INDUCTION OF GENETIC VARIABILITY FOR QUANTITATIVE TRAITS *VIA* GAMMA RAYS IN HULL-LESS AND HULLED BARLEY UNDER NORMAL AND RAIN FED CONDITIONS

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ABSTRACT

This study was conducted to induce genetic variability in both Hull-less and Hulled Barley under normal conditions in Giza Experimental Research Station and rain fed conditions in Raffah N. Sinai, while the two varieties Giza 130 (Hull-less barely) and Giza 2000 (Hulled barely) by different gamma ray doses: 0,100,200,300,400 and 500 Gy during the first season 2008/2009. The first generation was planted in Giza Experimental Res. Station. The data were recorded on both morphological, yield and yield component traits of individual plants. In winter season 2009/2010 M_2 generation was planted in both conditions: irrigated and rain fed in both Giza Experimental Research Station and Raffah N. Sinai. Data were recorded on plant height, number of spike\plant, number of kernels\spike, 100-kernels weight, grain yield\plant and straw yield and harvest index. Irradiated treatments in M_1 generation affected on different studied traits for both varieties, while the highest grain yield per plant for Giza130 hull-less barley at 100 Gy of gamma ray dose, whereas 500 Gy dose was a lethal dose for M_1 generation and no plants were survived. 200 Gy dose was increase the biological yield for Giza 2000. Concerning to M_2 generation results, 100 Gy dose was increased significantly the grain yield/plant and the yield components, for Giza 130 in both conditions, while 400Gy dose increased yield and yield components for Giza 2000. The results proofed that the genotypic variances due to varieties and doses estimated under normal environment, was generally larger than under rainfed environment for all studied traits except for spike length. Positive and significant correlations among grain yield and all of biological yield/plant, straw yield, harvest index, plant height, 100 kernels weight, number of tillers/plant, number of spikes/plant, number and weight of kernels/spike under rain fed conditions, while under irrigated conditions in Giza Experimental res. Station, Positive and significant correlations among grain yield/plant and all of biological yield/plant, harvest index, plant height, number of tillers/plant and number of spikes/plant. Concerning to Giza 2000, there were Positive and significant correlations between grain yield/plant and both of biological yield/plant, straw yield, plant height, number of spikes/plant under rainfed conditions, While under irrigated conditions, there were Positive and significant correlations between grain yield/plant and both of biological yield, straw yield, harvest index, number of tillers/plant, number of spikes/plant and number of kernels/plant. The previous data indicated the high ability of selection in the next generation based on some traits with positive correlation with grain yield, such as 100 kernels weight, number of tillers/plant, number of spikes/plant and both weight and number of kernels.

Keywords: ***Hull-less barley, Hulled barley, Mutation, Gamma-rays, Correlations, Rainfed, Yield and yield components.***

INTRODUCTION

Barley (*Hordeum vulgare,* L.) is considered as one of the most important cereal crops in the world being used for many purposes such as malting and brewing industry, animal feeding, bread making as it is or by mixing with wheat flour in some places, some human food and beverages and many other uses.

Most of the rainfed areas in Egypt are planted with local types of barley (Bedouins, varieties) which give low yields and are more vulnerable to barley diseases and insects than the improved recommended barley cultivars. Therefore, using drought-tolerant barley cultivars is of great advantage, especially if they are resistant to diseases and insects, and have the potential to produce high yield under this drought-stress conditions. Ashmawy (1999) indicated that average of plant height, heading date, spike length, number of kernels per spike, weight of kernels per spike, 100-kernels weight, water use efficiency, grain and straw yield/fed. as well as harvest index were significantly decreased with decreasing the seasonal irrigation water applied.

Genetic variation among breeding stocks is a fundamental pre request to start breeding programs. Besides accurate variation measurements are needed to evaluate the power of doses and to determine suitable treatments. A comprehensive statistical model that able to show and explain more sources of variations would be a helpful tool to plant breeders.

Mutation breeding was used beside selection, in self as well as in cross pollinated plants. In that context artificially different means for induced mutation are the plant breeders hope to gain complete independence from nature as the only source of novel genetic variability which is necessary for further plant improvements. However, in mutation breeding, it was noticed that most of the artificially induced mutations were undesirable. This may explain the difficulties accompanying the use of radiation as a method for plant improvement. These difficulties should not exclude the use of mutation breeding especially if the breeder is looking for particular character that is not to be found in the known varieties (Abdel-Sattar and Afiah 1999).

The goal of mutation breeding in barley is to produce new genotypes more drought tolerant especially in new reclaimed lands in N. Sinai. This can be achieved by conducting such experiments at the target environments. Several investigators worked on the effect of the ionizing radiation on the induction of mutation in barley of them (El-Shawaf *et al* 1986) and (Cox *et al* 1987). Their results showed a wide range of effects mostly depending upon the variety, radiation type and dose.

From mutagen treated barley crop, many different types of mutants were identified. Pitirimova (1987) obtained two early forms than the mother variety. Correlations between characters are very helpful statistical parameters for studying the mutation effects on the expression of quantitatively inherited characters. Abdel-Sattar and Afiah (1999) reported changes in the correlations between barley quantitative plant characteristics by ionizing radiation.

This study aims to estimate the efficiency of gamma irradiation for inducing new genetic variances in respect to all traits studied with emphasis on grain yield/plant belonging to two varieties Giza130 (hull-less barley) and Giza 2000 hulled barley under normal and rainfed conditions. Also the estimation of simple correlation coefficient among yield and its attributes in M_2 irradiated and non irradiated populations was done.

MATERIALS AND METHODS

The materials used in this study included two cultivars: commercial cultivars: Giza 130 (hull-less barley) and Giza 2000 (hulled barley). They were exposed to six gamm ray doses: 0, 100, 200, 300, 400 and 500 Gy, at a dose rate of 0.8 Gy min^{-1} at the National Center for Radiation Research and Technology, Atomic Energy Authority. The M_1 irradiated seeds and non irradiated controls of the two barley cultivars were planted at Giza Research Station in 2008/2009 winter season to obtain M_1 plants and M_2 seeds. Bulked M_2 seeds of each treatment from M_1 plants were planted in 2009/2010 season in three replication under two agro-ecological conditions in two sites (Giza Res. Station and Raffah N. Sinai). In each experiment entries were grown using a randomized complete block design with three replications. Each plot consisted of ten rows 3m long, 30cm apart and 10 cm distance between plants within rows. All cultural practices were applied as usually recommended for barley in such areas. Morphological and yield characters were recorded on 10 random and guarded plants to study the effect of irradiation doses on the two studied cultivars on plant height in cm (Plh), spike length in cm (Sp L), number of tillers/plant (No. T/Pl), number of spikes/plant (No. SP/pl), spike kernels weight (g) (Sp.K.W), number of kernels/spike (No. K/Sp), 100-kernels weight (g) (100-KW), grain yield/plant (GY), biological yield (BY), straw yield (SY), and harvest Index% (HI).

