadense, L.* were chosen to study the effect of irradiating cotton seeds in inducing variation in the subsequent mutated generations. Giza 92(derived from the cross G.84 (G.74 x G.68)) and Giza 94 (derived from the cross 10229 x G. 86). Giza 92 is an extra long staple variety, while Giza 94 is a long staple variety. He-Ne laser with 650 nm was used at 7mw power irradiated cotton seed at 5, 10 and 15 minutes.

In 2014 season, irradiated seeds were grown to raise plants of the M_1 generation. M_1 plants were artificially self-pollinated to produce M_2 seeds, selfed bolls of each separate laser doses in each variety were bulk harvested.

In 2015 season, the M_2 selfed seeds from the irradiated doses were sown to obtain M_2 plants. M_2 plants were artificially self-pollinated to produce M_3 seeds, selfed bolls of each separate laser doses in each variety were bulk harvested.

In 2016 season, the M_3 selfed seeds from the irradiated doses were sown to obtain M_3 plants and M_1, M_2 and M_3 generations were sown in a randomized complete blocks design with four replications. Each replicate consisted of five rows, 4m long; 65 cm apart between rows and 70 cm between hills, plants were thinned to one plant per hill.

Data were recorded on individual plant basis as follows:

1. **Boll weight in grams (B.W. g):** The average boll weight in grams of 5 bolls picked at random from each plant.
2. **Number of open bolls per plant:** Obtained by the formula:

$$B / P = \frac{\text{weight of seed cotton yield per plant}}{\text{boll weight}}$$

3. **Seed cotton yield (S.C.Y):** estimated as the weight of seed cotton yield per plant in grams
4. **Lint cotton yield (L.C.Y):** estimated as the weight of lint cotton yield per plant in grams
5. **Lint percentage (L %):** Ratio of lint cotton yield to seed cotton yield sample expressed as percentage using the formula:

$$L\% = \frac{\text{weight of lint in sample}}{\text{weight of seed cotton in the same sample}} x100$$

6. **Fiber Fineness (F.F):** Fineness was expressed as micronaire instrument reading. The characters were measured with micromat instrument. ASTM D-3818-1998
7. **Fiber strength (F.S):** Measured by HVI in gram / tex units. ASTM D-3818-1998
8. **Fiber length (F.L):** measured by HVI in (mm). ASTM D-3818-1998

The fiber properties were carried out under the standard conditions of testers (65 ± 2% relative humidity and 70 ± 2F° temperature).In Cotton Tech. Res. Sec., Cotton research institute, Giza.

Statistical procedures:-

1-The analysis of variance of the three generations (M_1, M_2 and M_3) was statistically analyzed using (factor analysis) analysis of variance. The significance of means was determined using the least significant difference (L.S.D).

2- F- test: The ratio between the variance of the mutated population and control were computed as follows:

$$\frac{\text{variance of the mutated population}}{\text{variance of the untreated correspond ing one}}$$

One tail F ratio was used to test the significance of the mutated populations variance vs. its corresponding untreated populations variance for all studied characters to test significance of the induced variation if it found.

3- Phenotypic and genotypic variance:

Iyama (1968) postulated that the environmental variance should be equal to the variance of the fixed population, which means that individual plants of a pure line exhibited no genetic differences. Accordingly, in the M_1 and M_2 generations of this study the variance of control (untreated) was considered to be the environmental variance (Ve) for each genotype and the total variance of the mutagenized treatment to be the phenotypic variance (Vp). Therefore, the genotypic variance (Vg) was calculated as follows: $Vg = Vp - Ve$

4) Moment coefficient of skewness:

$$M.C.S = \frac{M_3}{\sqrt{(M_2)^3}}$$

Where:

$$M_3 = \frac{\sum (x - \bar{x})^3}{n}$$

$$M_2 = \frac{\sum (x - \bar{x})^2}{n}$$

The values of M.C.S take each of positive, negative and zero values.

5) Moment coefficient of kurtosis:

$$M.C.K = \frac{M_4}{(M_2)^2}$$

Where: $M_2 = \frac{\sum (x - \bar{x})^2}{n}$

$$M_4 = \frac{\sum (x - \bar{x})^4}{n}$$

Kurtosis provides a measurement about the extremities (i.e. tails) of the distribution of data, and therefore provides an indication of the presence of outliers. A normal distribution has kurtosis = 3 is called mesokurtic. Distribution with kurtosis < 3 is called platykurtic. Compared to a normal distribution, its tails are shorter and thinner, and often its central peak is lower and broader. A distribution with kurtosis >3 is called leptokurtic. Compared to a normal distribution, its tails are longer and fatter, and often its central peak is higher and sharper (Pearson 1905).

6- Broad sense heritability: (h^2_b) were calculated as follows:

$$\frac{\text{Variance of mutated population– Variance of unmutated population}}{\text{Variance of mutated population}}$$

7- Correlation between studied traits:

The phenotypic correlation coefficient which measure the degree of association between characters was calculated according to the formula proposed by Cochoran and Cox (1957).

The significant of r was detected using the following formula:

$$t = \frac{r}{\sqrt{(1 - 2r)/n - 2}}$$

RESULTS AND DISCUSSION

Mean squares of the studied varieties (Giza 92 and Giza 94) treated with 4 doses of laser irradiation (0, 5, 10 and 15 min) for three generations and the interactions among the three factors are presented in Table (1). There were highly significant differences between both varieties for all studied traits (except for seed and lint cotton yield per plant) indicating the different genotypic background of each variety.

Concerning the effect of the generations, there were highly significant differences among the three generations (M_1, M_2, and M_3) indicating the different response of varietal mean in each generation for the laser radiation doses with respect to the studied traits.

The four doses of laser irradiation (0, 5,10 and 15 min) used in this study exhibited highly significant differences for all traits which indicates the different effects of the four doses on the mean performance of the studied varieties. The first order interaction between varieties and generations (AB interaction) was highly significant for most of the studied traits (except for number of bolls per plant, seed and lint cotton yield per plant and fiber length) which reflects the different behavior of each variety through the three generations for most of the studied traits.

