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GAMMA RAYS MUTAGEN INFLUENCE IN DEVELOPMENT PEA AGRONOMIC AND BIOCHEMICAL CHARACTERS

BY

El.-Ghareeb, I.M.
Hort. Res. Institute. Agric. Res. Center, Egypt

ABSTRACT

During two successive seasons (2003-2004) and (2004-2005), Pea seeds of Master B, and Lincoln cultivars were gamma irradiated under 1 kr, 2 kr, 3 kr and 4 kr doses. Split plot design with four replicates was used.

1- Vegetative characters

Results in the first seasons (2003-2004) showed that one kr gamma rays dose gave highly significant values (90.36%) for germination ratio, 52.9 cm for plant height, 15.53 for number of leaves and 2.48 for number of branches per plant, with increasing over the control, Master B parent, at frequency 12.5%, 45.33%, 49.61%, 42.17% for the same characters, respectively, On the contrary, 4 kr dose gave sever reduction (30.81%, 17.78%, 26.49%, 11.02%) for the same characters respectively. As for the M_1 generation derived from irradiated Lincoln cultivar, the same dose "one kr" recorded highly significant values for same vegetative characters (88.28%, 99.44 cm, 21.15 and 3.69) with increasing 8.15%, 31.12%, 66.58% and 79.13% for germination ratio, plant height, number of leaves and branches per plant respectively. On the contrary, 4 Kr dose recorded the highest depression at 37.34%, 17.32%, 35.03% and 45.63% for the same vegetative characters, respectively.

2- Yield and it's components:-

One kr as the optimum dose gave the highest significant values (30.55-9,16, and 640 g. for number of pods per plant, seeds per pod, and yield of green pods per plant, with increasing (207.65%, 24.97% and 299.25%0 over the parent Master B for same agronomic characters respectively, while four kr dose recorded notable depression (36.25%, 16.78% and 49.78%).

In the M_1 derived from Lincoln, one kr dose gave also the highest significant values (38.75, and 680.88(g)) for number of pods, and yield of green pods per plant while two kr dose gave the highest significant number of seeds per pod, (9.03) with increasing (217.62%, 18.35% and 223.84% for number of pods, seeds per pod, and yield of green pods. However four kr dose gave depression for the same agronomic characters 37.5%, 19.66% and 61.86%. Results also showed highly significant interaction between different doses of gamma rays and cultivars for vegetative and agronomic characters in M_1 of Master B and Lincoln. Same

trend of results was obtained in the second season (2004-2005) for all vegetative and agronomic characters.

3- Biochemical studies:-

Protein electrophoretic studies in M_1 generation showed that the low dose "one Kr" of gamma rays was distinguished with the highest band number and intensity and exceeded all treatments and their respective parents. Such results are similar to be realized by hybridization method. Moreover the same dose gave the highest increase in seed protein content (38.89% and 41.18%) for the M_1 derived from Master B and Lincoln, respectively.

INTRODUCTION

Induced economic and interest mutations caused by physical mutagens considered one of the methods to obtain genetic variation. Useful mutations derived from such mutants as gamma rays, respectively are of utmost importance if it will be related to some agronomic characters, "yield and it's components "Geetha & Vaidyanathan (1998), Rajput *et el.* (2001a+b) and Ramesh *et al.* (2001)".

As regards, pea, the crop ranks one of the four most important grain legumes in the world, because it constitutes an important source of proteins for human consumption.

It's demonstrated that the new genetic variability coming from mutagenic treatments responds to artificial selection under high population density for which selection under normal conditions is ineffective.

In peas effectiveness and efficiency were higher at lower doses of physical mutagens such as gamma rays. Gad and El-Sawah (1985), El-Demerdash (1993), Eman (2000), Kharkwal (2000), Hassan *et al.* (2001) and Azza (2004).

Knowing that the recombination of closely linked genes is very less probable, one may think of the mutagenic treatment as a method to facilitate the release of co- variation that will need plenty of crosses and time in traditional breeding.

More than 90% of the scored mutations, presented from 1363 cultivars, and derived valuable characters, are induced by gamma rays (Mick *et al.*, 1990 and FAO/LAEA, 1991).

The different responses for the genotypes may be due to the differential sensitivity of different genes to gamma rays as suggested by Abd El-Raheem *et al.* (1988) who recorded quite variation with regard to either mutagen dose or to the genotype employed in peanut and Azza (2004) reported same trend in faba bean. Thus studying the mutability of some pea cultivars differ in their sensitivity to physical mutagenesis is important in our investigation.

The aim of this investigation is how to make use of mutagenesis in pea breeding and production through the effect of gamma rays doses mutagen on some vegetative and agronomic characters in the first mutagenic generation, as well as some biochemical characters.

MATERIALS AND METHODS

This work was carried out through two successive winter seasons (2002-2003) and (2003-2004) at a private farm in Sharkia Governorate to study the influence of natural mutagen gamma rays on some agronomic characters of pea in the first mutagenic generation of Master B and Lincoln cultivars, that were obtained from Hort. Res. Institute. Egypt and differed in their growth habit.