Data were analyzed by using MStatC program and standard analysis of variance using least significant differences (LSD) was performed to estimate the significant differences and the interactions among different treatments (Steel and Torrie 1980). As well as Standard Deviation, range and the genetic components were estimated.

Phenotypic correlations among traits were computed according to Singh and Chaudhary (1977).

RESULTS AND DISCUSSION

M_1 generation

Mean performance of the two barley cultivars as affected by 6 gamma ray radiation in M_1 generation for morphological and physiological characters is presented in Table (1). 500 gamma ray dose was a lethal dose for Giza 130 cultivar and revealed no survived plants. Sarduie-Nasab (2010) reported that high gamma ray doses decreased emergency index compare with control treatment. Base on, experimental and greenhouse studies, doses of 700 and 1200Gy strongly decline plant growth and treated plant seed with these radiation dosages did not emerge in the field, therefore, they suggested that 200Gy gamma ray dose was the best treatment to screen mutant barely.

The data revealed that plant height of the two cultivars was affected significantly by gamma ray treatments. The results of Irradiated G130 with 100 Gy and 200 Gy were equal to their control, while G130 treated with 300 Gy or 400 Gy and Giza 2000 treated with all doses were shorter than the control.

Spike length indicated that G130 treated with 200, 300 and 400 Gy produced the longer spikes than Giza 130 treated with 100 Gy. On the other hand, Giza 2000 for all doses resulted in short spikes.

Number of tillers in M_1 generation for G130 and Giza 2000 was significantly increased by gamma rays. By contrast, 130 developed from 400 Gy showed the lowest number of tillers per plant.

The analysis of variance of number of spikes per plant revealed that Giza 130 treated with 300 Gy and Giza 2000 treated with 200 Gy produced the greatest number of spikes per plant.

It is evident from the data presented in Table (1) that kernels weight/spike of the two barley cultivars of all doses were significantly lower than the control.

In accordance with mean performance for grain yield\plant (g.), results indicate that Giza 130 treated with 100 Gy, 300 Gy or 400 Gy were significantly higher in their mean values of grain yield/plant than the control by 10.44 %, 17.33% and 17.33% respectively.

Means of biological yield\plant (g.) in M_1 generation for G130 and Giza 2000 were affected significantly by gamma rays. Giza 130 irradiated with 100 Gy, 200 Gy or 300 Gy and Giza 2000 irradiated with 100 Gy a high biological yield and were more sensitive to radiation. They were higher than their untreated control by 34.61%, 55.75%, 8.65% and 10.68% respectively for Giza 2000 treated with 100 Gy. On the other hand, Giza 130 treated with 400 Gy and Giza 2000 with 200 Gy, 300 Gy or 400 Gy recorded the lowest biological yield\plant (g.) among all M_1 irradiated plants of the two cultivars. These results are in harmony with Amer and El-Rassas (1994).

Table 1. Morphological and physiological characters of two barley genotype as affected by 6 gamma ray treatments during M_1 generation in Giza

Genotypes	Plant height	S. D	Spike length	S D	No. tiller /plant	S D	No. Spike per plant	S D	Spike kernels weight	S D	Grain Yield	S. D	Biological Yield	S D	Straw yield	S D	Harvest index	S D
									Giza 130									
Control	101.7	2.89	6.7	0.58	17.00	1.00	16.3	1.15	2.03	0.06	16.0	1.00	34.67	0.58	18.67	1.53	46.19	3.60
Range	100-105		6-7		16-18		15-17		1.6-2.1		14-17		34-35					
100 Gy.	102.7	4.62	6.3	0.58	17.67	0.58	5.3	0.58	1.93	0.12	17.67	0.58	46.67	2.89	29.00	2.65	37.93	2.00
Range	100-108		6-7		17-25		4-6		1.8-2		17-25		45-55					
200 Gy	105.7	6.03	8.0	0.87	22.00	1.00	4.3	0.58	3.53	0,25	10.00	0.00	54.00	1.00	44.00	1.00	18.52	0.34
Range	100-112		7.5-9		18-23		4-6		2.5-3.8		10-20		43-55					
300 Gy	95.0	5.00	6.7	0.76	19.00	1.00	18.3	0.58	1.33	0.15	17.33	2.52	37.67	5.52	20.33	2.52	46.00	5.75
Range	95-100		6.5-7.5		18-20		18-19		1.2-1.5		15-24		35-80					
400 Gy	93.0	7.55	7.5	0.50	14.67	0.58	14.0	1.00	0.70	0.00	17.33	2.52	28.00	2.00	10.67	0.58	61.69	4.57
Range	85-100		7-8		14-15		13-15		0.7-1.2		17-20		23-30					
500 Gy	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Means	99.62		7.04		18.07		11.64		1.90		15.67		40.20		24.53		42.06	
									Giza 2000									
Control	113.0	3.61	8.5	0.50	21.33	1.53	20.0	1.00	3.17	0.25	66.67	6.11	121.67	2.89	55.00	6.24	54.80	5.01
Range	110-117		8-9		20-32		19-23		2.6-3.4		55-72		120-150					
100 Gy	112.3	4.04	8.0	0.50	32.00	2.00	18.7	0.58	2.60	0.10	57.67	3.51	134.67	4.16	77.00	5.00	42.84	2.72
Range	110-117		7.5-8.5		25-34		18-26		2.7-2.3		48-61		130-138					
200 Gy	104.7	2.52	8.3	0.58	34.33	0.58	27.7	2.52	1.90	0.10	39.33	1.51	112.67	11.68	73.33	12.58	35.23	4.57
Range	102-107		8-9		34-45		21-30		1.5-1.9		38-54		100-180					
300 Gy	105.0	5.00	6.7	0.58	29.67	0.58	13.7	0.58	1.37	0.06	18.33	1.53	84.00	1.73	65.67	2.08	21.83	1.77
Range	100-110		6-7		29-37		10-14		1.3-1.8		17-20		82-95					
400 Gy	105.0	5.00	7.2	0.29	33.00	1.00	29.7	1.53	1.13	0.35	24.00	2.00	91.33	9.02	67.33	7.02	26.31	0.46
Range	100-110		7-7.5		32-41		20-31		0.77-1.5		22-41		82-120					
500 Gy	91.3	2.08	6.2	0.29	27.00	2.00	19.7	1.53	1.27	0.06	22.67	0.58	72.67	7.5	50.00	8.00	31.46	3.94
Range	89-93		6-6.5		25-29		18-21		1.1-1.3		23-26		65-80					
Means	105.21		7.48		29.55		21.58		1.91		38.11		102.84		64.72		35.41	
CV%	3.98		8.39		4.01		7.08		9.26		9.81		6.74		11.85		9.74	
LSD 5% Dos (D)	4.483		0.669		1.070		1.324		0.194		3.00		5.498		6.034		4.106	
Varieties (V	2.588		0.386		0.618		0.764		0.112		1.734		3.174		3.484		NS	
D x V	6.339		0.946		1.514		1.872		0.274		4247		7.776		8.533		5.807	

S.D= Standard Deviation

M_2 generation

Morphological characters

Table (2) presents mean performance and the rang of M_2 cultivars barley gamma ray for morphological characters under the two environments. Data revealed that marked variability was induced as a result of all gamma ray doses for all traits studied, whereas, in some cases, varieties insignificantly differ.