Table 1. The mean squares of the effect of varieties and treatments in the three generations

Source	d. f	Boll weight	No. of bolls / plant	Seed cotton yield/ plant	Lint cotton yield / plant	Lint %	Fiber fineness	Fiber strength	Fiber length
Replications	3	0.104	135.38	1836.88	330.57	0.361	0.140	0.287	5.155
Varieties (A)	1	0.510**	303.88**	619.15	131.84	185.65**	3.643**	0.98**	0.008**
enerations (B)	2	0.272**	446.28**	8478.55**	1546.28**	5.48**	0.59**	0.291**	12.220**
AB	2	0.150**	63.08	869.08	138.53	2.89**	0.15**	0.336**	1.164
Doses (C)	3	0.135**	407.59**	3490.08**	552.72**	23.60**	1.02**	0.251**	4.887**
AC	3	0212**	217.50**	1855.12*	373.15*	27.84**	0.44**	0.236**	1.173
BC	6	0.062*	126.32**	2197.45**	358.48**	1.29**	0.22**	0.153*	0.795
ABC	6	0.37	257.16**	3734.03**	627.83**	2.12**	0.02**	0.131*	2.511**
Error	69	0.021	37.79	561.6	93.88	0.368	0.03	0.050	0.637

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

The interaction between varieties and doses of laser irradiation (AC interaction) was also significant or highly significant for all the studied traits (except for fiber length) indicating the different response of each variety to the four doses of laser radiation.

The interactions between generations and doses of laser irradiation were significant or highly significant for all the studied traits (except for fiber length) that reflects the different effects of laser doses among the three generations in this study. Respecting the second order interaction among varieties, generations and doses (ABC interaction), data in Table (1) showed highly significant interaction among the three factors for all the studied traits (except boll weight) which reflect the different response of each variety to the studied doses through the three generations in this study.

The mean performance and variability:

Data of Table (2) represented the mean performance, variance induced as a result of the mutagen treatments and its ratio to the control in two cotton varieties of all guarded plants in the studied populations through three generations, for the studied traits.

Table 2. Mean performance, variance induced and its ratio to the control in two cotton varieties in three generations.

Variety	Gen.	Doses	Boll weight			No. bolls/plant			Seed cotton/Plant			Lint cotton/plant		
			Mean	Var.	Ratio	Mean	Var.	Ratio	Mean	Var.	Ratio	Mean	Var.	Ratio
G.92	M_1	Con.	3.50	0.11	1.00	52.20	89.68	1.00	181.64	1062.36	1.00	73.07	179.95	1.00
		5min	3.53	0.33	3.03**	40.56**	270.90	3.02**	142.03*	3726.69	3.51**	56.24**	612.91	3.41**
		10min	3.02**	0.23	2.13**	35.68**	520.96	5.81**	102.37**	3362.41	3.17**	35.95**	423.15	2.35**
		15min	3.22**	0.12	1.14	47.97	340.74	3.80**	154.25	3963.45	3.73**	56.22*	494.49	2.75**
	M_2	5min	3.66	0.23	2.12**	38.89**	251.79	2.81**	140.00*	2962.64	2.79**	55.05**	408.95	2.27**
		10min	3.37	0.13	1.14	37.01**	317.98	3.55**	125.41**	3640.46	3.43**	44.79**	511.05	2.84**
		15min	3.34	0.14	1.26	55.94	409.21	4.56**	185.81	4552.16	4.28**	65.62	563.68	3.13**
	M_3	5min	3.74**	0.23	2.14**	41.75*	150.69	1.68**	153.48	1617.45	1.52*	62.36	265.33	1.47*
		10min	3.49	0.19	1.75**	63.58**	677.27	7.55**	219.85*	7679.50	7.23**	84.03	1238.48	6.88**
		15min	3.28**	0.20	1.84**	60.27*	715.09	7.97**	194.13	6773.76	6.38**	73.98	953.74	5.30**
G.94	M_1	Con.	3.43	0.23	1.00	38.23	149.62	1.00	130.67	1893.92	1.00	53.10	334.57	1.00
		5min	3.61	0.37	1.63**	43.02	416.10	2.78**	153.03	5076.84	2.68**	63.87	952.15	2.85**
		10min	3.49	0.31	1.37	42.17	413.53	2.76**	147.19	5842.46	3.08**	60.83	1010.92	3.02**
		15min	3.65*	0.33	1.44*	48.87*	450.07	3.01**	177.18**	5910.23	3.12**	72.26**	992.60	2.97**
	M_2	5min	3.40	0.27	1.21	36.55	210.91	1.41*	123.77	2856.71	1.51*	50.99	505.77	1.51*
		10min	3.57	0.19	0.84	43.29	342.54	2.29**	151.42	3599.96	1.90**	62.42	590.53	1.77**
		15min	3.37	0.23	1.01	39.60	240.79	1.61**	130.36	2087.41	1.10	52.97	346.95	1.04
	M_3	5min	3.79**	0.28	1.26	48.86*	282.57	1.89**	184.37**	4208.55	2.22**	77.84**	753.90	2.25**
		10min	3.79**	0.18	0.81	45.06	333.46	2.23**	168.79*	4140.56	2.19**	68.93*	706.68	2.11**
		15min	3.77**	0.34	1.49*	42.57	200.62	1.34	157.69	2271.82	1.20	64.96	402.43	1.20
LSD 0.05			0.20			8.67			33.43			13.67		
LSD 0.01			0.27			11.51			44.39			18.15		

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

Data of Table (2) obviously showed that mutagen treatments generally increased the total phenotypic variance for both cotton varieties in the three generations with respect to the studied traits with a few exceptions. Comparing the means of control of both varieties and mutated populations in the three generations, cleared that boll weight for Giza 92 (5min) in M_3 and Giza 94 (15 min) in M_1 and all mutated populations in M_3 means increased significantly than the control of both varieties, while the mutated populations of Giza 92 (10 and 15 min) in M_1 and (15 min) M_3 generation means decreased significantly than the control. The lower dose of laser mutagen (5 min) significantly induced the higher variability for Giza 92 variety in the three generations (3.03,2.12 and 2.14 for M_1, M_2 and M_3, respectively), in addition to M_1 in Giza 94 variety(1.63), while the intermediate dose (10 min) induced significantly higher variability as compared to the untreated population in both M_1 (2.13) and M_3 (1.75) for Giza 92 variety, whereas the differences did not reach the significance level in M_2 for Giza 92 and all mutated generations in Giza 94 variety. The higher dose of laser radiation failed to induce significant higher variability in Giza 92 variety except for M_3 (1.84), while for Giza 94

variety the variability reached the significance level in M_1 (1.44) and M_3 (1.49).