1500 g. of dry seeds for each of two cultivars "Master B and Lincoln were arranged in monolayer in poly ethylene bags and subjected to the acute doses 10,20.30 and 40 Gy of gamma rays. The exposure time was exactly adjusted to allow the seeds to receive the predetermined dose. Irradiation was achieved at the National Res. Centre of Radiation Technology. Nasr city. Atomic Energy in Cairo. The irradiated and unirradiated seeds were sown on October 10^{th} at one side in (2003-2004) and (2004-2005) seasons in a hills, 15 cm a part in ridges. Asplit plot design with four replicates was adopted, where cultivars were distributed at the main plots and gamma rays treatments were randomly arranged at sub plots. Each experimental plot included 7 ridges of 60 cm awide and 4.5 m long.

Data were subjected to the proper statistical analysis of variance according of Snedecor and Cochran (1982). L.S.D at 5% and 1% levels of significance was used to compare treatment means.

The treatments are:

1- Control
2- One Kr dose: (10Gy) Gamma Rayes.
3- Two Kr dose: (20 Gy) Gamma Rays.
4- Three Kr dose: (30Gy) Gamma Rays.
5- Four Kr dose: (40Gy) Gamma Rays.

Data on 40 plants, represented by 10 plants from each replicate and each treatment were as follow:-

Vegetative characters:-

a) Germination ratio
b) Plant height (cm) after 65 days from sowing.
c) Number of leaves per plant after 65 days from sowing..
d) Number of branches per plant after 65 days from sowing..

Yield and some of it's components

a) Number of pods per plant
b) Number of seeds per pod.
c) Yield of green pods per plant (g)

Biochemical studies

A- Protein electrophoresis

This investigation was carried out at laboratory of genetic engineering. Department of genetics, Faculty of agriculture, Ain Shams University. Sodium dodocyl sulphate – polyacrylamide gel electrophoresis (SDS-PAGE) was performed according to the method of Laemmli (1970) after being modified by Studier (1973).

Sample preparation:

Seed samples from the first generation mutagenic and the two pea cultivars "Master B and Lincoln" were used. Seeds were pressured by a drill to repture the cells and release their contents. Samples of 0.5 gram of each genotype with 5 ml of sample buffer was homogenized, than they were containing water soluble protein were used for SDS-PAGE.

Gel preparation:

Polycrylamide standard gel at PH 8.9 consists of 150 ml monomer solution (8.55 Acrylamide; 0.45 Biscarylamide in 0.150 M Tris-Borate buffer). Then the following were added without delay: 300 mgs sodium sulphate (dissolve completely); 0.40 ml TEMED (tetramethlendiamine), and 40 ml ammonium Presulphate (2%) freshly prepared 200 μ extract of each sample was mixed with 50 μ glecrol and 50 μ bromophenol blue.

Gel incubation and agitation were carried out at room temperature until the bands appear in clear background. Then the gel was washed with distilled water and photographed.

B- Protein chemical analysis:

A random sample of dried seeds (0.500 gm) was taken from each treatment and finally ground. The samples were digested to estimate nitrogen, using the methods outlined by Kock and McMeekin (1924).

RESULTS AND DISCUSSION

1- The first season (2003-2004)

a- vegetative characters:-

Vegetative characters of M_1 generation as affected by different gamma rays doses are presented in Table (1). The two cultivars "control", Master B and Lincoln showed significant differences for most vegetative studies characters i.e. plant height, number of leaves and branches per plant.

It was clearly observed that the lowest dose of gamma rays (one kr) gave the highest significant values of all studied vegetative characters. The values of such vegetative characters decrease significantly as the doses of gamma rays increase. These results agree with those reported by Kulikov and Shits (1989) who mentioned that the effect of low gamma doses was to activate the intracellular repair of enzymes, whatever damaging effect of high irradiation doses occurs on chromosome abaration in root meristimatic cells.

Table (1): Some vegetative characters of M1 generation of pea plants as affected by cultivars and different gamma rays doses during two successive seasons (2003-2004) and (2004-2005).

Cultivars	Gamma Rays Doses	Germination Ratio		Plant Height (cm)		No. of Leaves/ plant		No. of Branches/ plant	
		First Season	Second Seasons	First Season	Second Seasons	First Season	Second Seasons	First Season	Second Seasons
Master B		80.76	81.30	36.40	40.3	10.38	10.50	1.18	1.38
Lincoln		81.63	82.40	75.83	80.9	13.33	14.70	2.06	2.10
L.S.D 0.05		n.s.	n.s	1.633	1.70	0.327	0.34	0.052	0.06
L.S.D 0.01		n.s.	n.s	2.96	2.40	0.489	0.50	0.078	0.09
	Control	81.20	81.30	56.12	60.6	11.86	12.6	1.62	1.74
	1kr(10 Gy)	89.33	91.26	76.17	76.75	18.34	19.43	3.09	3.39
	2kr(20 Gy)	85.85	86.5	66.99	67.21	15.99	17.00	2.46	2.59
	3kr(30 Gy)	62.13	91.95	51.60	52.95	10.66	11.12	1.35	1.62
	4kr(40 Gy)	53.52	52.87	46.32	47.5	8.15	8.94	1.09	1.18
L.S.D 0.05		1.57	1.60	0.95	0.98	0.20	0.20	0.06	0.06
L.S.D 0.01		2.30	2.36	1.71	1.80	0.36	0.39	0.10	0.14

