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The Effects of Cobalt-60 Applications on Yield and Yield Components of Cotton (*Gossypium barbadense* L.)

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Abstract: This study was carried out to determine mutation effects and to investigate the positive mutant types that can be emerged as a result of this mutagen effect at Acalpi 952 cotton cultivar. Gamma irradiation was employed at 100, 200, 300 and 400 grey doses at Turkish Atomic Energy Foundation. Irradiated seeds from each dose were sown separately to form M_1 generation (first mutation generation) and the surviving seeds were collected afterwards. In M_2 generation (second mutation generation), seeds form each plant were grown as one a pice row and some characteristics were studied and 36 lines were selected according to yield and yield components. In M_3 generation, 36 lines that selected M_2 generation with three standard cultivars were made yield and adaptation experiments according to Complete Block Design with three replications. At the and of studies for three years among 2000-2002 growing period, ACH_8, ACH_9 and ACH_{25} lines were find as superior lines according to yield and yield components. On the other hand these lines were obtained high yielded from standard cultivars.

Key words: Cotton, mutation, lines, gamma radiation

INTRODUCTION

Cotton is an agricultural and industrial crop. Therefore farmers prefer cotton cultivars that are early maturing, high yielding and resistant biotic and abiotic stress conditions, although textile industry prefer cotton seed yield with high lint percentage, more fineness and strong fibers. The cultivars with superior fiber technological characters are bought in high prices. In order to develop new superior cotton cultivars, one method is mutation breeding. Mutations are known to enhance the genetic variability of crop plants as the variability at species level has reached the ceiling due to high breeding intensity and rapid erosion of genetic resources. Since spontaneous mutations occur at very low frequency, induced mutations facilitate the development of improved varieties at a swifter rate. Cotton is an economically important crop plant and cultivated in many parts of the world and it is a leading fiber crop, the second best potential source of plant proteins and fifth best oil-producing crop. In addition to being the world's most important textile fiber crop, cotton is also an important source of edible oil and protein. Among the different breeding methods used, mutation induction has been used as an important tool to supplement existing variability and to create additional variability for qualitatively as well as quantitatively inherited traits in cotton, especially various degrees of resistance to biotic and abiotic stress, number of bolls, seed yield and oil content (Muthusamy *et al*., 2005). The conventional breeding methods are usually very labourous take long time and are expensive. For that reasons, mutation breeding has been used in the last years, because this method takes less time and new superior cultivars could be developed easily (Baysal *et al*., 1994, Yıldırım and Tugay, 1977). There are different type of chemical and radiation mutagens. Gaul (1977) and Mukhov (1987) reported that the achievement in mutation breeding, related to living species, mutagens, dose of mutagens applications and application methods]. In addition, cotton seed radiated with cobalt 60, superior mutant lines were found according to parent cultivars in view of morphological characters and the most suitable radiation dose were determined at 100 and 200 Gray (Constantin, 1968; Karaevoi *et al*., 1981; Atilaa and Peokircioglu, 1990; Vlkova, 1992). Meanwhile it is reported that seeds dead with application high radiation and its obtained that low mutation frequency, by reason demand of physiological in M_1 generation (Gençer *et al*., 1992; Baysal *at al*., 1994). On the other hand the high mutagen dose applications affect negative mutation (Tagiev, 1984). Some researchers have reported that mutagen applications are increased, but higher doses decreased the plant height (Yıldırım and Tugay, 1977) at wheat and barley (Karaevoi *et al*., 1981; Tyaminov, 1982; Kuodemir, 1999) at cotton (Özbek *et al*., 1986; Saeel, 1994)

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at soybean (Hatipoğlu, 1999) at vetch. The mutagens affected number of sympodial and monopodial branches and caused of some lines high or low value of cotton (Gaul, 1977; Kuodemir, 1999). In another study, mutagen applications affected boll weight and boll number per plant (Ibragimov *et al*., 1989; Kuodemir, 1999). According to Mamedov and Bazhanova (1987), higher radiation applications had negative effects on fiber yield, fiber length and boll weight of many plants. On the other hand, selected from M_2 and M_3 generation some lines have been using cotton improvement. Some researchers Kerbabeva *et al*. (1984), Ibragimov *et al*. (1989), Kuodemir (1999) reported that mutagen applications increased the number of boll, boll weight and 100 seed weight. Kurepin *et al*. (1985) announced that, mutagen applications affected 100 seed weight. Meanwhile, according to Kuodemir (1999), mutagen applications were ineffective on 100 seed weight in cotton.

Cotton fiber is a unique raw material for the textile industry. Increase in world population and, rise of living standard, textile products have to be increased. For that reasons, textile industry prefers quality cotton in terms of fiber length, high lint percentage, fiber strength, fiber fineness, fiber uniformity etc. Therefore, breeders have to improve these characters. Mutagen applications create variation on genetic structure. Some researchers had reported that, mutagen applications had caused variations on fiber characters and by selecting the superior progenies, the new superior cultivars can be developed (Kuliev, 1983; Kerbabeva *et al*., 1984; Tagiev, 1984; Ibragimov *et al*., 1989; Mamedov and Bazhanova, 1987; Gençer *et al*., 1992; Auld *et al*., 1998; Raffat, 1998; Kuodemir, 1999). On the other hand, mutagen applications that had made artificial mutation, caused to earliness, 100 seed weight, cold and dry tolerance and verticillium and the genetic structure has been changed and could be improved were reported (Aitzhanov, 1984; Bughio *et al*., 1984; Mamedov and Bazhanova, 1987; Kuodemir, 1999).