Respecting number of bolls per plant, significant increments were recorded in means for Giza 92 (10 and 15 min) in M_3 and Giza 94 (15 min) in M_1 and (5 min) in M_3. Whereas, significant reductions were found in means of Giza 92 (5 min) in the three generations and (10 min) in M_1 and M_2. Highly significant induced variations were obtained for all doses for all populations of Giza 92 and Giza 94 varieties, except for Giza 94 (15 min)in M_3 generation. The higher ratios of induced variability (7.97 and 7.55) obtained in the higher dose (15 and 10 min, respectively)in M_3 .

For seed cotton yield per plant, significant increases were observed in means for Giza 92 (10min) in M_3, as well as Giza 94(15 min) in M_1 and (5 and 10min) in M_3. Whereas, significant decreases in means were observed for Giza 92 (5 and 10 min) in M_1 and M_2 generation.

All doses of laser radiation used in this study were able to induce significant variability in the seed cotton yield per plant in both varieties as compared to the control treatment (except for the higher dose in M_2 and M_3). The higher ratios were obtained by the intermediate dose (10 min) in M_3 as it reached 7.23 for Giza 92 variety and in M_1 for Giza 94 variety that gave 3.08.

For lint cotton yield per plant data in Table (2) showed significant increment in means of Giza 94 (15min) in M_1 and (5 and 10 min) in M_3. In the contrary significant reductions were recorded for means of all treated populations in Giza 92 (5, 10 and 15 min) in M_1 and (5 and 10 min) in M_2 generation. Laser irradiation doses used in this study were able to induce significant variability in the lint cotton yield /plant in both varieties as compared to the control treatment (except for the higher dose in M_2 and M_3). The higher ratios were obtained by the intermediate dose (10 min) in M_3 as it reached 6.88 for Giza 92 variety and in M_1 in Giza 94 variety that gave 3.02.

Table 2.Cont.

Variety	Gen.	Doses	L %			Fiber fineness			Fiber strength			Fiber length		
			Mean	Var.	Ratio	Mean	Var.	Ratio	Mean	Var.	Ratio	Mean	Var.	Ratio
G.92	M_1	Con.	40.21	0.94	1.00	3.74	0.04	1.00	10..55	0.08	1.00	35.07	1.50	1.00
		5min	39.41	5.35	5.67**	3.84	0.30	8.07**	10.56	0.23	3.09**	34.60	3.28	2.19**
		10min	35.30**	1.70	1.80**	3.21**	0.31	8.33**	10.60	0.05	0.66	35.33	1.82	1.22
		15min	36.56**	3.20	3.39**	3.64	0.10	2.82**	10.60	0.07	0.87	35.55	1.09	0.73
	M_2	5min	39.58	4.04	4.29**	4.30**	0.06	1.75**	10.59	0.08	1.09	36.31**	0.83	0.56
		10min	35.48**	1.07	1.13	3.83	0.05	1.29	10.61	0.12	1.60**	36.12	0.78	0.52
		15min	35.33**	0.84	0.89	3.89	0.01	0.38	10.62	0.10	1.32	36.38*	0.69	0.46
	M_3	5min	40.69	3.67	3.89**	4.35**	0.12	3.19**	10.50	0.12	1.61**	35.66	3.20	2.13**
		10min	37.89**	3.66	3.88**	3.97	0.26	6.93**	10.39	0.18	2.35**	35.04	1.80	1.20
		15min	38.24**	3.75	3.97**	3.74	0.12	3.29**	10.35	0.34	4.56**	34.23	3.06	2.04**
G.94	M_1	Con.	40.51	0.94	1.00	3.42	0.23	1.00	10.43	0.06	1.00	33.65	0.34	1.00
		5min	41.47*	2.30	2.45**	4.26**	0.09	0.37	10.00**	0.37	6.46**	35.62**	5.32	5.68**
		10min	41.19	4.27	4.54**	4.18**	0.35	1.51*	9.57**	0.66	11.51**	34.35	6.73	9.85**
		15min	40.79	2.01	2.14**	4.12**	0.29	1.26	9.77**	0.44	7.66**	34.94**	2.93	8.64**
	M_2	5min	41.09	3.27	3.49**	4.54**	0.05	0.20	10.42	0.21	3.63**	37.25**	2.87	8.45**
		10min	41.29	2.39	2.54**	4.56**	0.03	0.13	10.34	0.15	2.65**	36.23**	1.88	5.55**
		15min	40.60	1.28	1.36	4.39**	0.03	0.15	10.69	0.07	1.15	36.51**	1.51	4.46**
	M_3	5min	42.16*	1.54	1.64**	4.46**	0.19	0.81	10.46	0.11	1.93**	35.13**	3.78	11.16**
		10min	40.80	5.41	5.76**	4.39**	0.21	0.93	10.38	0.12	2.04**	35.20**	2.58	7.60**
		15min	41.12	2.02	2.15**	4.19**	0.22	0.95	10.24	0.14	2.47**	36.04**	3.47	10.23**
LSD 0.05			0.86			0.24			0.32			1.13		
LSD 0.01			1.14			0.32			0.42			1.49		

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

Regarding lint %, significant increases were obtained in means for Giza 94 variety (5 min) in M_1 and M_3 generations. Whereas Giza 92 variety showed significant decreases in means for mutated populations (10 and 15min) in the three generations. All doses of laser irradiation succeeded to induce significant variability in lint% for both varieties as compared to the control treatment (except in M_2 for 10 and 15 min doses for Giza 92, as well as 15 min for Giza 94 variety) the lower dose induced the higher ratio in both M_1 (5.67) and M_2 (4.29) for Giza 92 variety, while the intermediate dose (10 min) gave the higher ratio in M_3 (5.76) and in M_1 (4.54) for Giza 94 variety.