The highest values of germination ratio were 90.37 % and 88.28% - due to irradiation with one kr dose for Master B and Lincoln cultivars, respectively. On the contrary the lowest germination ratio was recorded from the treatment 4 kr dose. Kulikov and Shits (1989) mentioned that high doses of gamma rays cause dormant pea seeds. Moreover Eman (2000) proved that high doses of gamma rays (5 to 60 kr) caused continuous decrease in seed cotton germination ratio, while the highest germination ratio was at one kr dose (93%) and mentioned that the interaction between Egyptian cotton cultivars and gamma rays doses differed in their response degree to gamma rays doses

Comparing the elevation and the depression of the germination ratio with the respective cultivar is presented in Table (3). The heterotic values (12.50%, 8.15%) were were obtained from the treatment one kr dose for Master B and Lincoln, respectively. The highest depression was from 4 kr gamma rays dose 30.81%, 37.34%) for the same cultivars, respectively.

Concerning plant height character, the two cultivars Master B and Lincoln showed highly Significant differences, where cv Lincoln recorded 75.83 cm and being taller than cv Master B (36.4 cm). Table (1) clearly proved that the lowest treatment (one kr dose) of gamma rays gave the highest plant height (76.17 cm). This character reduced as the doses of gamma rays increased till four kr dose. The mean treatment resulting from three and four kr shared to be less than the control, with highly significant differences. These results were in harmony with those obtained by Sinha and Chowdhury (1991) who observed that 20 kr gamma rays gave a semidwarf plant height compared to the control "the parent in lentil" and El-Demerdash (1993) who mentioned that, irradiation three soybean cultivars with high doses decreased plant height and the reduction in plant height increases with the increase of gamma rays doses. Moreover Naglaa (2001) recorded significant differences between two triticale straines in plant height, she also added that one kr dose of gamma rays activated plant height, while the highest doses (3 or 4 kr) reduced significantly this character.

The interaction between cultivar and gamma rays doses concerning plant height character is presented in Table (2). Results share that one kr gamma rays gave highly significant interaction (52.90 and 99.43cm) for the M_1 of cv Master B and Lincoln. Naglaa (2001) recorded significant interaction between tritical, straines and mutagenic treatments of gamma rays, and Azza (2004) who obtained variability due to different gamma rays doses, for faba bean in plant height.

Table (2): Some vegetative characters of M_1 generation for pea plants as affected by the interaction between cultivars and different gamma rays doses during two successive seasons (2003-2004) and (2004-2005).

Cultivar	Gamma Rays Doses	Germination Ratio		Plant height (cm)		No. of leaves/plant		No. of branches/ plant	
		First Season	Second Seasons	First Season	Second Seasons	First Season	Second Seasons	First season	Second season
Master B	Control	80.76	81.10	36.40	40.30	10.38	10.50	1.18	1.38
	1kr(10 Gy)	90.37	92.40	52.90	54.6	15.53	16.33	2.48	2.70
	2kr(20 Gy)	85.20	86.30	44.00	46.3	12.95	13.50	2.03	2.16
	3kr(30 Gy)	63.50	62.70	37.70	37.6	9.55	6.93	1.17	1.25
	4kr(40 Gy)	55.88	54.83	29.93	30.7	7.63	8.11	1.05	1.10
Lincoln	Control	81.63	81.50	75.83	80.0	13.33	14.70	2.06	2.10
	1kr(10Gy)	88.28	90.11	99.43	98.9	21.15	22.13	3.69	4.07
	2kr(20Gy)	86.50	86.7	89.98	88.11	19.03	20.5	2.88	3.01
	3kr(30Gr)	60.76	61.20	65.50	68.2	11.76	12.60	1.53	1.98
	4kr(40Gr)	51.15	50.90	62.70	64.3	8.66	9.77	1.12	1.26
L.S.D 0.05		2.62	2.83	3.05	3.11	0.65	0.70	0.10	0.11
L.S.D 0.01		3.63	3.96	4.56	3.98	0.98	1.05	0.16	0.18

Table (3) showed that large positive heterotic values were recorded under one kr gamma rays dose for both cvs Master B and Lincoln. Irradiation with such predictable dose of gamma rays increased plant height with 45.33% and 31.12% for the two cultivars, respectively. Nearly equal values of reduction were obtained under the treatment four kr for both cultivars. These results are in agreement with the results reported by Constantin *et al.* (1976) who found that plant height reduced by approximately 35% of control soybean plants, Vocia *et al.* (1984) and Krausse (1986) found that low doses of gamma rays caused an increase in plant height of two soybean varieties as well as Mohammed *et al.* (1988) who reported the same results.