The data revealed that plant height of barley cultivars was affected significantly by gamma ray doses. Irradiated plants in the two environments were shorter than the control except Giza 130 treated with 200 Gy and Giza 2000 irradiated with 200 Gy at Giza under irrigation. They were taller than the control by 5.96 % and 3.64 %, in the two cultivars, respectively. Sarduie-Nasab (2010) mentioned that in greenhouse experiment, analysis of obtained data from shoot length trait showed that there was significant difference between treatment on irradiated plants and irradiated plants with 200 Gy, which had highest shoot length (20.20 and 19.78cm length) respectively which bases on Duncan's New Multiple range test (DNMRT) and irradiated plants with 700Gy had lower length (10.36cm). However irradiated plant with 1200 Gy died after short period of growth (1.0 cm) in the greenhouse

Sarduie-Nasab (2010) reported that analysis of shoot length trait showed significant difference between the treatments and non-irradiated plants had highest shoot length (4.95 cm) but in irradiated plants, shoot length decrease with increase of gamma ray dosage, thus shoot length at 1200Gy decrease to 1.15 cm in greenhouse experiment and also, radiation has inhibitory effect on stem height and width.

Spike length indicated that Giza130 irradiated with 300 Gy was equal to the untreated control under drought tolerant in N. Sinai. But Giza130 with 400 Gy and evaluated under irrigated conditions at Giza station produced the longest spike. It was taller than the control by 11.49%.

However Giza 2000 for all treatments radiation in the two environments showed great increase as in spike length compared to their untreated control except Giza 2000 irradiated with 200 Gy and evaluated at respect to N. Sinai and Giza 2000 treated with 500 Gy and evaluated at Giza station were the shortest with spike length barley genotypes. This result is in harmony with that obtained by Tipples and Norris (1963).

Number of tillers per plant in M_2 generation for G130 and Giza 2000 was affected significantly by gamma rays; Giza 130 treated with 100 Gy or 400 Gy were the highest in number of tillers per plant and were significantly higher than the control. The data also showed that Giza 130 revealed lower number of tillers per plant when evaluated at Giza station. Giza 2000 was affected significantly by gamma rays, gamma irradiation treatment were higher in the tillers per plant than the control in both locations except Giza

Table 2. Morphological and physiological characters of two barley cultivars in the M_2 of 6 mutations treatments were evaluated in N. Sinai and Giza locations under rainfed and irrigation conditions.

Locations and Studied traits / Gamma ray doses	N. Sinai						Giza					
	Plant height	SD	Spike length	SD	No. tiller /plant	SD	Plant height	SD	Spike length	SD	No. tiller/Plant	SD
Giza 130												
Control	42.67	2.52	5.77	1.55	8.0	1.0	89.0	1.73	8.7	1.15	26.7	1.53
Range	26-45		4.5-6		5-9		80-90		6-10		25-28	
100 Gy	40.00	5.00	5.27	0.25	9.0	1.0	83.3	2.89	8.7	1.15	21.0	1.00
Range	35-45		4-5.5		6-10		58-85		7-10		20-24	
200 Gy	41.00	1.00	4.50	0.00	7.0	1.0	94.3	4.04	8.0	1.00	13.7	1.15
Range	38-42		3.5-5		6-8		90-98		5-9		13-15	
300 Gy	34.50	8.32	5.77	0.75	6.0	0.0	71.7	2.89	8.0	1.73	13.3	0.58
Range	30-40		5-6.5		6-12		60-75		7-10		13-14	
400 Gy	39.33	6.66	5.60	1.51	8.5	0.50	78.3	2.89	9.7	0.58	10.0	1.00
Range	36-47		4-6		8-9		65-80		8-10		9-12	
500 Gy	-	-	-	-	-	-	-	-	-	-	-	-
Means	39.5		5.38		7.7		83.32		8.62		16.94	
Giza 2000												
Control	40.50	4.50	5.67	0.29	5.3	0.58	90.7	13.65	8.2	0.76	32.7	1.53
Range	36-45		5.5-6		4-6		60-85		6-8.5		15-34	
100 Gy	40.00	0.00	7.10	0.36	7.5	0.50	85.7	12.50	8.2	1.61	30.7	3.06
Range	35-40		6.8-7.5		7-8		65-90		6-8		28-34	
200 Gy	33.50	1.50	5.33	0.29	7.2	0.76	94.0	6.56	9.3	0.58	33.7	3.51
Range	30-38		4.6-5.7		5-8		75-95		7-11		22-62	
300 Gy	32.00	2.00	5.93	0.12	6.8	1.04	85.0	15.0	8.7	0.58	33.3	1.15
Range	28-34		4.5-6.5		5-8		70-85		6-9		28-58	
400 Gy	35.00	0.00	7.10	0.96	5.0	0.00	83.7	15.50	8.3	0.58	31.0	11.53
Range	32-38		6-7.8		5-5		60-85		7-10		21-37	
500 Gy	27.50	2.50	5.83	0.29	6.5	0.50	86.3	11.50	8.0	1.32	35.7	2.52
Range	23-32		5.5-6		6-7		55-85		6-10		16-38	
Means	34.75		6.16		6.38		87.57		8.45		32.85	
CV %	11.21		12.36		10.03		12.29		13.35		13.69	
LSD 5% Doses (D)	4.536		0.787		0.768		11.539		1.247		3.843	
Varieties (V)	N.S		0.454		N .S		6.662		0.720		2.219	
D x V	6.415		1.113		1.086		16.319		1.763		5.432	

S.D= Standard Deviation

2000 with 400 Gy in N. Sinai and Giza 2000 with 100 Gy in Giza station. Besides, the differences between the two varieties were insignificant in N. Sinai but significant at Giza.

Yield and Yield Components

Giza 130 treated with 100 Gy was higher than control by 27.27% for number of spikes/plant in N. Sinai under drought condition while all treatment at Giza station under normal irrigation was deçreased than the control. Also, under normal environment, varieties differed significantly and Giza 2000 with 400 Gy was the best one (Table 3).