With respect to fiber fineness expressed as micronaire reading data showed that increases were found in means for Giza 92 (5 min) in M_1 and M_3 generations and all mutated populations of Giza 94 in the three generations. Data presented in Table (2) showed that doses of laser irradiation induced significant variability as compared to the untreated population for Giza 92 variety, except for 10 and 15 min in both M_2 and M_3. Whereas, Giza 94 variety had significant ratio only at the dose of 10 min in M_1. The intermediate dose (10 min) induced the higher ratio (8.33) followed by the lower dose (5 min) that gave a ratio of 8.07 in Giza 92 variety.

Fiber strength expressed as Pressley index significantly decreased than the control in means of all mutated populations for Giza 94 (5, 10 and 5 min) in M_1. Laser irradiation doses used in this study induced significant variability in fiber strength for Giza 94 variety in the three generations (except for 15 min in M_2) and for Giza 92 in M_3 ,as well as 5 min in M_1 and 10 min in M_2. The three doses of laser irradiation gave the higher ratios in M_1 generation for Giza 94 variety as 10 min dose gave the highest value (11.51) followed by 15 min (7.66) while 5 min ranked third and gave 6.46. On the other hand, for

Giza 92 variety the higher dose in M_3 gave the highest ratio (4.56) followed by the lower dose in M_1 (3.09).

Concerning fiber length, significant increments were recorded in means of fiber length for Giza 92 variety in (5 min dose) in M_2 and all mutated populations of Giza 94 variety in the three generations except for (10 doses) in M_1 generation. All doses of laser irradiation induced significant variability for Giza 94 variety in all generations and for Giza 92 5 min dose in both M_1 and M_3 as well as 15 min in M_3 and 10 min in M_2. The three doses of laser irradiation gave the higher ratios in M_1 generation. Giza 94 showed the highest ratio (11.16) at 5 min dose followed by 15 min dose that gave 10.23 ratio, while for Giza 92 the lower dose in M_1 and M_3 gave the higher ratios (2.19 and 2.13, respectively).

The shifts in means of quantitative traits of cotton plant after treating with different mutagens were recorded and discussed in details by many workers; i.e.: Brock(1965), Fotiadis and Miller (1973), Okaz(1978), El-Helow(1981), Selim *et al.,* (1985), Abd El-Aziz(1988), Awaad *et., al*(1995), El-Marakby *et al*.,(2000), Amer (2004), and Amer *et al*., (2016). Moreover, Brock (1971) postulated that induced mutation can be used to generate useful variation in quantitative inherited characters. Fotiadis and Miller (1973) indicated that quantitative variability among i.e., radiated cotton populations was larger than get of the central. Okaz (1978) found that gamma ray caused significant increase of the phenotypic variances among the homozygous genotype for most of the characters in both M_1 and M_2 generations. Awaad *et al* (1995), Raffat (1995) El – Marakby *et al* (2000), Orabi (2004 and 2009) and Amer *et al*. (2016) obtained increase in quantitative variation of Egyptian cotton by using physical mutagens.

The moment coefficients of skewness and kurtosis:

Data in Table (3) showed the moment coefficients of skewness and kurtosis of all guarded plants for boll weight , number of bolls per plant , seed and lint cotton yield per plant, lint percentage, fiber fineness , fiber strength and fiber length. The important of calculated the moment coefficient of kurtosis can help the plant breeder in determining the level of selection intensity .As it cleared previously, the moment coefficient of kurtosis take one of each three values i.e., less than3 , which denote that curve was normal or (misokurtic) in shape . In the case of (leptokurtic) the individual plants are concentrated around the means so the plant breeder might increase the selection intensity.

Regarding boll weight, the coefficient of skewness was significantly negative for Giza 92 (10 and 15 min) in M_1 and M_2, respectively, while, it was significantly positive for 94 (10 min) in M_3 generation. Moreover, the moment coefficient of kurtosis was less than 3 (platykurtic) in all populations.

Concerning number of bolls per plant, seed and lint cotton yield per plant, the moment coefficient of skewness was significant positive in all guarded plants except for Giza 92 control and Giza 94 (control and 15 min) in M_1, seed and lint cotton yield per plant for Giza 94 (15 min) in M_2 and M_3 generations. Whereas, the moment coefficient of kurtosis was more than three indicating that it's the curve was leptokurtic for Giza 92 (15 min) in the three generations, (10 min) in M_2 and Giza 94 (15 min) in M_3 generation, while the moment coefficient of kurtosis was less than 3 indicating that it's curves were platykurtic in other populations. For seed cotton yield per plant, moment coefficient of kurtosis was (leptokurtic) for Giza 92 (15 min) in the three generations, and Giza 94 (10 min) in M_1 generation, while it was less than 3 (platykurtic) in other populations. The moment coefficient of kurtosis was less than 3 (platykurtic) for lint cotton yield per plant for most populations of Giza 92 and Giza 94 verities, except for Giza 92 (15 min) in M_1 and M_2 generations which were more than 3 (leptokurtic), while it was equal 3 (mesokurtic) for Giza 92 (15 min) in M_3 generation.

Table 3. Moment coefficients of skewness and kurtosis in different populations of Giza 92 and Giza 94 in M_1, M_2 and M_3 generations.