Regarding number of leaves per plant, Table (1) shows that the treatment one kr gamma rays activated number of leaves per plant in M_1 generation. In spite of the highest significant difference between the two studied cultivars, highest significant value was recorded under one kr odes (18.34 and 19.23) for the two seasons (2003-2004) (2004-2005). As the dose of gamma rays increases, number of leaves decrease.

Table (3): Elevation and depression % of some vegetative characters under irradiation with different gamma rays doses on M_1 pea generation during two successive seasons (2003-2004) and (2004-2005).

Cultivars	Gamma rays doses	Germination ratio		Plant height (cm)		No. of leaves/plant		No. of branches/plant	
		First Season	Second Seasons	First Season	Second Seasons	First Season	Second Seasons	First Season	Second Seasons
Master B	1kr	12.5	13.93	45.33	35.48	49.61	59.33	110.17	95.65
	2kr	5.50	6.41	20.88	14.89	24.76	28.57	72.03	56.52
	3kr	-21.37	-22.69	3.57	-6.7	-8.00	-8.29	-0.85	-9.42
	4kr	-30.81	-32.39	-17.78	-23.82	-26.49	-22.76	-11.02	-20.29
Lincoln	1kr	8.15	10.56	31.12	32.63	58.66	50.54	79.13	93.81
	2kr	5.97	6.38	18.66	10.14	42.76	39.46	39.81	43.33
	3kr	-25.57	-24.91	-13.62	-14.75	-11.78	-14.29	-25.73	-5.71
	4kr	-37.34	-37.55	-17.32	-19.63	-35.03	-33.54	-45.63	-40.00

Table (2) shows highly significant interaction between cultivar and doses of gamma rays. One kr dose gave highly number of leaves per plant (15.53 and 21.15) for the M_1 of Master B and Lincoln. These results are in agreement with Hajduch *et al.* (1999) who irradiated dry seeds of *Glycine max*, Tolena and Toping cultivars with different doses from 80-400 Gy gamma rays and found that Tolena was more sensitive to the mutagenic treatments than Toping. On the contrary he found height in number of leaves with increasing dosage of gamma irradiation. Results in Table (3) elucidate that the highest increase over the parent "Master B" was obtained from the treatment one Kr (49.61%) followed by 24.76% increase from two kr treatment. Same trend was observed on the parent., "Lincoln." Where (58.66% and 42.76%) increase were recorded under one and two kr doses respectively. At the contrast the remaining treatments, three or four kr gamma rays gave a severe depression specially for four kr dose (26.49%, 35.03%) for Master B and Lincoln, respectively.

From Table (1). It was clearly noticed that the one kr treatment gave the highest number of branches per plant (3.39), this inspite of the highly significant difference in this character for the unirradiated cultivars. As mentioned before in all vegetative characters the reduction in number of branches is due to the increase of gamma rays doses. Table (2) shows also highly significant interaction specially for one kr dose treatment. Where 2.48 and 3.96 branches per plant were recorded for M_1 of Master B and Lincoln. The same trend was obtained by Kumar and Sinha (1989) who recorded mutants in M_1 generation of irradiated cultivars of *C. cajan* .Such mutants were of different sensitivity under gamma radiation for number of branches and El.Demerdash (1993) who found significant differences in M_1 generation of irradiated Clark and Krowford soybean cultivars, also Naglaa (2001) who recorded significant interaction between triticale strains and gamma rays doses in number of branchas. On the contrary, Mihov *et al.* (2001) obtained mutant formed greatest number of branches resulting from 50 GY dose of gamma rays on *lens culinaris M.*

Table (3) showed that the highest positive heterotic values of number of branches per plant were obtained from one Kr gamme rays dose (110.17% and 79.13%) for Master B and Lincoln, respectively. Two Kr dose gave also high increase over the Parents. On the other hand, the treatments 4 kr gave a considerable depression in number of branches per plant (11.02% - 45.63%). El-Bayomi (1985) on lentil, Mohamed *et al.* (1988), Kassem & Nasr (1995) on soybean, Solaniki & Sharma (1999) and Azza (2004) on faba bean reported the same trend.

B: yield and some of its components:

Highly significant differences were observed for most yield components during two successive seasons (2003-2004) (2004-2005) for both the two cvs Master B and Lincoln. Moreover highly significant values of number of pods/plant (34.65), number of seeds per pod (8.68), and yield of green pods per plant, 660.44 (g) were obtained as the effect of the treatment one kr gamma rays dose. Table (4).

Table (4): Yield and some of it's components of M_1 generation for pea plants as affected by cultivars and gamma rays doses during two successive seasons (2003-2004) and (2004-2005).