The objective of this study was to investigate to develop new cotton cultivars through mutagen (cobalt 60) applications.

MATERIALS AND METHODS

Materials: The experimental materials used in this study consisted of Acalpi-1952 (*Gossypium barbadense* L.) cultivar. Acalpi-1952 cv is taken from Cagdas Seed Agency that placed in Turkey representation by Hazera Seed Company in Israel. This Cultivar has thin, long and strong fibers and resistant to dry, but it has long vegetation period.

The experiment field was sandy clay, pH 7.4-7.6, amount of lime 24.45, available phosphate and potassium 3.1 and 69.1 kg day^{-1}, organic matter content 2.01% (Anonymous, 2003)

At the region, 400 mm total rainfall, from 30.8 to 46.5°C maximum, from -6 to 16°C minimum, from 12.9 to 31.5°C average weather hot were fixed from may to November in 2002. The proportional moisture was fixed from 27 to 58% (Anonymous, 2003).

Methods

The first year studies (M_1 generation): Original seeds of Acalpi-1952 cv (*Gossypium barbadense* L.) was ensured from Cagdash Seed Agency that placed in Turkey representation of Hazera Seed Company in Israel.

The seeds of Acalpi-1952 cultivar had counted 4×1000 and then put nylon baggies separately. The baggies that content seeds were irradiated 100, 200, 300 and 400 gray doses with cobalt 60 mutagen in Atom Energy Foundation of Turkey, at 17.04.2000. The seeds belong every irradiated doses (100, 200, 300 and 400 gray) were sown at separately plots in Harran University Agricultural Faculty experiment fields at 19.04.2000. Each plots consist have 25 rows with ten meters length was established at a 80 centimeters row spacing and plants were placed 25 cm apart on beds. The edge rows of every plot were sown control cv. (no radiation). Necessary cultivation process (irrigation, cultivation and fertilization) were apply to experiment.

During this study, the following parameters were recorded.

- Date of emergence.
- Plants were count on the rows for twice (15 and 30 days after planting).
- Date of flowering.
- Each plants (about 1, 000) were evaluated in terms of agricultural characters.
- Seed and lint index
- Boll number
- Number of sympodial branch
- Boll weight
- Earliness
- Weight of hundred seeds
- Number of carpel
- Fiber quality

On the other hands every radiation doses content plants were self pollinated especially at first three week of flowering.

The plants of every plot had been made self pollinated by hand and then determined of as superior plants were be harvested separately and put bagged. The boll number and boll weight of every single plant had evaluated. The following characters were been investigated.

The second year studies (M_2 generation): The seeds that obtained from single selected plants at M_1 generation had been sown by hand at 25.04.2001. The experiment design was Randomized Complete Block design with three replications. In this study, every experiment plot consist of two plant rows, because of not enough seeds belong selected single plants. The seeds were sown 5 m length rows was established at a 70 cm row spacing and plants were placed 25 cm apart on beds. Essential cultural processes were been applied to experiment. The following characters were determined in M_2 population according methods of Senel (1980) and Gençer *et al*. (1992).

Plant height,
Number of sympodia per plant
Boll weight
Number of boll per plant
Number of Fruit per plant
Seed cotton of boll weight (g)
Seed cotton yield per plant (g)
Seed cotton yield per day (kg)
Earliness
Weight of hundred seeds (g)

The superior 36 line belong Acalpi-1952 cv. (*Gossypium barbadense* L.) were selected from M_2 population.

The third year studies (M_3generation): The selected from M_2 generation 36 lines with standard and control cultivars (Sayar 314 and Stoneville-453 and control Acalpi-1952) were sown by hand of 70×20 cm plant density in Harran University Agricultural Faculty experiment fields at 23 April 2002. Each plots of experiment have consists of 4 rows with 10 m length. The experiment was established according to randomized complete block design with three replications. The necessary cultural process were applied. First and second harvesting of the experiment's were been done at 1 October and 28 October 2002. The following characters were obtained from 20 plants selected by change in each plots,

Plant height,
Number of sympodial branches
Number of boll per plant
Boll weight
Seed cotton yield per plant (g)
Number of sympodial per plant
In addition, the following characters were found from each plots
Seed cotton yield per day (kg)
Earliness
Seed and lint index
100 seed weight
Fiber quality

TARIST statistical analysis packet program was used in the statistical analysis (Ackgoz *et al*., 1993) and Duncan method had been used to classification significant differences between lines and standard cultivars.

RESULTS AND DISCUSSION

The results of some yield and yield components of mutant lines from obtained M_3 population and standard cultivars are shown in Table 1 and 2, some fiber technological characters are given in Table 3.

Plant height: As noticed in Table 1, the highest plant height was obtained from ACH_3 line height belong cultivars and lines were changed from 70.70 to 111.13 cm. at 100 Gray dose, while the lowest plant height was from ACH_{23} line at 300 gray radiation dose. Compared to the control Acalpi, some of the lines (ACH_3, ACH_{31}, ACH_1, ACH_2) had found higher from control cultivars on plant height. Meanwhile, extreme plant height was not observed among the lines compare to the controls. The similar results were obtained by Karaevoi *et al*. (1981), Tyaminov (1982) and Kuodemir (1999).