Variety	Gen.	Doses	Boll weight		No. bolls/plant		Seed cotton/Plant		Lint cotton/plant	
			Skew.	Kurt.	Skew.	Kurt.	Skew.	Kurt.	Skew.	Kurt.
G.92	M_1	Con.	0.324	-0.349	0.323	-0.550	0.259	-0.786	0.317	-0.643
		5min	-0.025	-0.477	0.538**	-0.650	0.987**	1.037**	0.973**	1.141**
		10min	-0.255	-0.319	0.759**	-0.261	0.672**	1.001**	0.896**	2.038**
		15min	-0.344	-0.037	2.396**	7.986**	2.558**	8.670**	2.439**	8.377**
	M_2	5min	0.318	0.261	1.179**	1.214**	1.263**	1.601**	1.122**	1.274**
		10min	0.013	-0.440	1.671**	4.199**	1.279**	2.542**	1.412**	2.917**
		15min	-0.263	-1.104**	2.146**	6.417**	2.035**	5.163**	2.089**	5.804**
	M_3	5min	-0.023	-0.209	0.628**	0.512	0.447*	0.365	0.514**	0.578
		10min	0.335	0.231	0.492**	-0.471	0.445*	0.105	0.494**	0.191
		15min	0.375	-0.152	1.707**	3.644**	1.669**	3.331**	1.609**	3.104**
G.94	M_1	Con.	-0.238	0.127	0.264	-0.718	0.216	-0.624	0.325	-0.369
		5min	0.195	-0.873	0.965**	0.481	0.740**	-0.243	0.799**	-0.081
		10min	-0.534**	0.087	1.045**	1.563**	1.408**	3.433**	1.221**	2.201**
		15min	0.055	-0.160	0.419*	-0.913*	0.203	-1.129**	0.233	-1.039**
	M_2	5min	0.162	0.160	0.475*	-0.563	0.888**	0.437	0.912**	0.426
		10min	-0.002	0.037	0.609**	0.067	0.427*	-0.310	0.350	-0.360
		15min	-0.435*	0.409	1.230**	2.638**	0.979**	1.105**	0.931**	1.014**
	M_3	5min	-0.161	0.761	0.891**	2.250**	0.596**	1.132**	0.523**	1.057**
		10min	0.437*	-0.017	0.852**	0.346	0.706**	0.208	0.656**	0.111
		15min	0.351	0.462	1.189**	4.220**	0.372	0.476	0.342	0.223

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

Coefficient of skewness was highly significant and negative for lint percentage of Giza 92 (5 min) in the three generations, (10 min) in M_1 and (15 min) in M_2, as well as Giza 94 (10 min) in M_1 and M_3, (5 and 15 min) in M_2, while it was significantly positive for Giza 94 (control and 10 min) in M_2 generation. The moment coefficient of kurtosis was less than 3 in all populations of Giza 92 and Giza 94 varieties, except for Giza 92 (5 min) in M_3 and Giza 94 (5 min and 10 min) in M_2 and M_3 generations, respectively.

Table 3. Cont.

Variety	Gen.	Doses	L %		Fiber fineness		Fiber strength		Fiber length	
			Skew.	Kurt.	Skew.	Kurt.	Skew.	Kurt.	Skew.	Kurt.
G.92	M_1	Con.	-0.169	-0.832	-0.859**	-0.03	-0.124	0.904	0.162	-0.709
		5min	-1.005	-0.083	-0.777**	-0.433	-1.635**	2.751***	0.289	-1.189**
		10min	-0.790**	-0.428	0.239	-1.219**	-0.471*	2.287**	-0.539**	-0.623
		15min	0.187	-1.205**	-0.462	-1.292**	-0.270	-0.966*	-0.010	-0.260
	M_2	5min	-1.475**	1.753**	-1.052**	1.131**	-0.272	-0.513	0.106	0.015
		10min	-0.271	1.184**	-0.846**	2.979**	-0.293	-0.822	0.557**	-0.262
		15min	-1.012**	0.943*	0.861**	0.209	0.053	-1.158**	0.571**	-0.059
	M_3	5min	-1.063**	3.815**	-0.624**	0.912	0.062	-0.423	0.519**	1.345**
		10min	-0.022	-0.277	-0.192	-0.890	0.165	-0.918*	-0.033	0.115
		15min	-0.049	-0.637	0.054	0.756	-0.788**	-0.314	-0.006	-0.932*
G.94	M_1	Con.	1.026**	1.032**	-0.066	-1.441**	-0.030	-1.109**	1.242**	0.507
		5min	0.250	0.458	-1.020**	1.579**	-0.072	-1.179**	0.371	-0.933*
		10min	-0.471*	0.117	-1.015**	-0.060	0.359	-1.317**	-1.452**	1.978**
		15min	0.032	-0.759	-1.385**	1.165**	0.487*	-1.222**	-0.471*	-0.318
	M_2	5min	-1.053**	3.640**	-0.209	-0.503	-0.950**	1.094**	-0.419	-1.027**
		10min	0.864**	1.496**	-0.026	0.415	-0.359	-0.328	-0.253	-0.965*
		15min	-0.625**	1.385**	0.301	0.452	-0.514**	0.136	1.085**	1.302**
	M_3	5min	-0.405	0.732	0.045	0.611	-1.137**	2.876**	0.657**	0.234
		10min	-0.712**	8.733**	-0.517**	-0.282	0.275	-0.618	-0.470*	1.003**
		15min	-0.027	1.314**	-0.633**	-0.099	-0.363	-0.011	-1.012**	3.613**

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

For fiber fineness, coefficient of skewness was highly significant and negative for Giza 92 control, (5 min) in M_1 and M_2 generations, (15 min) in M_1 ,(10 min) in M_2 and Giza 94 (5 min) in M_1 and (10 and 15 min) in M_1,and M_3 ,while it was significantly positive Giza 92 (15 min) in M_2 generation. Regarding to fiber strength, the moment coefficient of skewness was significantly negative for Giza 92 (5 and 10 min) in M_1, (15 min) in M_3 and Giza 94 (5 min) in M_2 and M_3 and 15 min in M_2, while it was significantly positive for Giza 94 (15 min) in M_1. Data in Table (3) cleared significant positive coefficient of skewness of fiber length for Giza 92 (10 and 15 min) in M_2, (5 min) in M_3 generation and Giza 94 control and (15and 5 min) in M_2 and M_3 generations, respectively. While, it was significant and negative for Giza 92 (10 min) and Giza 94 (10 and 15min) in M_1 and M_3 generations.

Data in Table (3) revealed that significant positive coefficient of skewness for fiber length of Giza 92 (10 and 15 min) in M_2, (5 min) in M_3 generation and Giza 94 control and (15and 5 min) in M_2 and M_3 generations, respectively. While, it was significantly negative for Giza 92 (10 min) and Giza 94 (10 and 15min) in M_1 and M_3 generations. As for fiber traits, fiber fineness, fiber strength and fiber length, the moment coefficient of kurtosis was less than three (platykurtic) in all population of Giza 92 and Giza 94 varieties.