Mean values for number of kernels/spike between the two varieties were insignificant in N. Sinai. Change up to Giza 2000 under rain fed condition while, it was significant at the normal environments. Similar trends were also reported by Amer and El-Rassas (1994) and El-Shawaf *et al* (1986).

For Spike kernels weight (g) the differences between the two varieties were significant Giza 130 with 100 Gy, 200 Gy or 400 Gy and Giza 2000 with 500 Gy evaluated in N. Sinai under rainfed conditions gave heavier grains than their respective control by 25%,2% and 3%.While Giza 130 with 100 Gy, 200 Gy, 400 Gy and Giza 2000 with 300 Gy or 400 Gy in Giza station under normal irrigation gave highest spike kernels weight and it was higher than their untreated control by 2.50%, 4.64%, 6.07%, 11.87%, 4.75 over respectively over their respective controls.

For 100–kernels weight (g) cultivars significantly affected by gamma rays in the M_2 generation evaluated in the two environments. Giza 130 with 100 Gy or 400 Gy and Giza 2000 with 100 Gy, 200 Gy, 400 Gy in N. Sinai under rainfed condition gave heavier grains than their respective control by 1.32%, 6.58% , 22.37%. While Giza 130 with 200 Gy, 400 Gy and Giza 2000 with 300 Gy or 400 Gy, 500 Gy in Giza station under normal irrigation gave the heaviest hest 100–kernels weight compared to their respective control by 10.64%, 11.28%, 1.12%, 4.47% and 0.55% respectively . This result is in harmony with that obtained by Hagberg and Persson (1968).

With respect to mean performance for grain yield/plant (g.) results indicates treated that Giza 130 with 100 Gy and Giza 2000 irrigation with 300 Gy or 400 Gy were significantly higher and gave heaviest mean values of grain yield/plant compared to the control by 106.85%, 1.90% and 13.85% respectively where evaluated in N. Sinai rainfed areas. While grain yield/plant for Giza 130 evaluated in the two cultivars at Giza station was decreased compared with the control. On the other hand, Giza 2000 irradiation with 200 Gy, 300 Gy, 400 Gy or 500 Gy and M_2 was evaluated at Giza station, gave obvious increased in grain yield/plant and it was higher than their untreated control by 67.93%, 41.26%, 130.9% and 37.46% for the four mentioned doses, respectively. This superiority in yield capacity were attributed to high values for yield components. It is noticeable to utilize these new genetic variability's in the breeding program for improving barley crop under each water environment studied.

Table 3. Mean performance of eight morphological characters of two barley genotype as affected by 6 gamma ray treatments during M_2 in N. Sinai

Genotypes	No. Spike per plant	S. D	No. Kernels per spike	S. D	Spike kernel weight	S. D	Grain Yield	S. D	Biological Yield	S. D	100 Kernels weight	S. D	Straw yield	S. D	Harvest index	S. D
Giza 130																
Control	5.5	0.50	33.00	3.00	1.00	0.20	5.40	0.60	16.60	1.15	3.40	0.20	11.20	1.04	32.57	3.36
Range	4-6		21-39		0.8-1.2		4.8-6.0		15.4-17.7		3.2-3.6		10-11.9		28.5-35.1	
100 Gy	8.5	0.50	31.67	1.53	1.25	0.05	11.17	0.32	32.17	2.42	3.60	0.10	21.00	2.52	34.86	3.17
Range	4-9		26-33		1-1.3		9.5-11.3		29.6-34.4		3.5-3.7		18.2-23.1		32.8-38.5	
200 Gy	4.3	0.58	28.33	1.53	1.02	0.18	3.91	0.55	14.50	1.28	2.95	0.55	10.59	1.59	27.23	5.51
Range	4-8		23-30		0.5-1.2		3.4-4.5		13.4-15.9		2.4-3.5		8.9-12.6		23.9-33.6	
300 Gy	4.3	0.58	30.00	5.29	1.00	0.17	4.20	0.60	19.80	1.75	3.14	0.10	15.60	0.57	21.23	2.72
Range	4-8		14-34		0.6-1.2		3.6-4.8		18.1-21.6		2.8-3.4		14.5-17.4		19.4-24.4	
400 Gy	6.3	0.58	27.33	6.43	1.03	0.25	4.93	0.23	21.10	0.82	3.55	0.15	16.17	0.67	23.38	0.74
Range	4-7		8-32		0.3-1.3		4.8-5.2		20-21.8		3.2-3.7		15.4-16.6		22.5-23.9	
500 Gy	-		-		-		-		-		-		-		-	
Means	5.78		30.07		1.06		5.92		22.42		3.33		14.91		27.85	
Giza 2000																
Control	4.7	1.15	28.67	0.58	0.97	0.06	5.27	1.12	19.57	0.55	3.80	0.30	14.30	0.61	26.83	5.04
Range	4-6		23-30		0.9-1.0		4-6.1		19-20.1		3-3.9		13.9-15		21-30.3	
100 Gy	4.7	0.58	34.00	4.00	0.90	0.10	4.40	0.40	22.43	2.45	3.85	0.65	18.03	2.85	19.90	3.97
Range	4-7		22-38		0.8-1.0		4-4.8		20-24.9		3.2-4.5		15.2-20.9		16-24	
200 Gy	4.3	0.58	25.67	1.53	0.97	0.06	3.67	0.12	16.53	0.55	4.05	0.25	12.87	0.65	22.21	1.39
Range	4-5		20-27		0.9-1.0		3.2-3.9		16-26.5		3.6-4.2		12-13.5		20-23.8	
300 Gy	4.3	0.58	26.00	1.00	0.85	0.05	5.37	1.96	29.37	3.33	3.60	0.40	24.00	4.50	18.68	8.22
Range	3-7		22-27		0.9-1.2		3.2-7		25.8-32.4		3.2-3.8		18.8-26.7		10.7-27.1	
400 Gy	4.3	0.58	29.00	3.61	1.05	0.15	6.00	2.09	27.10	3.90	4.65	0.55	21.10	4.24	22.44	8.23
Range	4-7		20-30		0.8-1.0		3.6-7.4		23.2-31		4-5.2		16-23.6		13-30.2	
500 Gy	4.3	0.58	19.00	1.00	0.88	0.13	2.87	0.81	13.53	0.38	3.05	0.35	10.67	0.90	21.20	5.93
Range	4-6		15-23		0.8-1		2-3.6		13-13.8		2.7-3.4		10-11.7		14-26.1	
Means	4.43		27.06		0.94		4.60		21.42		3.83		16.83		21.88	
CV%	13.49		9.89		14.85		17.75		9.29		10.29		13.08		16.59	
LSD 5% Doses (D)	0.748		3.080		0.163		1.012		0.736		0.407		2.289		4.475	
Varieties (V)	NS		NS		NS		NS		0.425		0.235		1.322		NS	
D x V	1.058		4.357		0.229		1.431		1.040		0.575		3.237		6.328	

S.D= Standard Deviation

Data recorded in Table (4) indicated that there were significant differences among barley genotypes in straw yield /plant in N. Sinai rainfed area, Giza 130 with 100 Gy, 300 Gy or 400 Gy and Giza 2000 with 100 Gy, 300 Gy and 400 Gy gave high straw yield/plant than the control by 87.5 %, 39.29%, 44.38% for Giza 130 and/or 26.08%, 67.83% and 47.55% for Giza 2000, respectively. Straw yield /plant for Giza 130 cv. treated with 100 Gy, 300 Gy or 400 Gy and Giza 2000 in irrigated with 100 Gy, 300 Gy and or 400 Gy gave high straw yield/plant than the control by 87.5 %, 39.29%, 44.38% for Giza 130 cv. and 26.08%, 67.83% and 47.55% for Giza 2000 treated vc., respectively at Giza station under normal irrigation condition.