Number of sympodial branches: Number of sympodial branches have been affected on number of flower and number of boll, therefore it is an important character for cotton cultivation. As shown in Table 1, number of sympodia branches of cultivars and lines were changed from 14.83 to 23.67 per plant. The highest number of sympodia per plant were obtained from $ACH_{31,}$ ACH_3 and ACH_{12} lines while the lowest was found from Acalpi cultivar. All radiation doses have affected positive and negative on number of sympodial branches. Compared to the control Acalpi, all lines were found higher from it. Similar results were obtained by some investigators (Gaul, 1977; Kuodemir, 1999).

Number of boll per plant: Boll number is an important for cotton seed yield. For that reason it has wishes high. The effect of cobalt 60 mutagen was indicated positive and negative of lines on boll number per plant (Table 1). Boll number per plant of cultivars and lines were indicated from 11.73 to 24.60. The highest boll number per plant was found from ACH_8 line while the lowest was found from ACH_6 line. These two lines belong 100 gray radiation dose application. The radiation applications were created variation on boll number per plant. Boll number of some lines (ACH_8, ACH_9, ACH_{22}, ACH_{25}, ACH_{30}, ACH_{36}) were indicated higher from control Acalpi and some (ACH_8, ACH_{25}, ACH_{25}) were passed control Sayar 314 cv that

Table 1: Results for plant height (cm), number of sympodial branches, number of boll per plant, number of fruit per plant and boll weight at different cobalt 60 aplication doses

Radiation dose		Cultivars and lines	Plant height (cm)	No. of sympodial branches	No. of boll per plant	No. of fruit	Boll weight (g)
Control		Ston.-453	76.33fj	19.93ac	17.33dh	4.53mo	5.80ae
(Cultivars)		Acalpi-952	92.50bg	20.47ac	20.30ae	6.37in	6.35ab
(No radiation)		Sayar-314	95.07ad	14.83c	19.33bg	7.53ek	5.02bg
Lines and	100 gray	ACH_1	101.83ac	20.20ac	19.13bh	14.37ab	4.68cg
radiation		ACH_2	100.33ad	19.40ac	16.33di	15.17a	3.89g
doses		ACH_3	111.13a	22.37a	16.37di	7.13gl	4.50dg
		ACH_4	76.07fj	15.47bc	16.13dj	11.63c	5.05bg
		ACH_5	97.03ad	18.40ac	12.60ij	9.83ce	3.90g
		ACH_6	90.23bh	20.97ac	11.73j	9.60cf	4.07fg
		ACH_7	94.93ad	18.20ac	15.23fj	14.37ab	4.65cg
		ACH_8	98.80ad	19.80ac	24.60a	10.30cd	5.21bg
		ACH_9	90.60bg	19.70ac	20.17ae	9.40cg	5.96ab
		ACH_{10}	95.63ad	21.67ab	18.37cg	7.53ek	5.03bg
		ACH_{11}	98.70ad	20.13ac	16.07ej	8.70di	4.28eg
		ACH_{12}	99.40ad	22.37a	17.47ch	4.53mo	5.04bg
	200 gray	ACH_{13}	73.10hj	17.10ac	14.83hj	4.43no	4.86cg
		ACH_{14}	99.70ad	19.83ac	17.40dh	5.13lo	4.79cg
		ACH_{15}	89.10bi	19.27ac	15.97ej	11.67bc	4.98cg
		ACH_{16}	84.13dj	19.27ac	15.43fj	9.07dh	4.83cg
		ACH_{17}	77.37ej	19.57ac	18.43ch	7.30fl	5.91ad
		ACH_{18}	72.73ij	18.73ac	18.67bh	6.73hn	4.35eg
		ACH_{19}	96.56ad	20.47ac	16.17dj	6.57in	4.30eg
		ACH_{20}	93.07bf	20.80ac	15.60fj	4.53mo	4.58dg
	300 gray	ACH_{21}	75.37gj	18.37ac	16.90di	5.47ko	5.25bf
		ACH_{22}	70.70 j	18.57ac	22.93ab	6.43in	5.81ae
		ACH_{23}	71.43 j	18.77ac	17.57ch	4.73mo	4.20eg
		ACH_{24}	88.00bj	20.60ac	17.87ch	7.83ej	4.16eg
		ACH_{25}	90.50bh	20.23ac	21.87ac	7.10gl	6.32ac
		ACH_{26}	85.73cj	19.37ac	14.90gj	7.33fl	4.51dg
		ACH_{27}	92.43bg	20.97ac	16.07ej	6.70in	4.76cg
	400 gray	ACH_{28}	83.90dj	21.77ab	17.03di	6.20jn	4.68cg
		ACH_{29}	96.30ad	21.67ab	18.33ch	5.40ko	4.89cg
		ACH_{30}	93.67be	20.03ac	19.57bf	5.33ko	4.95cg
		ACH_{31}	103.10ab	23.67a	18.73bh	6.73hn	5.48bf
		ACH_{32}	99.27ad	22.00ab	17.77ch	6.60in	4.04fg
		ACH_{33}	90.77bg	20.70ac	18.60bh	5.73jo	4.44eg
		ACH_{34}	83.77dj	19.10ac	17.73ch	3.70o	4.79cg
		ACH_{35}	85.67cj	19.57ac	18.13ch	7.67lk	4.15eg
		ACH_{36}	85.50cj	21.80ab	20.57ad	6.83hm	6.95a
		Error	37.407	5.742	2.465	0.685	0.219
		%CV	6.81	12.02	8.89	11.07	9.54

Values followed by different letter(s) differ significently at $p<0.05$

can the highest boll number per plant among control cv. The result in this study confirms the similar results obtained by Kerbabeva *et al.* (1984), Ibragimov *et al.* (1989) and Kuodemir (1999).