Cultivar	Gamma rays doses	No. of pods per plant		No. of seeds/ pod		Yield of green pods / plant (g)	
		First season	Second season	First season	Second season	First season	Second season
Master B	-	9.93	10.03	7.33	7.05	160.30	153.17
Lincoln	-	12.20	13.63	7.63	7.13	210.25	225.33
L.S.D0.05		0.29	0.30	n.s	n.s	2.36	3.11
L.S.D0.01		0.44	0.44	n.s	n.s	3.08	4.27
	Control	11.07	11.83	7.48	7.08	185.28	189.25
	1kr(10Gy)	34.65	35.93	8.68	8.76	660.44	648.62
	2kr(20Gy)	18.12	19.78	8.77	8.85	297.48	290.02
	3kr(30Gy)	10.14	10.34	6.24	6.07	126.27	123.22
	4kr(40Gy)	6.98	7.50	6.12	6.03	80.35	82.05
L.S.D0.05		0.33	0.34	0.66	0.53	3.05	4.11
L.S.D0.01		0.59	0.63	0.76	0.79	4.70	5.07

From Table (5), in the M_1 of Master B, It was also clearly noticed that the predictable dose,one kr gamma, rays gave the highest number of pods per plant (30.55), number of seeds per pod (9.16). and 640 (g) yield of green pods per plant. These highest values, reduced as the gamma rays doses increase. Four kr treatment gave the lowest values 6.33, 6.10, and 80.51 g for the same characters, respectively.

Concerning the irradiated cultivar "Lincoln" it could be mentioned that the same trend of results was obtained as the effect of the lowest dose one kr of gamma rays, that gave 38.75 and 680.88 (g) as the highest values of number of pods per plant, and yield of green pods, respectively. On the other hand, the dose two kr activated number of seeds per pod (9.03). It could be also noticed that as the dose of gamma rays increase, yield and some of it's components decreased. The same trend of result was reported in some legumes cultivars and barly on yield and some of it's components by Ozbek *et al.* (1991), Zakri (1991), Zakri & Jalani (1991), El-Demerdash (1993), Hodsone and Hezky (1994), Odeigah *et al.* (1998), Hajduch *et al.* (1999), Hassan *et al.* (2001), Mihov *et al.* (2001), Rajput *et al.* (2001a+b), Ramesh *et al.* (2001) and Azza (2004),

Table (5): Yield and some of it's components of M_1 generation pea plants as affected by the interaction between cultivars and gamma rays doses during two successive seasons (2003-2004) and (2004-2005).

Cultivars	Gamma rays doses	No. of pods per plant		No.of seeds per pod		Yield of green pods / plant (g)	
		First Season	Second Seasons	First Season	Second Seasons	First Season	Second Seasons
Master B	Control	9.93	10.03	7.33	7.05	160.30	153.17
	1kr(10Gy)	30.55	32.70	9.16	9.20	640.00	630.15
	2kr(20Gy)	18.75	19.01	8.50	8.70	240.77	230.04
	3kr(30Gr)	9.50	9.70	6.11	6.02	118.88	115.77
	4kr(40Gr)	6.33	7.12	6.10	5.98	80.51	81.30
Lincoln	Control	12.20	13.63	7.63	7.13	210.25	225.33
	1kr(10Gr)	38.75	39.15	8 .20	8.01	680.88	667.09
	2kr(20Gr)	17.48	20.55	9.03	9.00	354.18	350.00
	3kr(30Gr)	10.78	10.98	6.36	6.12	133.65	130.67
	4kr(40Gr)	7.63	7.87	6.13	6.07	80.18	82.8
L.S.D0.05		0.59	0.59	0.47	0.48	3.01	3.15
L.S.D0.01		0.88	0.91	0.70	0.74	3.50	4.07

The increase and depression % in yield and some of it's components for M_1 generation due to irradiation with different gamma rays are presented in Table (6). One kr treatment elevated yield and it's components, while depression in the same characters was due to four kr dose. This elucidates that the increase in gamma rays doses decreased yield and some of it's components. For Master B the treatment one kr gave the highest increase (207.65%, 24.97%, 299.25 %) for number of pods per plant, number of seeds per pod, and yield of green pods per plant, respectively. On the contrary, the depression resulting from four kr treatment was 36.25%, 16.78%, 49.78%, for the same arrangement of the previous studied yield and it's components characters. The same results were obtained from Lincoln cultivar, where the highest increments (217.62%, 7.47%, and 223.84%) were obtained from the lowest dose one kr for the same characters, respectively. The same characters with same arrangement reduced by, 37.5%, 19.66%, and 61.86% under four kr gamma rays dose. These results are in agreement with those reported by Mori *et al.* (1981a) in Tanba-kure soybean cultivar, mentioned that the reduction was severe in number of pods as the dose of gamma rays increased, and El-Sahhar *et al.* (1984) who reported that the first mutagenic generation achieved an increase in seed yield ranging from 40-70% for Colland soybean cultivar, moreover the cultivar "Hampton" recorded an increase at frequency of 14-38%. Same results were observed by Mihov *et al.* (2001), Rajput (2001a), Ramesh *et al.* (2001) and Azza (2004) in faba bean, who obtained superior mutants in yield and some of it's components under the similar doses to our present study .