Mean performance for Harvest index for Giza 130 irrigated with 100 Gy was significantly higher than the control by 7.03 % in N. Sinai rainfed area. On the Besides in Giza station under irrigation Giza 2000 treated with 400 Gy and or 500 Gy gave the highest values were compared to the control by 9.42 % and 1.02%, respectively for the two doses. Ashmawy (1999) indicated that average of plant height, heading date, spike length, number of kernels per spike, weight of kernels per spike, 100-kernels weight, water use efficiency, grain and straw yield /fed. as well as harvest index significantly decreased with decreasing water applied in two seasons.

Data in Table (5) represent mean squares of M_2 generation for nine studied characters at the two locations.

Plant height mean squares between varieties, between doses and their interactions were highly significant in two locations except between varieties at N. Sinai, while plant height was not significant.

Spike length mean squares between varieties, between doses and their interactions were highly significant in the two locations.

Concerning to, number of tiller/plant, number of spikes/plant, number of kernels/sp, spike kernels weight, 100 - kernels weight, grain yield/plant and straw yield the mean squares between varieties were significant at Giza location and insignificant at Raffah in North Sinai. However, mean squares between doses and their interactions were highly significant in the two locations. These obtained results showed clearly that the highly significant genotype by environment interaction masked the effects of irradiation treatments. It could be easily concluded that irradiation treatments succeeded in inducing new variability's in this trait of about one- half more than the original varieties as estimated by relatively mean square values. These results are agreement with the findings of Morsi *et al* (1977).

Table 4. Mean Performance of M_2 generation of eight studied traits of the two barley cultivar as affected by 6 mutation treatments when evaluated at normal irrigation condition at Giza research station.

Genotypes	No. Spike/ plant	SD	No. Kernels/ spike	SD	Spike kernel weight	SD	Grain Yield	SD	Biological Yield	SD	100 Kernels weight	SD	Straw yield	SD	Harvest index	SD
Giza 130																
Control	19.00	1.00	52.67	1.53	2.80	0.10	55.10	3.12	204.00	10.91	4.70	0.20	148.90	9.00	27.02	1.12
Range	18-20		51-54		2.7-2.9		51.8-56		192.3-213.9		4.9-4.5		140.5-158.4		25.9-28.2	
100 Gy	17.00	1.00	62.33	3.06	2.87	0.15	46.80	1.80	212.70	8.20	4.67	0.06	165.90	6.40	22.00	0.00
Range	16-18		59-65		2.7-3		45-48.6		204.5-220.9		4.6-4.7		159.5-172.3		21-22,3	
200 Gy	12.00	1.00	56.00	2.00	2.93	0.15	35.27	1.15	174.97	5.35	5.20	0.10	139.70	4.20	20.16	0.04
Range	11-13		54-58		2.9-3.1		34.1-36.4		169.5-180.2		5.1-5.3		135.4-143.8		20.11-20.2	
300 Gy	11.67	0.58	43.67	0.58	2.63	0.15	26.37	1.15	233.80	10.60	4.70	0.00	207.43	9.45	11.28	0.02
Range	11-12		43-44		2.5-2.8		25.2-27.5		223.2-244.4		4.7-4.7		198-216.9		11.29-11.3	
400 Gy	7.33	0.58	56.33	1.53	2.97	0.15	19.27	0.35	123.17	2.25	5.23	0.12	103.90	1.90	15.64	0.02
Range	7-8		55-58		2.8-3.1		18.9-19.6		120.9-125.4		5.1-5.3		102-105.8		15.6-15.7	
500 Gy	-		-		-		-		-		-		-		-	
Means	13.40		54.07		2.84		36.56		189.73		4.9		153.17		19.22	
Giza 2000																
Control	27.67	3.51	58.33	7.02	3.37	0.35	35.77	1.48	84.00	9.59	5.37	0.70	48.23	10.80	43.08	6.76
Range	15-28		44-60		2.3-3.3		34.5-37.4		73.5-92.5		4.7-6.1		36.2-57.1		38.3-50.8	
100 Gy	20.33	1.53	52.33	0.58	2.63	0.15	35.70	3.86	101.60	1.21	5.30	0.26	65.90	3.51	35.13	3.61
Range	11-22		52-54		2.5-3.5		32-39.7		100.3-101.8		5.1-5.6		63-69.8		31.4-38.7	
200 Gy	24.33	4.51	62.33	6.03	3.13	0.40	60.07	3.11	165.77	4.96	5.43	0.32	105.70	7.95	36.29	2,89
Range	20-53		23-77		1.3-3.6		56.5-62.2		161-170.9		5.2-5.8		98.8-114.4		33-38.6	
300 Gy	25.00	2.00	65.00	2.00	3.77	0.25	50.53	0.50	138.90	2.26	5.61	0.16	88.37	196	36.39	0.43
Range	23-27		63-67		3.2-4		50-51		136.5-141		5.5-5.8		88.2-90.4		35.9-36.6	
400 Gy	36.00	4.00	63.00	4.00	3.53	0.35	82.60	2.49	175.27	1.70	5.40	0.72	92.67	3.50	47.14	1.64
Range	14-40		55-67		2.7-4.5		80.4-85.3		173.6-177		4.6-6		89.96.6		45.4-48.7	
500 Gy	24.00	2.00	53.67	0.58	3.17	0.25	49.17	2.45	112.97	1.36	5.27	0.57	63.80	1.73	43.52	1.82
Range	22-34		54-63		2.8-3.4		46.7-49.2		111.9-114.5		4.8-5.9		62.7-65.8		41.5-45.1	
Means	26.22		59.11		3.27		52.31		129.75		5.40		77.45		40.26	
Cv	11.43		6.10		7.47		5.25		4.47		7.75		6.16		8.81	
LSD 5% Doses (D)	2.52		2.20		0,252		2.60		7.70		0.44		7.56		2.97	
Varieties (V)	1.46		3.81		0.145		1.45		4.45		0.25		4.36		1.71	
D X V	3.57		5.38		0.356		3.67		10.89		0.62		10.69		4.20	

SD= Stander Deviation

Table 5. Mean squares for M_2 barley genotypes for all traits studied under the two environmental conditions.