Number of fruit per plant: The effects of radiation applications were caused genetic variations on number fruits per plant (Table 1). On the other hands, number of fruit per plant is related to earliness. For that reason, more fruit number per plant is not desirable. Fruit number of cultivars and lines were changed from 6.95 to 3.89 per plant. The lowest number of fruit per plant were indicated ACH_2 and ACH_5 while the highest were indicated ACH_{36} line. Most of lines have been got lower fruit number from control Acalpi and the other standard cultivars. The similar results were found by Kuodemir (1999).

Boll weight (g): As shown in Table 1, the effects of radiation applications on cotton seeds were obtained positive and negative on boll weight. Boll weight of cultivars and lines were changed 3.89 to 6.95 g. The highest boll weight was obtained from ACH_{36} line while the lowest was obtained from ACH_2 line. Boll weight of lines, compared with control Acalpi and the other standard cultivars, it can said that, radiation applications were created genetic variation on boll weight. Meanwhile boll weight of some lines (ACH_4, ACH_8, ACH_9, ACH_{12}, ACH_{17}, ACH_{21}, ACH_{22}, ACH_{25}, ACH_{31}, ACH_{36}) were increased, the others had been decreased. The result in this study confirms by Kerbabeva *et al.* (1984), Ibragimov *et al.* (1989) and Kuodemir (1999).

Seed cotton boll weight: Seed cotton boll weight is an important character of yield per unit area. For that reasons it should be high. Seed cotton boll weight of cultivars and lines belong experiment were changed from 2.33 to 5.22 g (Table 2). The highest seed cotton boll weight were

Table 2: Results for seed cotton boll weight (g), seed cotton yield per plant (g), seed cotton yield per da (kg), earliness ratio (%) and hundred seed weight (g) at different cobalt 60 aplication doses

Radiation dose		Cultivars and lines	Seed cotton boll weight (G)	Seed cotton yield per plant (g)	Seed cotton yield per ha (kg)	Earliness ratio (%)	Hundred seed weight (g)
Control		Ston.-453	4.25im	66.99ce	3928bc	81.2gm	10.19bI
(Cultivars)		Syr-314	4.72ab	54.40ej	3420cd	81.0hm	10.00cI
(No radiation)		Acalpi	3.63dj	35.97ln	2439hk	70.2mn	11.16af
Lines and	100 gray	ACH$_{1}$	2.77im	50.87fl	2604fi	93.0a	9.72di
radiation		ACH$_{2}$	2.85im	45.92Im	3158df	68.9n	9.72di
doses		ACH$_{3}$	3.34dl	52.93ek	2994dh	84.3ej	10.45bI
		ACH$_{4}$	3.70ci	56.53dj	3091dg	88.1af	10.74ah
		ACH$_{5}$	2.72jm	28.26n	1936jk	77.6km	9.09hI
		ACH$_{6}$	2.56lm	31.06mn	1820k	81.3gm	10.31bI
		ACH$_{7}$	3.16hm	46.57im	2700fi	88.6af	10.88ah
		ACH$_{8}$	3.49dl	85.99ab	4579ab	89.4ae	10.29bI
		ACH$_{9}$	4.14bg	83.36ab	4393ab	89.7af	10.73ah
		ACH$_{10}$	3.83bh	70.33be	3928bc	85.3ag	10.60bI
		ACH$_{11}$	2.68km	42.90jm	2426hk	84.1ej	10.31bi
		ACH$_{12}$	3.34dl	57.75dj	3389ce	81.4gm	11.30ae
	200 gray	ACH$_{13}$	3.29fl	46.81hl	2476gj	90.0ae	10.31bI
		ACH$_{14}$	3.04hm	49.88hk	2715ei	87.4cI	10.33bI
		ACH$_{15}$	3.31el	53.43ej	2978dh	85.3cI	10.48bi
		ACH$_{16}$	3.29el	49.36hk	2946dh	79.8Im	10.49bi
		ACH$_{17}$	4.20bf	75.13bc	4578ab	78.7jm	9.17gi
		ACH$_{18}$	3.05hm	56.74dj	2976dh	92.6ab	9.28gi
		ACH$_{19}$	2.64km	42.72jn	2265ik	89.7ae	9.53ei
		ACH$_{20}$	3.06hm	46.32im	2583fi	85.3ci	10.65ai
	300 gray	ACH$_{21}$	3.55dk	57.71dj	3153df	87.1ah	9.83df
		ACH$_{22}$	4.22ae	95.12a	4902a	84.5dj	9.42fi
		ACH$_{23}$	2.99hm	50.38fl	2620fi	89.1af	11.26af
		ACH$_{24}$	3.14hm	50.08gl	3218df	77.7km	9.25gi
		ACH$_{25}$	4.62ac	83.35ab	4708a	86.3bh	10.07bi
		ACH$_{26}$	3.78ch	60.34ci	3402cd	84.4ej	10.90ah
		ACH$_{27}$	3.15hm	50.50fl	2881di	83.0fl	11.95ab
	400 gray	ACH$_{28}$	3.07hm	52.23ek	3426cd	75.3lm	11.31ae
		ACH$_{29}$	2.80im	51.65el	3042dh	77.5lm	12.48a
		ACH$_{30}$	3.25gm	65.63cg	3097dg	90.8ad	10.22bi
		ACH$_{31}$	3.85bh	65.87cf	3394cd	91.5ac	11.82ac
		ACH$_{32}$	2.33m	37.53ln	2603fi	84.8dj	11.44ad
		ACH$_{33}$	2.70jm	48.63hk	2880di	81.0hm	10.68ai
		ACH$_{34}$	3.51dk	62.40ch	3384cd	91.2ac	8.85i
		ACH$_{35}$	2.74jm	49.67hk	2713ei	86.7ah	10.96ag
		ACH$_{36}$	5.22a	97.32a	4891a	83.9ek	9.67di
		Error	0.108	30.834	504.375	4.961	0.435
		%CV	9.71	9.80	7.03	2.64	6.33