Nazir and Khan (1974) found that the frequency curves generally shifted in the direction of lower yield, Shaheen (1984) showed increase in the right margin of range in all treatments of the M2 generation, Orabi (2004 and 2009) obtained significant negative coefficient of skewness in M_2 generation for fiber fineness, as well as , significant positive coefficient of skewness in M_2 generation for yield and it's component traits i.e., number of bolls per plant , boll weight , seed and lint cotton yield per plant , lint percentage and seed index. Srour (2006), Allam (2007) and El-Hoseiny *et al*.,(2017) found significant positive coefficient of skewness for seed and lint cotton yield per plant.

Orabi (2004 and 2009) found that the moment coefficient of kurtosis was more than three (of leptokurtic) in M_2 generation regarding to number of bolls per plant, seed cotton yield per plant, lint cotton yield per plant, lint percentage and fiber length. Srour (2006) and Allam (2007) indicated that the moment coefficient of kurtosis were less than three (platykurtic) for most of the traits.

Broad-sense heritability:

Broad-sense heritability values were calculated for all traits as a percentage between the induced variance (if the test of significance indicated to) and the variance overall the populations in M_1, M_2 and M_3 generations, the calculated values were presented in Table (4). The data showed that broad-sense heritability values for boll weight were (67.01 % , 53.03 % and 12.36 %) for Giza 92 variety for the three doses, respectively in M_1 , (52.93 %, 12.46 % and 20.89 %) in M_2 and (53.23 % , 42.84 % and 45.55 %) in M_3 generation, as well as (38.82 % , 26.88 % and 30.73 %) for mutated populations of Giza 94 variety in M_1 , less than 17 % for (5 min) in M_2 and 20.57 % and 33.05 % for (5 and 15 min) in M_3 generation .

Regarding number of bolls per plant, heritability values were 66.89 % , 82.79 % and 73.68 % for the three doses 5 , 10 and 15 min, respectively of Giza 92 in M_1; 64.38 % , 71.80 % and 78.08 %, respectively in M_2 and 40.49 % , 86.76 % and 87.46 %, respectively in M_3 . Heritability values for mutagen treated Giza 94 exceeded 60% in M_1 and 25 % in M_2 and M_3.

Table 4. Heritability in broad sense for M_1, M_2 and M_3 generations of the mutated populations

Variety	Gen.	Doses	B.W	No. B/P	S.C.Y/P	L.C.Y/P	L %	F.F	F.S	F.L
G.92	M_1	5min	67.01	66.89	71.49	70.64	82.37	87.61	67.65	54.28
		10min	53.03	82.79	68.40	57.47	44.59	88.00	0.00	17.73
		15min	12.36	73.68	73.20	63.61	70.50	64.54	0.00	0.00
	M_2	5min	52.93	64.38	64.14	56.00	76.68	42.74	8.52	0.00
		10min	12.46	71.80	70.82	64.79	11.80	22.73	37.65	0.00
		15min	20.89	78.08	76.66	68.08	0.00	0.00	24.05	0.00
	M_3	5min	53.23	40.49	34.32	32.18	74.27	68.61	37.98	53.14
		10min	42.84	86.76	86.17	85.47	74.26	85.57	57.41	16.82
		15min	45.55	87.46	84.32	81.13	74.84	69.57	78.06	50.98
G.94	M_1	5min	38.82	64.04	62.69	64.86	59.23	0.00	84.51	93.62
		10min	26.88	63.82	67.58	66.90	77.99	33.81	91.31	94.96
		15min	30.73	66.76	67.96	66.29	53.22	20.34	86.95	88.43
	M_2	5min	17.11	29.06	33.70	33.85	71.31	0.00	72.49	88.17
		10min	00.00	56.32	47.39	43.34	60.68	0.00	62.23	81.99
		15min	1.01	37.86	9.27	3.57	26.44	0.00	12.92	77.58
	M_3	5min	20.57	47.05	55.00	55.62	38.90	0.00	48.31	91.04
		10min	00.00	55.13	54.26	52.66	82.64	0.00	51.09	86.84
		15min	33.05	25.42	16.63	16.86	53.59	0.00	59.57	90.23

For seed cotton yield per plant , heritability values for mutated Giza 92 populations were more than 68.0% in M_1 , 64.0 % in M_2 and 34 % in M_3 , moreover, heritability values for mutated Giza 94 populations were more than 62.0% in M_1, 9.0 % in M_2 and 16 % in M_3 generation.

Concerning lint cotton yield per plant, values of heritability for mutated populations of Giza 92(5, 10 and 15 min doses) were surpassed 50% in M_1 and M_2 while in M3 the values were 32.18%, 85.47% and 81.13%, respectively; while for Giza 94, heritability values were 64.86 %, 66.90 % and 66.29 % in M_1, 33.85 %, 43.34 % and 3.57 % in M_2 and 55.62 %, 52.66 % and 16.86 %, respectively in M_3 generation.

Values of heritability for lint percentage were 82.37 % , 44.59 % and 70.50 % for mutated Giza 92 populations in M_1 , 76.68 % and 11.80 % (5 and 10 min) in M_2 and more than 74.0 % in M_3 generation , as well as 59.23% , 77.99 % and 53.22 % for mutated populations of Giza 94 in M_1 , 71.31 % , 60.68 % and 26.44 % in M_2 and 38.90 % , 82.64 % and 53.29 % in M_3 generation of Giza 94 .

For fiber fineness, values of heritability were 87.61 % , 88.00 % and 64.54 % for mutated populations of Giza 92 (5 , 10 and 15 min) in M_1 , 42.74 % , 22.73 % and 0% in M_2 and 68.61% , 85.57% and 69.57 %, respectively in M_3 generation , in addition to 33.81 % and 20.34 % for mutated Giza 94 populations (10 and 15 min) in M_1 generation .

Regarding fiber strength , heritability values were 67.65 % for Giza 92 (5 min) in M_1 , 8.52 % , 37.65 % and 24.05 % for (5, 10 and 15 min) in M_2 , 37.98 % , 57.41 % and 78.06 % for (5 , 10 and 15 min) in M_3 and more than 84.0% for mutated Giza 94 populations (5, 10 and 15 min) in M_1 , 72.49 %, 62.23 % and 12.92 % in M_2 and more than 48.0 % in M_3 generation .