S.O.F.	D.F	Plant height	Spike length	No. tiller /plant	No. Spike/ plant	No. Kernels/ spike	Spike kernels weight	100-Kernels weight	Biological Yield	Grain Yield	Straw yield	Harvest index
N. Sinai												
Between varieties	1	30.25	25.33**	0.007	1.36	36.00	0.025	10.11**	148.43**	1.047	174.42**	16.08
Between doses	5	629.47**	9.82**	16.81**	12.91**	422.38**	0.33**	4.93**	345.34**	26.37**	198.03**	274.63**
Varieties X doses	5	246.62**	7.04**	19.37**	11.18**	116.13**	0.27**	1.63**	95.82**	16.77**	34.80**	218.38**
Error	22	14.38	0.43	0.41	0.39	6.63	0.018	0.116	3.25	0.715	3.52	13.99
Giza												
Between varieties	1	2952.11**	14.69**	4053.44**	1906.78**	1750.03**	7.29**	15.52**	7236.34**	4292.43**	22675.34**	5287.92**
Between doses	5	1997.53**	21.21**	521.56**	76.24**	947.43**	2.374**	6.51**	12417.59**	525.54**	9199.63**	141.39**
Varieties X doses	5	1709.98**	17.61**	1192.89**	149.91**	715.56**	2.157**	5.75**	13945.65**	1578.87**	7363.92**	204.29**
Error	22	93.06	1.09	280.27	4.44	10.12	0.044	0.14	41.45	4.71	39.92	6.15

Table 6. Genetic variance components (due to varieties (δ^2 v) and doses (δ^2 d) for M_2 barley genotypes evaluated under drought and normal environments

Studied Characters	N. Sinai Rainfed		Giza Normal Environment	
	δ^2 v	δ^2 d	δ^2 v	δ^2 d
Plant height	30.25	3147.33	2952.11	9987.67
Spike length	25.33	49.10	14.69	106.06
Number of tillers/plant	0.007	84.04	4053.44	521.56
Number of spikes/plant	1.36	64.56	1906.78	381.2
Number of kernels/spike	36.00	2111.89	175.03	4737.14
Spike kernels weight	0.025	1.66	7.290	11.87
Grain yield	1.047	131.86	4292.43	2627.68
Biological yield	148.43	1726.69	7236.34	62087.97
100- Kernels weight	10.11	24.64	15.52	32.53
Straw yield	174.42	990.16	22675.34	22675.34
Harvest index	16.077	1373.16	5287.92	5287.92

Estimates of genetic variance components for plant height, spike length, number of tillers/plant, number of spikes/plant, No. kernels/sp, Spike kernels weight, grain yield/plant, biological yield/plant, 100-kernels weight, straw yield and harvest index in M_2 barley evaluated at N. Sinai and Giza locations are presented in Table (6). The relative magnitudes of these components indicate the relative importance of the corresponding source of variation. It is clear those variances between varieties and/or among doses were enough to allow successful selection from M_2 generation to release improved lines in M_3 (Mode and Robinson 1959).

Change in phenotypic correlations between grain yield and its components under the influence of radiation for the two environments are presented in Table (7). Simple correlation coefficients among grain yield and its attributes were generally higher in untreated populations than in the treated ones for the two varieties across over the two environments.

Under normal condition all radiated M_1 barley genotypes showed significantly positive association between grain yield/plant and harvest index, and also between biological yield/plant and each of straw yield, plant height and spike kernels weight, also between straw yield and each of plant height and no-of tillers/plant. Data also showed significantly positive association between plant height and each of no. of tillers/plant and spike kernels weight.

Table 7. Estimates of phenotypic simple correlations among eleven characters in M_1 grain hull-less and hulled barley genotypes when cultivated under irrigation system at Giza.

Giza 130	GY	BY	SY	HI	Plh	Sp L	No. T/Pl	No. Sp/pl	Sp.kw
GY	1								
BY	-0.693**	1							
SY	-0.814**	0.983**	1						
HI	0.815**	-0.970**	-0.990**	1					
Plh	-0.680**	0.877**	0.881**	-0.897**	1				
Sp-L	-0.765**	0.198	0.354	-0.305	0.117	1			
No. T/Pl	-0.789**	0.875**	0.907**	-0.932**	0.693**	0.342	1		
No. Sp/pl	0.515*	-0.803**	-0.779**	0.702**	-0.766**	-0.255	-0.455*	1	
Sp.kw	-0.887***	0.883**	0.938**	-0.962**	0.927**	0.391	0.862**	-0.650**	1
Giza2000	**GY**	**BY**	**SY**	**HI**	**Plh**	**Sp L**	**No. T/Pl**	**No. Sp/pl**	**Sp.kw**
GY	1								
BY	0.902**	1							
SY	0.138	0.552*	1						
HI	0.961**	0.755**	-0.124	1					
Plh	0.732**	0.834**	0.501*	0.558*	1				
Sp-L	0.850**	0.903**	0.432	0.752**	0.791**	1			
No. T/Pl	-0.399	0.009	0.791**	-0.576**	-0.094	-0.044	1		
No. Sp/pl	-0.039	0.070	0.237	-0.035	-0.053	0.294	0.467*	1	
Sp.kw	0.980**	0.855**	0.070	0.948**	0.738**	0.812**	-0.500*	-0.200	1

*** and ** : Denote signify cant at $P \leq 0.05$ and 0.01 respectively.**

(Plh)= plant height in cm, Sp L = spike length in cm, No. T/Pl = number of tillers/plant, No. SP/pl=number of spikes/plant, Sp.K.W= spike kernels weight (g), No. K/Sp = number of kernels/spike, 100-KW= 100-kernels weight (g), GY = grain yield/plant, BY= biological yield, SY= straw yield, and HI= harvest Index%.

The other significantly positive correlation was shown between grain yield/plant and number of spikes/plant and between biological yield/plant and number of tillers and between straw yield and spike kernels weight and also between harvest index and spike kernels weight, and between number of tillers/plant and spike kernels weight in Giza 130.

While in the cultivar Giza 2000 a significantly positive association between grain yield/plant and each of biological yield/plant, plant height and spike kernels weight also between biological yield and each of harvest indexes, spike length and spike kernels weight. The other significantly positive correlation was show between harvest index and each of plant height, spike length and spike kernels weight also between spike length and spike kernels weight, as well as between number of tillers/plant and number of spike/plant.

Tables 8 and 9 presents a speciation among traits in M_2 Associations were positive and highly significant between grain yield/plant and biological yield/plant in Giza130variety under rainfed and also for Giza 2000 variety under both environments.