Values followed by different letter(s) differ significently at $p<0.05$

obtained from ACH$_{36}$ lines that created from 400 gray radiation applications. Seed cotton boll weight were affected from cobalt 60 applies and it can say that 200 and 300 Gray doses of cobalt 60 applies were decreased seed cotton boll weight. Meanwhile ACH$_{25}$ and ACH$_{36}$ lines were placed among high values. However, some lines (4, 10, 17, 22, 25, 26, 31, 36) were found high from control Acalpi. The result in this study confirms the similar results found by Kerbabeva *et al.* (1984), Ibragimov *et al.* (1989) and Kuodemir (1999).

Seed cotton yield per plant (g): Yield per plant plays important role on yield per unit area. For these reasons yield per plant wishes higher. According to our results, it can said that the affects of radiation applications were caused genetic variations on yield per plant (Table 2). Yield per plant of cultivars and lines were changed from 28.26 to 97.32 g. The highest seed cotton yield per plant were obtained from ACH$_{36}$ and ACH$_{22}$ lines, while the lowest was obtained from ACH$_{5}$ line. As a matter of fact, sympodia number per plant, number of fruit, seed cotton boll weight of ACH$_{36}$ and ACH$_{22}$ lines were obtained higher from the other lines (Table 1). Seed cotton yield per plant of lines, when compared with control Acalpi and the other standard cultivars, it can said that radiation applications were created genetic variation on seed cotton yield per plant. In addition, ACH$_{8}$, ACH$_{9}$, ACH$_{10}$, ACH$_{17}$, ACH$_{22}$, ACH$_{25}$ and ACH$_{36}$ lines were placed in high values. These lines were created from 100, 200, 300 and 400 Gray radiation doses applies. The similar results were obtained by Kerbabeva *et al.* (1984), Ibragimov *et al.* (1989) and Kuodemir (1999).

Seed cotton yield (kg ha^{-1}): According present results the effects of radiation applies were caused genetic variations on total seed cotton yield (Table 2). Total seed

Table 3: Results for ginning outturn ratio (%), fiber thickness (mic), fiber stronght (g/tex), fiber height (mm), uniformity (%) at different cobalt 60 aplication doses

Radiation doses		Cultivars and lines	Ginning outturn ratio (%)	Fiber thickness (Mic)	Fiber stronght (g/tex)	Fiber length (mm)	Uniformity (%)
Kontrol		Stonovil 453	38.6ac	4.07ad	29.47ad	29.23	82.70
(Cultivars)		Sayar-314	39.0ab	4.30ab	28.40bd	28.53	85.10
(Unradiation)		Acalpi	30.9ei	3.40be	31.67ad	31.63	82.97
Lines and	100 gray	ACH_1	29.8fi	3.13e	31.33ad	30.07	84.67
radiation		ACH_2	31.5di	3.33ce	32.17ac	30.40	84.63
doses		ACH_3	31.2di	3.43be	35.70ab	29.67	82.83
		ACH_4	31.2di	3.50be	32.33ac	31.50	83.70
		ACH_5	32.3di	3.40be	35.23ab	31.60	84.07
		ACH_6	28.2hi	3.17de	36.33a	28.23	84.20
		ACH_7	31.2di	3.23ce	30.83ad	32.50	82.03
		ACH_8	30.5fi	3.60be	33.90ac	31.40	83.17
		ACH_9	33.9ai	3.83ae	30.97ad	32.27	85.00
		ACH_{10}	32.8bi	3.67ae	30.20ad	28.43	84.27
		ACH_{11}	36.9ae	4.30ab	34.30ac	28.73	82.57
		ACH_{12}	31.9di	3.57be	33.77ac	31.57	84.93
	200 gray	ACH_{13}	31.3di	3.40be	31.40ad	30.63	83.43
		ACH_{14}	30.4fi	3.10e	32.30ac	31.60	83.27
		ACH_{15}	33.2bi	3.30ce	33.03ac	31.23	82.20
		ACH_{16}	30.5fi	3.40be	31.23ad	32.10	82.50
		ACH_{17}	37.2ad	3.63be	28.63bd	28.23	82.30
		ACH_{18}	32.7ci	3.17de	29.77ad	30.87	82.33
		ACH_{19}	31.5di	3.17de	30.20ad	29.87	82.17
		ACH_{20}	31.0ei	3.67ae	29.23ad	31.67	83.40
	300 gray	ACH_{21}	35.4ag	3.80ae	28.53bd	30.90	83.97
		ACH_{22}	39.6a	3.30ce	24.47d	29.40	82.27
		ACH_{23}	31.1di	3.40be	29.73ad	30.17	81.57
		ACH_{24}	33.5ai	4.57a	30.00ad	29.60	84.17
		ACH_{25}	36.0af	3.80ae	27.53cd	29.47	83.23
		ACH_{26}	35.0ag	4.30ab	31.60ad	33.90	83.07
		ACH_{27}	29.7gi	3.57be	31.33ad	31.47	83.40
	400 gray	ACH_{28}	31.7di	3.63be	33.93ac	32.73	83.87
		ACH_{29}	27.8i	4.10ac	32.17ac	30.10	83.60
		ACH_{30}	29.6gi	3.00e	34.50ac	32.73	85.07
		ACH_{31}	31.3di	4.07ad	32.10ad	30.93	83.23
		ACH_{32}	29.4gi	3.53be	30.47ad	30.90	83.43
		ACH_{33}	34.2ah	3.67ae	29.73ad	30.90	83.20
		ACH_{34}	29.7gi	2.97e	28.33bd	31.00	81.67
		ACH_{35}	32.1di	3.47be	30.67ad	30.57	84.17
		ACH_{36}	39.5a	3.73ae	28.73ad	29.50	82.30
		Hko	4.795	0.106	7.270	4.148	2.393
		%CV	6.70	9.09	8.64	6.64	1.86