Table (6): Elevation and depression in yield and some of it's components for M_1 generation under irradiation with different gamma rays doses during two successive seasons (2003-2004) and (2004-2005).

Cultivars	Gamma rays doses	No. of pods/ plant		No. of seeds/ pod		Yield of green pods / plant (g)	
Master B	1Kr	207.65	226.02	24.97	30.5	299.25	311.41
	2Kr	88.82	89.53	15.96	23.40	50.20	50.19
	3Kr	-4.33	-3.29	-16.64	-14.61	-25.84	-24.42
	4Kr	-36.25	-29.01	-16.78	-15.18	-49.78	-46.92
Lincoln	1Kr	217.62	187.23	7.47	12.34	223.84	196.05
	2Kr	43.28	50.77	18.35	26.23	68.46	55.33
	3Kr	-11.64	-19.44	-16.65	-14.17	-36.43	-42.01
	4Kr	-37.5	-42.26	-19.66	-14.87	-61.86	-63.25

2- The second season (2004-2005)

Results concerning all agronomic characters at the second season are listed in Table (1-6). It was worth noting that, nearly same trend of the results was sustained.

(1) Electrophoretic studies:-

Electrophoresis banding patterns (SDS-PAGE) of extracted protein from dry seeds of two pea cultivars, Master B and Lincoln and their M1 generation are presented in Figures (1 and 2)

The cultivars;-

Four major regions are dected for both two cultivars, Master B and Lincoln. (Fig 1) Rl region containes three major bands, two out of them are slightly dark and the other is faint. (R2} region consists of one major band. Such major band is distinguished with the increase of its density in Master B more than Lincoln cultivar. Three major bands were observed in the third region (R3). As for R4 region which indicated three bands, the two cultivars also were differed.

From the previous conclusion, it could be noticed that, large differences were observed for the major protein banding patterns of the two cultivars, Master B and Lincoln. Such differences in size and density make one assumes that the variation in banding patterns are genotypically and evolutionary different. This was substantiated by the facts that some of the subtractions of a particular protein either slightly disappeared or were reduced in size and mobility. Such quantitative variations in the two cultivars banding patterns could be found if one assumes that the genes responsible for these metabolic phenomena are different in their action. A reasonable explanation that could be forward is that these cultivars are of different origins and they have gone through completely different paths during evolutionary processes. Similar results were obtained by El-Maghawry *et al.* (1997) on tomato., Fahmy *et al.* (1997) on soybean, Amer *et al.*, (1999) on pea, Ismail and El-Ghareeb (2000) on cowpea and El-Ghareeb *et al.*, (2004) on tomato.

M_1 generation:

SDS-PAGE profiles of seed protein banding patterns according to their density and intensity for M_1 generation of irradiated pea cultivars under different gamma rays doses are presented in Fig. (2). Great appearance was observed in M_1 generation, either in size of protein banding patterns or intensity as well as the increase in band number. All M_1,s were characterized by increasing band number and intensity in spite of having the same number," four regions."

Comparing the major bands of the M_1,s with their respective cultivars, it could be concluded that .Region (1) that had slightly dark appearance in the two cultivars before irradiation and represented as a control, showed an increase in density in their derived irradiated seeds (M_1).The appearance of the other three major regions showed also very dark and high intensities as well as some faint bands that were absent in the control cultivars before irradiation. All M_1,s recorded dark stained bands "heavy molecular weight "such intensities have unequal distribution and appearance in the two irradiated seed cultivars.

According to the effect of irradiated cultivars, the M_1, of Master B showed the higher appearance in density and intensity more than, Lincoln. As for doses of irradiation effect on band density and intensity, it could be clear that the treatment 1 kr dose. (10 Gy) and 2 Kr.(20Gy) gave the highest band density and intensity. The de novo appearance of these darkly stained "heavy molecular weight " bands in the M_1,s reflected over dominance action frame for the genes that control a particular protein fraction .These results were very near to those reported by Abd El-Salam (1991), Ozbek *et al.*, (1991) and Amet (1992) who detected not only quantitative variability, presence / absence of bands but also qualitative variability in band number and intensities among the genotypes.

From (Fig 2) it could be seen, the appearance of very distinctive darkly stained protein bands is identified as the interaction between the two cultivars and gamma rays doses .These results elucidate that such increase in band number and intensity in M_1 resulting of irradiation methods with low doses are very near with those obtained by normal hybridization methods. Thus there is no time waste moreover efforts can be saved by the optimum irradiation doses effects. Amer *et al.* (1991) and Ismial and El-Ghareeb(2000) reported same results in F_1s derived from crossing in pea and cowpea respectively. Moreover El-Ghareeb *et al.* (2004) on tomato reported same results from heterotic performance on some electrophoretic protein banding patterns in tomato. with relation to yield and some of its components. They mentioned that the best F_1,s not only had the highest values in yield and it's components but also distinguished with the highest band number and intensities.