While in N. Sinai Giza 130 and Giza 2000 showed significantly positive association between grain yield and each of biological yield, straw yield/plant, plant height, 100 kernels weight and number of kernels/spike and also between biological yield/plant and each of number of tillers/plant and number of spikes/plant under rainfed environment in the North-Coastal area. The results showed great similarity with those obtained by Khattab and Afiah (1999) and Abdel-Sattar and Afiah (1999).

The other significantly positive correlation was show between grain yield/plant and harvest index, number of tillers/plant, number of spikes/plant and spike kernels weight, and between biological yield/plant and number of tillers/plant, number of spikes/plant and spike kernels weight, and between straw yield and 100-kernels weight, number of tillers/plant and spike kernels weight and also between harvest index and number of tillers/plant number of spikes/plant and number of kernels/spike, spike kernels weight and between plant height and both number of tillers/plant and number of spikes/plant also between spike length and 100 kernels weight, also between number of tillers/plant and number of spikes/plant, spike kernels weight, and between number of spikes/plant and number of kernels/spike, spike kernels weight in Giza 130.

While that association among M_2 plants of Giza 2000 was significantly positive between grain yield/plant and each of biological yield/plant, straw yield/plant, plant height and 100 kernels weight, number of kernels/spike also between biological yield and each of straw yield, spike length, 100-kernels weight and number of kernels/spike. The other significantly positive correlation was show between harvest index and each of plant height, number of spike/plant and spike kernels weight also between plant height and 100 kernels weight number of spike/plant and number of kernels/spike. Also between spike length and 100-kernels weight and number of kernels/spike, and between 100 kernels weight and number of kernels/spike and spike kernels weight, as well as between number of spike/plant and number of kernels/spike.

M_2 plants evaluated at Giza station of both Giza130 and Giza 2000 showed highly significant correlation between grain yield/plant and each of biological yield, harvest index, number of tillers/plant and number of spikes/plant also between biological yield /plant and both straw yield and number of tillers/plant, and between harvest index and both number of spikes/plant and number of kernels/spike, also between number of tillers/plant and number of spikes/plant , as well as between number of spikes/plant and spike kernels weight, also between number of kernels/spike and spike kernels weight. These results are agreement with the findings of Mackey (1985).

This result beside the great variation induced by gamma rays as previously discussed indicated that effective selection for improving grain yield/plant could be achieved via these traits. It is also suggested that selection criteria should be based on number of spikes/plant, number of kernels/spike and 100 kernels weight for achieving maximum yield potential in both hulled and naked-grain barley genotypes under normal as well as rainfed conditions.

The other significantly positive correlations among M_2 plants evaluated at Giza station was shown between grain yield/plant and both harvest index and number of spikes/plant also between biological yield/plant and number of spikes/plant and between harvest index and both of plant height and number of tillers/plant and between plant height and both number of kernels/spike and spike kernels weight as well as between spike length and spike kernels weight for Giza 130 variety. While Giza 2000 variety showed significantly positive association between grain yield and both straw yield and number of kernels /spike and between biological yield and both spike length and number of kernels/spike, also between straw yield and each of spike length and 100 kernels weight and number of kernels/spike, also between plant height and spike length, as well as between spike length and number of kernels/spike and between number of spikes/plant and spike kernels weight. Rashal (1985) reported changes in the correlations between barley quantitative plant characteristics by ionizing radiation.

Sarduie-Nasab (2010) reported that Base on results suggested that gamma ray with 200Gy dosage is the pre-eminent applied gamma ray dosage among all dissimilar dosages used, in this case is advisable for further researcher studies, which looking for dominant and recessive mutation on barely Nosrat variety plant seed, to have mutant plants and mutant screening for biotic and abiotic stresses.

Table 8. Estimates of phenotypic simple correlations among eleven characters in M_2 grain hull-less and hull-led barley genotypes evaluated under irrigation system at Raffah in N. Sinai.

Giza 130	GY	BY	SY	HI	Pl.h	Sp-L	100-kw	No. T/pl	No. Sp/pl	No. k/sp	Sp.kw.
GY	1										
BY	0.930**	1									
SY	0.799**	0.964**	1								
HI	0.730**	0.433	0.179	1							
Pl.h	0.175	-0.144	-0.364	0.720**	1						
Sp-L	0.010	0.159	0.247	-0.157	-0.325	1					
100-kw	0.677**	0.715**	0.677**	0.424	0.206	0.518*	1				
No. T/Pl	0.705**	0.602**	0.474*	0.665**	0.604**	0.040	0.853**	1			
No. Sp/pl	0.865**	0.631**	0.408	0.927**	0.489*	-0.303	0.360	0.593**	1		
No. k/sp	0.463*	0.252	0.073	0.716**	0.291	0.376	0.275	0.188	0.592**	1	
Sp.kw.	0.973**	0.926**	0.814**	0.644**	0.114	-0.171	0.566**	0.650**	0.844**	0.285	1
Giza 2000	GY	BY	SY	HI	Pl.h	Sp-L	100-kw	No. T/Pl	No. Sp/pl	No. k/sp	Sp.kw.
GY	1										
BY	0.860**	1									
SY	0.795**	0.993**	1								
HI	0.176	-0.346	-0.452*	1							
Pl.h	0.507*	0.249	0.179	0.453*	1						
Sp-L	0.443	0.522*	0.519*	-0.289	0.343	1					
100-kw	0.677**	0.498*	0.437	0.218	0.473*	0.469*	1				
No. T/Pl	-0.589**	-0.204	-0.107	-0.663**	-0.148	-0.138	-0.406	1			
No. Sp/pl	0.210	-0.019	-0.071	0.485*	0.837**	-0.100	-0.026	0.034	1		
No. k/sp	0.579**	0.510*	0.474*	0.054	0.892**	0.621**	0.607**	0.032	0.584**	1	
Sp.kw.	0.436	0.062	-0.026	0.606**	0.348	0.240	0.840**	-0.665**	-0.057	0.286	1

(Plh)= plant height in cm, Sp L = spike length in cm, No. T/Pl = number of tillers/plant, No. SP/pl=number of spikes/plant, Sp.K.W= spike kernels weight (g), No. K/Sp = number of kernels/spike, 100-KW= 100-kernels weight (g), GY = grain yield/plant, BY= biological yield, SY= straw yield, and HI= harvest Index%.

Table 9. Estimates of phenotypic simple correlations among eleven characters in M_2 of a hull-less and hulled barley genotypes evaluated under irrigation system at Giza.