Values followed by different letter(s) differ significently at $p<0.05$

cotton yield of cultivars and lines were changed from 1820 to 4902 kg ha^{-1}. The highest total seed cotton yield were indicated ACH_{22} and ACH_{36} lines, while the lowest were indicated ACH_6 line. On the other hands while control Acalpi-1952 was given 2439 kg ha^{-1}, Sayar 314 and Stoneville-453 standard cultivars of study were given 3421 and 3928 kg ha^{-1}, respectively. Some lines (ACH_8, ACH_9, ACH_{22}, ACH_{25}, ACH_{36}) were higher from the super standard cv. in terms of total seed cotton yield. As a matter of fact, sympodia number per plant, number of fruit, seed cotton boll weight of these lines were found higher from the other lines. Similar results were obtained by Kerbabeva *et al.* (1984), Ibragimov *et al.* (1989) and Kuodemir (1999).

Earliness (%): First harvesting ratio is an important scala for earliness, there for it have been desired high. As noticed Table 2, the affects of radiation applications on first harvesting ratio were obtained positive and negative. First harvesting ratio of cultivars and lines were changed 68.9 to 93%. The highest first harvesting ratio was obtained from ACH_1 line, while the lowest was obtained from ACH_2 line. First harvesting ratio of lines, when compared with control Acalpi and the other standard cultivars, it can said that radiation applications were created genetic variation on first harvesting ratio. Some lines (1, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 21, 22, 23, 25, 26, 27, 30, 31, 32, 34, 35 36) were found higher from control Acalpi and the other standard cultivars. It can say that these lines earlier from the other lines and cultivars of experiment. The similar results were reported by Aitzhanov (1984), Bughio *et al.* (1984), Mamedov and Bazhanova (1987) and Kusdemir (1999).

Hundred seeds weight (g): As shown in Table 1, the effects of radiation applications on hundred seeds weight had been positive and negative. Hundred seeds weight of cultivars and lines were changed 8.85 to 12.48 g. While the highest hundred seeds weight was obtained from ACH_{29} line that applied 400 Gray radiation applies, the lowest was obtained from ACH_{34} line. Hundred seeds weight, when compared with control Acalpi and the other standard cultivars, it can said that radiation applications were created genetic variation. The result in this study confirms the similar results obtained by Aitzhanov (1984), Bughio *et al.* (1984), Kerbabeva *et al.* (1984) Kurepin *et al.* (1985), Ibragimov *et al.* (1989) and Mamedov and Bazhanova (1987). On the other hands some researcher was reported that, mutagen applications were not affected on hundred weight in cotton (Kusdemir, 1999). This situation might be different genotypic structure, different ecological conditions, different mutagen and its dose applications.

Fiber technological characters: Fiber technological characters are very important in textile industry. In this study was investigated follow characters.

Lint percent: As noticed in Table 3, lint percent of cultivars and lines belong experiment were changed from 27.8 to 39.6%. The highest ginning outturn were indicated from ACH_{22} and ACH_{36} lines that applied 300 and 400 gray radiation doses, meanwhile these lines were found higher from control Acalpi and the other standard cultivars. On the other hand, radiation applies were created variation on lint percentage. Two lines (ACH_{22} and ACH_{36}) were found higher from control Acalpi and the other standard cultivars, however the others were found lower from the point of view of lint percent. Similar results were obtained by some investigators (Kusdemir, 1999).