Heritability values of fiber length for Giza 92 (5 and 10 min) were 54.28 % and 17.73 % in M_1 and 53.14 % , 16.82 % and 50.98 % for (5 , 10 and 15 min) in M_3 and more than 77.0 % for mutated populations of Giza 94 (5 , 10 and 15 min) in M_1 , M_2 and M_3 generations .

Okaz(1978) found significant increase in quantitative variation for boll weight, seed index and fiber properties. Broad sense heritability was higher in the irradiated M_2F_2 populations than the control, Raafat and Haikal(1986) noticed that irradiation increased the heritability values in broad and narrow senses for lint percentage, Simongulyan and Kim (1990) found significant increase in heritability values for yield and yield components and Orabi (2004) stated that heritability values were more than 70% for boll weight and lint percentage. Srour (2006) indicated that the heritability values were ranged from 41% to 98% and from 81% to 98% in the families of M_4 generation for boll weight and lint percentage characters.

Phenotypic correlation coefficient between each of seed cotton and lint yield per plant and the rest of the studied traits i.e., boll weight, lint percentage, fiber fineness, fiber strength and fiber length for all populations in M_1, M_2 and M_3 generations in both cotton varieties are presented in Table (5).

Respecting correlation between seed cotton yield and boll weight, it was significantly positive for Giza 92 (control) and Giza 94 (control and 10 min) in M_1, (5 min) in M_2 and M_3 generations. Significant positive correlation was found between seed cotton yield and lint % for Giza 92 (10 min) in M_2 and M_3 generations and Giza 94 (control and 5 min) in M_1 generation.

Seed cotton yield per plant and fiber fineness were significantly positive correlated for Giza 92 at two doses (10 and 15 min) in M_1 and M_2 generation and (10 min) in M_3 generation, while significant negative correlation was found for Giza 94 at 15 min dose in M_1 generation.

Concerning the phenotypic correlation between seed cotton yield and fiber strength, significant positive correlation was found for Giza 92 (5 min) in M_2 generation and Giza 94(control), while significant negative correlation was obtained for Giza 94 (5, 10 and 15 min) in M_1 generation. Significant negative correlation was found between seed cotton yield per plant and fiber length for Giza 94 (15 min) in M_1 and (5 min) in M_2 and(5 and 15 min) in M_3.

Table 5. Phenotypic correlation coefficient between each of seed and cotton yield per plant and some studied traits in M_1, M_2 and M_3 generations of two varieties Giza 92 and Giza 94.

Variety	Gen.	Doses	Seed cotton yield per plant					Lint cotton yield per plant				
			Boll weight	L %	Fiber fineness	Fiber strength	Fiber length	Boll weight	L %	Fiber fineness	Fiber strength	Fiber length
G.92	M_1	Con.	0.27*	0.09	0.08	-0.02	-0.04	0.27*	0.22	0.07	0.00	-0.07
		5min	0.21	0.19	-0.07	-0.23	-0.06	0.24	0.30*	-0.03	-0.16	-0.02
		10min	-0.14	-0.25	0.29*	0.04	0.24	-0.09	-0.16	0.29*	0.05	0.20
		15min	0.24	-0.16	0.53**	-0.06	0.14	0.20	-0.04	0.51	-0.06	0.09
	M_2	5min	0.00	-0.34**	-0.20	0.27*	0.07	0.01	-0.20	-0.11	0.24	0.06
		10min	0.28*	0.47**	0.35**	0.07	0.04	0.27*	0.51**	0.35**	0.07	0.03
		15min	0.12	-0.04	0.38**	0.02	-0.04	0.11	0.04	0.40**	0.04	-0.03
	M_3	5min	0.03	-0.13	-0.12	0.05	-0.23	0.07	0.05	-0.09	0.05	-0.18
		10min	0.17	0.44**	0.30**	-0.19	0.01	0.15	0.51**	0.31**	-0.18	0.00
		15min	0.00	-0.16	-0.18	0.20	0.01	-0.02	-0.05	-0.19	0.18	-0.06
G.94	M_1	Con.	0.30**	0.40**	-0.01	0.36**	-0.01	0.32**	0.47**	0.00	0.37**	-0.02
		5min	0.20	0.38**	-0.23	-0.38**	-0.01	0.19	0.45**	-0.23	-0.38**	-0.02
		10min	0.31**	0.13	-0.21	-0.38**	-0.11	0.33**	0.22	-0.16	-0.37**	-0.07
		15min	0.25	0.00	-0.33**	-0.44**	-0.35**	0.25	0.09	-0.31**	-0.45**	-0.36**
	M_2	5min	0.31**	0.13	0.05	-0.01	-0.35**	0.30**	0.21	0.06	0.00	-0.38**
		10min	-0.10	-0.11	-0.05	-0.17	0.11	-0.11	-0.03	-0.04	-0.18	0.09
		15min	-0.01	0.08	-0.06	-0.08	0.00	-0.01	-0.44**	-0.03	-0.08	0.01
	M_3	5min	0.29*	0.13	0.18	-0.04	-0.45**	0.30**	-0.86**	0.19	-0.05	-0.45**
		10min	-0.02	0.04	0.14	-0.09	-0.02	-0.03	0.19	0.15	-0.09	-0.05
		15min	0.19	0.17	-0.09	-0.22	-0.32**	0.18	0.29*	-0.07	-0.21	-0.34**

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

Data presented in Table (5) for the phenotypic correlation between lint cotton yield and boll weight for all populations in M_1, M_2 and M_3 generations in both varieties showed significant positive correlation for Giza 92 control and Giza 94 (control and 10 min) in M_1, (5 min) in M_2 and M_3 generations.

Significant positive correlation between lint cotton yield per plant and lint percentage was recorded for Giza 92 (5 min) in M_1 and (10 min) in M_2 and M_3, as well as Giza 94 (control, and 5 min) in M_1 generation and(15 min) in M_3. While, significant negative correlation was obtained for Giza 94 (15 and 5 min) in M_2 and M_3 generations, respectively.