Giza 130	GY	BY	SY	HI	Pl.h	Sp-L	100-kw	No. T/Pl	No. Sp/pl	No. k/sp	Sp.kw.
GY	1										
BY	0.488*	1									
SY	0.166	0.942**	1								
HI	0.894**	0.048	-0.290	1							
Pl.h	0.573**	-0.171	-0.415	0.773**	1						
Sp-L	-0.227	-0.729**	-0.736**	0.078	-0.185	1					
100-kw	-0.601	-0.879**	-0.762**	-0.218	0.278	0.323	1				
No. T/Pl	0.970**	0.502*	0.193	0.845**	0.404	-0.112	-0.694**	1			
No. Sp/pl	0.978**	0.644**	0.350	0.785**	0.408	-0.299	-0.753**	0.972**	1		
No. k/sp	0.339	-0.364	-0.542*	0.554*	0.524*	0.397	0.200	0.219	0.218	1	
Sp.kw.	-0.084	-0.835**	-0.911**	0.328	0.538*	0.573**	0.733**	-0.192	-0.269	0.789**	1
Giza 2000	**GY**	**BY**	**SY**	**HI**	**Pl.h**	**Sp-L**	**100-kw**	**No. T/Pl**	**No. Sp/pl**	**No. k/sp**	**Sp.kw.**
GY	1										
BY	0.914**	1									
SY	0.729**	0.944**	1								
HI	0.489*	0.106	-0.220	1							
Pl.h	-0.230	-0.052	0.099	-0.285	1						
Sp-L	0.270	0.601**	0.795**	-0.530*	0.602**	1					
100-kw	0.229	0.427	0.534*	-0.310	-0.037	0.588**	1				
No. T/Pl	0.904**	0.657**	0.373	0.777**	-0.433	-0.142	0.006	1			
No. Sp/pl	0.778**	0.518*	0.240	0.805**	-0.271	-0.100	0.162	0.909**	1		
No. k/sp	0.524	0.761**	0.858**	-0.315	-0.086	0.695**	0.800**	0.192	0.101	1	
Sp.kw.	0.442	0.372	0.268	0.376	-0.201	0.158	0.740	0.435	0.606**	0.538*	1

(Plh)= plant height in cm, Sp L = spike length in cm, No. T/Pl = number of tillers/plant, No. SP/pl=number of spikes/plant, Sp.K.W= spike kernels weight (g), No. K/Sp = number of kernels/spike, 100-KW= 100-kernels weight (g), GY = grain yield/plant, BY= biological yield, SY= straw yield, and HI= harvest Index%.

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استحداث تباينات وراثية للصفات الكمية فى الشعير العارى والمغطى بواسطة اشعة جاما تحت الظروف العادية والمطرية

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يهدف هذا البحث الى استحداث تباين وراثى لكل من الشعير العارى والمغطى وذلك تحت نظم الرى العادية بمحطة بحوث الجيزة وتحت ظروف البيئة المطرية بمدينة رفح بسيناء الشمالية حيث تم معاملة الصنفين جيزة ١٣٠ شعير عارى وجيزة ٢٠٠٠ شعير مغطى بجرعات: ٥٠٠،٤٠٠،٣٠٠،٢٠٠،١٠٠ جراى من اشعة جاما وذلك فى الموسم الزراعى الاول ٢٠٠٨/٢٠٠٩ حيث تم زراعة الجيل الاول الاشعاعى بمحطة بحوث الجيزة بمركز البحوث الزراعية وسجلت البيانات المختلفة لكل من الصفات المورفولوجية وصفات المحصول ومكوناته بالنسبة للنباتات الفردية. وفى الموسم الزراعى ٢٠٠٩/٢٠١٠ تم زراعة الجيل الاشعاعى الثانى فى كلا البيئتين المروية والمطرية بكل من محطة بحوث الجيزة ورفح بشمال سيناء وسجلت البيانات لصفات طو ل النبات، طول السنبلة، عدد الافرع للنبات، عدد السنابل للنبات، عدد حبوب السنبلة، وزن حبوب السنبلة، المحصول البيولوجى للنبات، محصول الحبوب للنبات،محصول القش، دليل الحصاد. اثرت الزيادة فى المعاملة بالاشعاع فى الجيل الطفورى الاول على الصفات المختلفة لكل من الصنفين حيث كانت اعلى كمية زيادة فى محصول الحبوب للنبات للصنف جيزة ١٣٠ عند الجرعة ١٠٠ جراى من اشعة جاما، بينما كانت الجرعة الاشعاعية ٥٠٠ جراى جرعة مميتة ولم تعطى نباتات فى الجيل الاول. فى حين اعطت المعاملة ٢٠٠ جراى زيادة فى المحصول البيولوجى للصنف جيزة ٢٠٠٠. اما بالنسبة لنتائج الجيل الطفورى الثانى، فقد وجد ان الجرعة الاشعاعية ١٠٠ جراى ادت الى زيادة معنوية فى محصول الحبوب للنبات ومكوناته وذلك لصنف الشعير العارى جيزة ١٣٠ فى كل من البيئتين فى حين ان الجرعة الاشعاعية ٤٠٠ جراى ادت الى زيادة كلا من المحصول ومكوناته وذلك لصنف الشعير المغطى جيزة ٢٠٠٠. وقد اثبتت النتائج ان قيم التباين الوراثى المستحدث الراجع للاصناف والجرعات فى البيئة العادية اكبر من قيمته فى البيئة المطرية لجميع الصفات تحت الدراسة فيما عدا صفة طول السنبلة. وقد لوحظ فى صنف الشعير العارى جيزة ١٣٠ وجود ارتباط موجب ومعنوى بين محصول النبات وكل من المحصول البيولوجى للنبات ومحصول القش، دليل الحصاد وطول النبات ووزن ١٠٠ حبة وعدد الافرع للنبات وعدد السنابل للنبات، وعدد حبوب السنبلة ووزن حبوب السنبلة فى البيئة المطرية بينما فى البيئة المروية فى محطة بحوث الجيزة كان هناك ارتباط موجب ومعنوى بين محصول النبات وكل من المحصول البيولوجى للنبات و دليل الحصاد وطول النبات وعدد الأفرع للنبات وعدد السنابل للنبات. وفى صنف الشعير المغطى جيزة ٢٠٠٠ كان هناك ارتباط موجب ومعنوي بين محصول النبات وكل من المحصول البيولوجى للنبات ومحصول القش وطول النبات وعدد السنابل للنبات فى البيئة المطرية بينما فى البيئة المروية كان هناك ارتباط موجب ومعنوى بين محصول النبات وكل من المحصول البيولوجى للنبات ومحصول القش و دليل الحصاد وعدد الأفرع للنبات و عدد السنابل للنبات وعدد حبوب السنبلة. ومن النتائج السابقة يتضح امكانية الانتخاب فى الاجيال المتتالية اعتمادا على بعض الصفات ذات الارتباط الموجب المعنوى بمحصول الحبوب وهى وزن ١٠٠ حبة وعدد الافرع للنبات وعدد السنابل للنبات ووزن وعدد حبوب السنبلة.

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