Fiber fineness: Fineness is play important role in textile industry and it is desired quiet thin. As shown in Table 1, the affects of radiation applications on fiber fineness were obtained positive and negative. Fiber fineness of lines and cultivars were changed from 4.57 to 2.97 mic index. The thinnest fibers were found from ACH_1, ACH_{14}, ACH_{30} and ACH_{34} lines, nevertheless the thickest fibers were found ACH_{24} line. On the other hand while control Acalpi was given the thinnest fiber from the other standard cultivars, in a lot of lines were obtained thinner fiber from control Acalpi. According to our M_3 population results, it can said that radiation applications on cotton seed, were decreased fiber fineness. The similar results were reported by Kuliev (1983), Kerbabeva *et al.* (1984), Tagiev (1984), Ibragimov *et al.* (1989), Mamedov and Bazhanova (1987), Gençer *et al.* (1992), Auld *et al.* (1998), Raffat (1998) and Kusdemir (1999).

Fiber strength: Fiber strength is an important character in terms of textile industry. As shown in Table 1, the effects of radiation applications on fiber strength were obtained positive and negative. Fiber strength of cultivars and lines were changed from 24.47 to 36.33 g/tex. The highest fiber strength was obtained from ACH_6 line while the lowest was from ACH_{22} line. According to Table data, The most strength fiber was found control Acalpi of control cultivars. In addition to this, some of lines (2, 3, 4, 5, 6, 8, 11, 12, 14, 15, 28, 29 and 30) were indicated higher values. The result in this study confirms the similar results obtained by Kuliev (1983), Kerbabeva *at al.* (1984), Tagiev (1984), Ibragimov *et al.* (1989), Mamadov and Bazhanova (1987), Gençer *et al.* (1992), Auld *et al.* (1998), Raffat (1998) and Kusdemir (1999).

Fiber length: Fiber length plays leading role in textile industry. Quality thread is made only from longer fibers. As noticed in Table 3, the affects of radiation applications on fiber length were obtained positive and negative but, this variation was not significant from statistical methods. Fiber length of lines and cultivars were changed from 28.23 to 33.90 mm. On the other hand while control Acalpi was given the most length fiber from the other standard cultivars, in a lot of lines were obtained more length fiber from control Acalpi. The most length fibers were obtained from ACH_{26} line that created from 300 Gray radiation applies, while the shortest was from ACH_6 line. Some lines (ACH_7, ACH_9, ACH_{16}, ACH_{20}, ACH_{26}, ACH_{28}, ACH_{30}) were given longer fiber from superior cultivar. The similar results were reported by Mamedov and Bazhanova (1987) and Kusdemir (1999).

Uniformity (%): As noticed in Table 3, fiber uniformity of cultivars and lines belong experiment were changed from 81.57 to 85.07%. The highest uniformity was indicated from ACH_{30} line that applied 400 Gy radiation dose, meanwhile these line were found higher from control Acalpi and the other standard cultivars. On the other hand the lowest fiber uniformity were found from ACH_{23} and ACH_{34} lines. According to our study, the radiation applies were not statistically significant on fiber uniformity. The result in this study confirms the similar results obtained by Kusdemir (1999).

CONCLUSIONS

Sayar-314 and Stonovil-453 (*G. hirsutum* L.) are standard cultivars of Sout East Anatolia in Turkey. These cultivars have medium length fibers and are not resistant to hot, dry and salty. Acalpi-952 (*G. barbadense* L.) cotton cultivar has quality fiber and resistant to dry. This study was conducted that to improve new superior cotton cv. from these cultivars. According to result of M_3 generation, ACH_8, ACH_9, ACH_{17}, ACH_{22}, ACH_{25} and ACH_{36} lines were found good position in view of seed cotton yield per ha. These lines were found higher yielded from control Acalpi and standard cultivars (Stonovil-453 and Sayar-314) of region. In addition these lines had higher values in terms of some yield components (number of sympodia, number of boll, boll weight, seed cotton boll weight and yield per plant) (Table 1-3). Nevertheless, ACH_8, ACH_9 and ACH_{36} lines were indicated super characters from parent Acalpi and standard cv. in terms of yield and fiber technological characters. These lines were obtained hopeful. It is suggested that the studies must be continue to M_6 generation.

REFERENCES

Ackgoz, N., M.E. Akkao, A. Maghaddam and K. Ozcan, 1993. TARIST, statistics and quantitative package for personal computer. Proceedings of the International Symposium of Computer Applications, June 9-10, 1993, Konya, Turkey, pp: 10-19.

Aitzhanov, U.E., 1984. Variability of the growth period in interspecific cotton hybrids of the fourth generation and backcross hybrids. Second Generation using Pollen Irradiated with 60 Co. Vestn. USSR, 3: 43-46.

Anonymous, 2003. Meteoroloji genel mudurlug. Sanliurfa Mudurlugu, Sanliurfa Ili Aylik klim Kayitlari Sanliurfa.

Atilaa, A.S. and H. Peokircioglu, 1990. The effect of ? irradiation cukurova-1518 cotton cultivar. T.A.E.K. Nuclear Agricultural Research Center of Ankara. Department of Plant Breeding.

Auld, D.L., M.D. Etharidge, J.K. Dever and P.D. Dotray, 1998. Chemical mutagenesis as atool in cotton improvement. Plant Breed. Abst., Vol. 68,.

Baysal, I., M.A. Kaynak, M. Oğlakçı and M. Çölkesen, 1994. A research on determination effects of mutation on population which could be made up with cobalt-60 mutagen ın cotton (*Gossypium hirsutum* L.) At harran plain conditions. Fild Crops Department, Fild Crops Congree, Tubitak and Usigem, Plant Breeding Announcements, Bornova, Izmir, 2: 150-153.