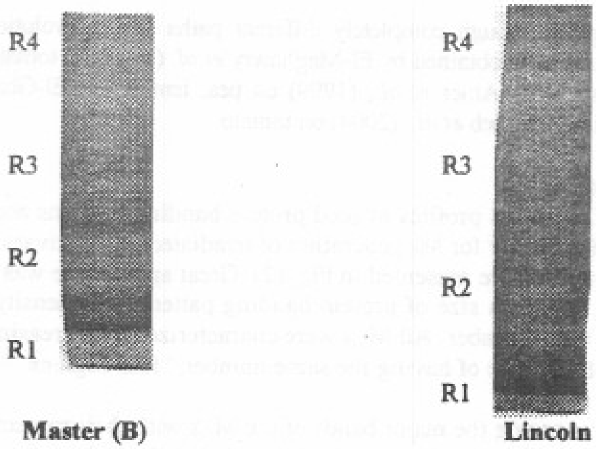

Fig. (1): SDS-PAGE Profiles of seed protein according to their density and intensity for the two cultivars, Master B and Lincoln as a control.

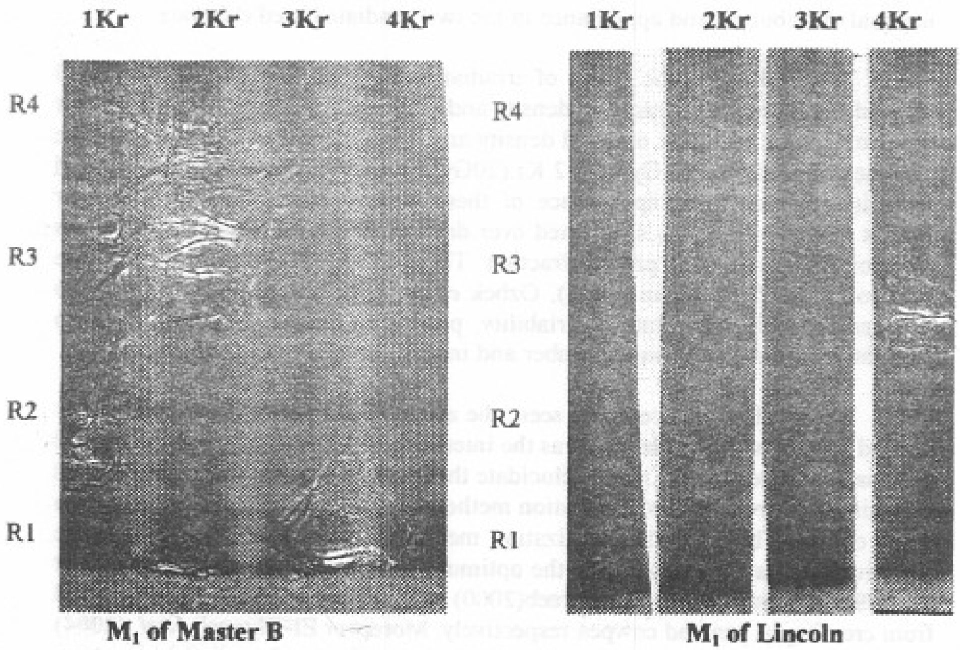

Fig (2): SDS-PAGE Profiles of seed protein according to their density and intensity for M_1 generation of irradiated pea cultivars under different doses of gamma rays.

Protein content.

Protein content and their standard deviations, moreover the elevation in this character (Table 7) clearly shows that all gamma rays doses exceeded the control. The optimum dose "one kr" gave the highest increase (38.9%, and 41.18%) for the M_1 of Master B and Lincoln, Odeigah *et al.* (1998) obtained lines with significant high increase in cowpea protein. Also Meng *et al.* (2002) recorded significant variations in protein percentage in common bean.

Table (7): Protein percentage and it's elevation% in M_1 generation derived from Master B and Lincoln cultivars.

Cultivars	Master B (M_1)		Lincoln (M_1)	
Gamma rays doses	Protein content	Elevation or Depression%	Protein content	Elevation%
Control	18.00±5.2		17.0±0.15	
1 kr(10 Gy)	25±0.6	38.89	24±6.36	41.18
2 kr (20 Gy)	24.5±0.4	36.11	23.0±0.35	35.29
3 kr (30 Gy)	21.00±0.3	16.67	22.0±0.30	29.41
4 kr(40 Gy)	20.5±0.3	13.89	19.0±0.25	11.76

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تأثير المطفر أشعة جاما في تحسين الصفات المحصولية والبيوكيميائية في البسلة

إكرام محمد الغريب
معهد بحوث البساتين ــ مركز البحوث الزراعية ــ وزارة الزراعة ــ مصر