Phenotypic correlation between lint cotton yield and fiber fineness was significantly positive for Giza 92 (10 min) in M_1, M_2 and M_3, and (15min) in M_2 generation, while significant negative correlation was obtained for Giza 94 (15min) in M_1. In addition, significant negative correlation between lint cotton yield and fiber strength for Giza 94 (5, 10 and 15 min) in M_1, while it was significantly positive for Giza 94 control. Moreover, phenotypic correlation was negative between lint cotton yield and fiber length for Giza 94 variety with 15 min dose in M_1 and M_3, and 5 min dose in M_2 and M_3 generations.

Sharoff and Srinivasachar(1977)found positive phenotypic and genotypic correlation in M_2 generation between seed cotton yield and boll weight, Kash,Kawther (1978)obtained positive correlation in M_1 and M_2 generations between seed cotton yield and each of number of bolls per plant and boll weight, El-Helow (1981) obtained positive phenotypic and genotypic correlation coefficient between boll weight and each of seed cotton yield and lint percentage, Mohamed (1983) found positive correlation coefficient in control between boll weight and each of number of bolls per plant, seed cotton yield per plant and lint percentage, Orabi (2004) reported that correlation coefficient between boll weight and lint percentage in P1 was positive but not significant in M_1, while it was positive and significant in M_2 and Srour (2006) obtained significant positive phenotypic correlation coefficient between boll and each of seed cotton yield per plant, lint yield per plant, seed index and lint index, also it was significant and positive between lint percent and each of lint yield per plant and lint index.

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استجابة بعض اصناف القطن المصري للمعاملة باشعة الليزر

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يهدف هذا البحث الي دراسة تأثير المعاملة بأشعة الليزر وتقييم التباينات الوراثية لبعض الصفات الكمية في صنفين من القطن المصري. اجريت هذه الدراسة خلال ثلاث مواسم زراعية (٢٠١٤-٢٠١٦) في محطة البحوث الزراعية بسخا –محافظة كفر الشيخ . تم استخدام صنفين من القطن المصري الاول الصنف جيزة ٩٢ والذي يتبع طبقة الاقطان فائقة الطول والثاني الصنف جيزة ٩٤ والذي يتبع طبقة الاقطان الطويلة بحري، تم تعريض بذور هذين الصنفين للمعاملة باشعة الليزر وذلك في معهد بحوث الليزر بجامعة القاهرة بثلاث جرعات مختلفة هي ٥ و ١٠ و ١٥ دقيقة. تم تقييم الثلاث اجيال الطفرية في الموسم الزراعي ٢٠١٦ في تجربة القطاعات الكاملة العشوائية في اربع مكررات كل مكررة تتكون من خمسة خطوط وكانت الصفات المدروسة : متوسط وزن اللوزة - عدد اللوز المتفتح علي النبات - محصول القطن الزهر والشعر علي النبات - تصافي الحليج- النعومة بالميكرونير- متانة التيلة - طول التيلةكانت اهم النتائج المتحصل عليها كما يلي :١- اظهرت النتائج انخفاضا معنويا في متوسط صفات المحصول ومكوناته للصنف جيزة ٩٢ بينما كانت هناك زيادة معنوية لنفس الصفات بالنسبة للصنف جيزة ٢.٩٤- لم يكن هناك تأثير معنوي للمعاملة بأشعة الليزر علي صفات الجودة للصنف جيزة ٩٢ بينما تأثرت صفات الجودة في الصنف جيزة ٩٤ حيث انخفضت متانة التيلة معنويا في الجيل الطفري الاول للثلاث جرعات.٣- زادت التباينات الوراثية المستحدثة بصفة عامة في جميع الصفات بالنسبة للصنفين محل الدراسة.٤- اظهرت هذه الدراسة أن معامل التفلطح العزمي لمعظم الصفات في الصنفين محل الدراسة اقل من ٣ للنباتات وبالتالي كان التوزيع الطبيعي للنباتات مفلطحا اي ان معظم النباتات متشتتة عن متوسط العشيرة وبالتالي فان شدة الانتخاب عالية مما يعطي مربي النبات فرصة جيدة في انتخاب أفضل النباتات .٥- كانت قيم درجة التوريث مرتفعة (اعلي من ٥٠%) في صفة متوسط وزن اللوزة في الجيل الطفري الاول للمعاملة ٥ دقائق والجيل الطفري الثاني للمعاملتين ١٠و ١٥ دقيقة بالاضافة الي أن معظم صفات المحصول ومكوناته كانت مرتفعة في معظم الحالات.٦- كانت درجة التوريث منخفضة (اقل من ٣٠%) في صفة متوسط وزن اللوزة للمعاملة ١٥ دقيقة للصنف جيزة ٩٤ في الجيلين الطفريين الاول والثاني بالاضافة الي المعاملة ١٠ دقائق في الجيل الطفري الثاني للصنف جيزة ٩٢، كانت درجة التوريث لصفة النعومة بالميكرونير منخفضة في الصنف جيزة ٩٤ بينما كانت عالية في الصنف جيزة ٩٢.٧- كان هناك ارتباطا معنويا موجبا بين صفتي المحصول الزهر والشعر علي النبات مع متوسط وزن اللوزة في الصنفين الغير معاملين والجرعة ١٠ دقائق في الجيل الطفري الثاني للصنف جيزة ٩٢ والجيل الطفري الاول للصنف جيزة ٩٤.٨- كانت هناك علاقة معنوية موجبة بين صفتي المحصول الزهر والشعر علي النبات مع تصافي الحليج في الجيلين الطفريين الثاني والثالث في المعاملة ١٠ دقائق وذلك للصنف جيزة ٩٢ بينما لم يظهر الصنف جيزة ٩٤ اي علاقة معنوية بين المحصول بشقيه الزهر والشعر علي النبات وبين تصافي الحليج والنعومة بالميكرونير.٩- لم يكن هناك ارتباطا معنويا بين صفتى محصول الزهر والشعر علي النبات مع صفة المتانة وطول التيلة بالنسبة للصنف جيزة ٩٢ بينما كانت هناك علاقة سالبة معنوية بالنسبة للصنف جيزة ٩٤ فى الجيل الطفرى الاول بالمعاملة ٥ ، ١٠ دقائق بالاضافة الى المعاملة ١٥ دقيقة فى الجيل الطفرى الاول والثانى .