Bughio, A.R., Z.A. Qureshi, T. Hussain and Q.H. Siddiqui, 1984. Nucleus, Pakistan Atomic Energy Res. Cent., tandojam, Pakistan, 21: 4-10.

Constantin, M.J., 1968. Gamma and Fission Neutron Irradiation of Gossypium F_1 Seed, Neutron Irradiation of Seeds, II. Technical Reports Series, No. 92, pp: 29-38.

Gaul, H., 1977. Manual on Mutation Breeding, Technical Reports Series No. 119, 2nd Edn. IAEA, pp: 87-98.

Gençer, O., F. Gülyaşar, M. Boyacı, M. Oğlakçı and M. Güvelioğlu, 1992. Researces on effects of mutations be made up cobalt 60 and ems. Cotton J. Doga, 3: 471-486.

Hatipoglu, R., 1999. Researches of some characters at m1 generation by application of different gamma ırradiations on common wetch (*Visia sativa* L.). University of Cukurova J. Agricultural Faculty.

Ibragimov, S.H.I., R.I. Koval'chuk, A. Kushaliev, 1989. Laser radiation in the experimental mutagenesis of cotton. Primenec, Nizkoenergeticheskikh Fizicheskikh Faktorov Biologii Se'skom Khozyaistve; Tezisy Dokladov Vsesoyuznol Nauchnoi Konferentsii 3-6 Iyulya, USSR. Vsesoyuznyi Instut Selektsii Semenovadstva Khlopchatnika, Tashkent, Uzbek SSR.

Karaevoi, S.Y., Z.Y. Maksudov and D. Amirkulov, 1981. Induced mutagenesis in ecologically distant intraspecific hybrids of cotton. Proceedings of 1-Yavses Konf. Po Prikl. Radiobiol. Teor. Iprikl. Aspekty Radiats-Biol Technol, Noyab. 10-12, Kishinev, Voldavian SSR., pp: 69-70.

Kerbabeva, Z.A., A.S. Konoplya and S.P. Konoplya, 1984. Qualitative evaluation of natural early leaf fall in isogenic lines of cotton. Sel'skokhozyaistvennaya Biologiya, 11, 10, Turkmen Univ. Ashkabad, pp: 31-33.

Kuliev, R.A., 1983. Combining hybrid and mutational variation in cotton breeding. Sel'skokhozyaistvennaya Biologiya, 7, 15, S. M. Kirov Univ. Bakın, Azerbaidzhan SSR, pp: 34-40.

Kurepin, Yu., V. Pak and A. Imamaliev, 1985. The question of induced mutation. Khlopkovodstvo 1, Russian, pp: 31-33.

Kuodemir, A., 1999. Determination of mutation effects of cobalt-60 at M1 and M2 progenies at cotton (*Gosyipium hirsutum* L.). Ph.D. Thesis, University Of Cukurova, Graduate School of Natural and Applied Sciences.

Mamedov, K. and A.P. Bazhanova, 1987. Ionizig radiation and economically useful traits in cotton of the species *G. barbadense* L. Plant Breed. Abst. Vol. 57.

Mukhov, V., 1987. The possibilities of improving cotton yields through radiation mutagenesis. Plant Breed. Abst. Vol. 57.

Muthusamy, A., K. Vasanth and N. Jayabalan, 2005. Induced high yielding mutants in cotton (*Gossypium hirsuthum* L.). Mut. Breed. Newslet. Rev., No: 1, June 2005, pp: 6-8.

Özbek, N., C. Atak, A.S. Atila and Z. Sağel, 1986. Improving yield and oil content by nuclear technology at soybean cv. Call and amsoy-71 that growing ın cukurova region. Plant Breeding Symposium Announcement Abst. 15-17 October, Izmir, pp: 38.

Raffat, M.A.A., 1998. Some features of egyptian cottons after chemical mutagens treatment. Plant Breed. Abst., Vol. 68.

Saeel, Z., 1994. The effects of various radiations doses on some characters of M1 and M2 generations of two soybean varietie. Ph.D. Thesis, University of Ankara, Graduate School of Natural and Applied Scinces.

Senel, M., 1980. Breeding growing and technology of cotton agricultural Ministry of Turkey. Cotton Research Institute Pub. No: 36, Adana.

Tagiev, A.A., 1984. Treatment of cotton pollen with chemical mutagens and its effect on seed set. Khim Mutagenez Pouysh Productiv. S. Kh. Rast. Moscow, USSR., pp: 161-162.

Tyaminov, A.R., 1982. Use of radiation mutagenesis in breeding *gossypium barbadense* varieties of the intensive type. Sel'skok Hozyaistvennaya Biologiya, 17, 2, 7 Vesoyuznyi Institut Selectsii Semenovadstua Khlopchatnica Salar Teshkent, Uzbek, SSR, pp: 209-211.

Vlkova, N., 1992. Radiosensitivity and mutability of some cotton varieties. Genetika-i. Selektsiya. ref. Instut po Pamuka Chirpan, 6200 Bulgaria, pp: 387-393.

Yildırım, M.B. and M.E. Tugay, 1977. Evaluation of artificial mutations at weath and burley breeding. Turk. J. Plant Sci., 4: 3- 289.