تم إجراء هذا البحث في موسمي (٢٠٠٣-٢٠٠٤)، (٢٠٠٤-٢٠٠٥) حيث تم استخدام جرعات من أشعة جاما مقدارها واحد كيلو راد، اثنين، ثلاثة، اربعة كيلو راد علي البذور الجافة لصنفين من البسلة. احدها قصير "ماستر بي" والأخر متوسط الطول "لنكولن" واستخدم لذلك تصميم القطع المنشقة في اربعة مكررات وكانت النتائج في الموسم الأول (٢٠٠٣-٢٠٠٤) كالتالي:

١- النمو الخضري:-

في الجيل الطفري الأول، اظهرت النتائج أن الجرعة واحد كيلو راد أعطت أعلي القيم وهي ٩٠,٣٧% لنسبة الإنبات، ٥٢,٩ سم لارتفاع النبات، ١٥,٥٣ لعدد الأوراق، ٢,٤٨ لعدد الفروع وذلك في صنف ماستر بي وذلك بزيادة قدرها ١٢,٥%، ٤٥,٣٣%، ٤٩,٦١%، ١١٠,١٧% مقارنة بالأب " ماستر بي "لكل صفة علي الترتيب بينما أعطت الجرعة ٤ كيلو راد نقصا ملحوظا (٣٠,٨١%، ١٧,٧٨%، ٢٦,٤٩%، ١١,٠٢%) لنفس الصفات الخضرية.

أما في الجيل الطفري الأول لصنف لنكولن " فلقد أعطت الجرعة "واحد كيلو راد أعلي القيم عالية المعنوية لنفس الصفات الخضرية علي الترتيب (٨٨,٢٨ و ٩٩,٤٤ سم، ٢١,١٥، ٣,٦٩)وذلك بزيادة عن الأب لنكولن مقدارها (٨,١٥%، ٣١,١٢%، ٥٨,٦٦.%، ٧٩,١٣%)وعلي العكس أعطت الجرعة ٤ كيلو راد اعلي نسبة نقص للصفات الخضرية مقدارها (٣٧,٣٤%، ١٧,٣٢%، ٣٥,٠٣%، ٤٥,٦٣%) لنسبة الإنبات وارتفاع النبات وعدد الأوراق وعدد الفروع علي الترتيب.

٢- المحصول ومكوناته:-

كانت الجرعة المثالية ١ كيلو راد فقد أعطت اعلي القيم عالية المعنوية (٣٠,٥٥، ٩,١٦، ٦٤٠ جرام) لعدد القرون وعدد البذور في القرن، ومحصول القرون الخضراء للنبات الواحد بزيادة عن الأب "ماستر بي" (٢٠٧,٦٥%، ٢٤,٩٧%، ٢٩٩,٢٥%) لنفس الصفات المحصولية علي الترتيب بينما سجلت الجرعة ٤ كيلو راد نقصا ملحوظا (٣٦,٢٥%، ١٦,٧٨%، ٤٩,٧٨%) لنفس الصفات المحصولية علي الترتيب أيضا.

أما في الجيل الطفري الأول للصنف لنكولن فلقد أعطت الجرعة ١ كيلو راد ٣٨,٧٥، ٦٨٠,٨٨جم وهي اعلي القيم عالية المعنوية لعدد القرون ومحصول القرون الخضراء بينما أعطت الجرعة ٢ كيلو راد اعلي قيمة (٩,٠٣) لعدد البذور في القرن وذلك بزيادة نسبتها ٢١٧,٦٢%، ١٨,٣٥%، ٢٢٣,٨٤% لعدد القرون وعدد البذور في القرون و محصول القرون الخضراء.إلا أن الجرعة ٤ كيلو راد أعطت نقصا ملحوظا للصفات المحصولية نفسها علي الترتيب حيث بلغت نسبة النقص ٣٧,٥%،١٩,٦٦%، ٦١,٨٦% علي الترتيب.

و قد أظهرت النتائج أيضا وجود تفاعل عالي المعنوية بين الجرعات المختلفة من أشعة جاما والأصناف لكل من الصفات الخضرية والمحصولية في الجيل الطفري الأول لكل من الصنفين.

وفي الموسم الثاني (٢٠٠٤-٢٠٠٥) تم الحصول علي نتائج متقاربة للتي تم الحصول عليها في الموسم الأول للصفات الخضرية والمحصولية.

٣- الدراسات البيوكيميائية:

أظهر التفريد الكهربي للبروتين أن الجرعة المنخفضة واحد كيلو راد تميزت باحداث أعلي عدد وأكثر كثافة من حزم البروتين حيث تفوقت علي جميع المعاملات وكذلك الأباء. وتوضح أن تأثيرها ونتائجها تتشابه مع طريقة التهجين.

كما أعطت نفس الجرعة ١ كيلو راد اعلي زيادة في محتوي البذور من البروتين ٣٨,٨٩% ، ٤١,١٨% في الجيل الطفري الأول للصنفين ماستر بي ولنكولن.