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INDUCED PROMOSING EARLINESS VARIANTS FROM LATE MATURE COTTON CULTIVAR ASHOR 1 BY GAMMA RAYS IN IRAQ

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ABSTRACT

Host diversity in the very late maturity cotton cultivar Ashor 1 was created by gamma rays in order to select agronomical desirable earliness genetic variants. Seeds of cotton cultivar Ashor 1 were exposed to 250 Gy of gamma rays and planted with untreated seeds. Selection for earliness was conducted in M2 progeny. Evaluation trails on the selected variants resulted in choosing ten promising variants. Earliness percentages of the selected variants ranged from 84.30 to 88.8 compared to 60.8% Ashor 1 cultivar. However, the productivity of these variants ranged from 85.0 to 133.30 g cotton flower/plant while it was 49.20 g in Ashor 1 in the first picking (160 days after seed sowing). The selected variants also surpassed their origin in total yield of both first and second picking (one month later). Fiber length was not affected in eight variants while remarkable reduction was observed in two variants.

Key-words: Cotton, *Gossypium hirsutum* L., Induced mutation, earliness.

INTRODUCTION

Cotton (*Gossypium hirsutum* L. is one of the most important fiber crops of the world. This crop is used to be a perennial plant but it has been adapted to be annual summer crop. In Iraq, during the 1970s of the last century, the Ministry of Agriculture introduced cotton cultivar Coker 310 (Al-Tayar, 1989). Due to physical and genetic decline in this cultivar, a new cultivar named Ashor 1 was introduced in 1997. This cultivar characterized by having many agronomic traits such as high productivity, high fiber strength and length along with good fiber softness but has a very long lasting period in the field (Dawood and Ahmad, 1998; Mursal and Jasim, 1999). However, the Iraqi growers and farmers rejected sowing this cultivar because of its late maturity.

The cultivar need more than 300 days starting from April 2nd which unable the growers and farmers to grow wheat or barley, since barley and wheat sowing time must be done in Iraq during November and December respectively. Therefore, early maturity cotton cultivars will solve this problem. Due to narrow genetic base of the available Iraqi cotton cultivars, the induced mutation technique in such crop represents an important source for host diversity. The International Atomic Energy Agency (IAEA) sponsored abroad spectrum of research activities in their member states on mutation induction to enhance the genetic diversity in the germplasm of food and industrial crops (Lagoda, 2008). Induced mutations technique have made significant contributions in developing and release of more than 3000 mutant cultivars in more than 175 crop species during the past 40 years (Kharkwal, 2008)

Breeding with induced mutation is one of the most effective methods of crop breeding if there are no genetic resources available for certain agronomic traits in certain crop. In Sudan for instance, cotton germplasm has been enrich with a number of useful mutants carrying desirable traits, and these mutants are being used in the breeding program and promising lines recently are under field evaluation for release to the farmers (Ali, 2008).Eighty years of Scandinavian barley mutation, research and breeding resulted in collection about 10000 different mutants with a broad variation, among them early maturity mutants (Lundqvist, 2008). About 61% of 200 direct-use mutant cultivars in Japan were induced by gamma ray irradiation (Nakagawa, 2008). Haq (2008) reported that induced mutations in NIAB has led to develop 24 varieties, some of them have been develop throughout using induced mutants or variants as one of the parent in conventional breeding programme. Thus, mutation breeding via gamma irradiation is an effective and highly successful approach for the generation of commercial cultivars. Al-Hamdany *et al.* (2000) were obtained two early maturity mutants from Race 5, which was selected from cultivar Coker 310 due to its high yield potential but has late maturity trait (Al-Tayar, 1989.

This study is aiming to create host diversity in late maturity cotton cultivar Ashor 1 and utilizing these variants in a screening program for earliness trait in order to meet the Iraqi growers and farmers demand.

MATERIALS AND METHODS

Seeds Ashor 1 cotton cultivar which characterized by having indeterminate type of growth, were irradiated with 250 Gy ^{60}Co gamma rays at dose rate of 19 rad/sec. Treated and non treated seeds were sown in the field on April 2nd .All field conditions, such as seedbed preparation ,fertilization, irrigation , and weed control (hand cutting) were optimal . Planting spacing between rows was 90 cm with 25 cm between seed bed. Seedlings in each seed bed were thinned to two. Using pedigree method, the first three pods from each survival M1 plant of both irradiated and non irradiated materials were harvested. M2 progeny was raised from M1 seeds as lines therefore, each line was planted with seeds of one selected M1 plant. All M2 plants were screened for earliness trait. Earliness criterion for selection adapted on M2 progeny was the full maturity of more than 80% of the pods in any line at day 160^{th} from planting. This date was chosen for the first and the last picking for any cotton genotype develop or introduced to the Iraqi Agriculture Sector. However, the second picking was done one month later. Data of first and second picking yield per plant was calculated from 10 plants of each variant. Fiber lengths of all selected variants were hand measured due to unavailable combs or fibrograph instrument. Data of earliness and fiber yield were statistically analyzed according to Duncan Multiple Range Test (Snedecor and Cochran, 1978).

RESULTS AND DISCUSSION

Due to our experiments with cotton induced mutation, the most effective dose of gamma rays for inducing desirable mutations in cotton were designated in earlier studies (AL-Hamdany *et al*., 2000; 2001 and 2008). Data for seedling emergence and percent of survival or abnormal plants in M1 was neglected in this study. There was no selection on M1 progeny. The M2 progeny exhibited several induced variants for agronomic contributing traits. Out of M2 lines, ten variant lines showing early maturity in their pods were obtained. Estimates of earliness based upon boll opining and yield measurements at the first picking were tabulated in Table 1. All the selected variants produced two to three fold increases in yield per plant at the first picking (160 days after seed sowing) as compared to their origin (Ashor 1). Fiber per plants was ranged from 85.0 to 133.3 g compared to 49.2 g in Ashor 1 (Table1). Ashor 1 showed remarkable increment only in the second picking which was obtained one month later. The yield of the selected variants in the second picking was ranged from 11.0 to 21.6 g while it was 31.7 g in Ashor 1. However, the total yield of first and second picking ranged from 96.0 to 149.9 g while it was 80.9 gm in Ashor 1 (Table 1). The results clearly indicated that Ashor 1 is highly late mature cotton crop. The yield of the first picking to both pickings in Ashor was 60.8% while it was more than 84% in all selected variants. Since the fiber length of Ashor 1 represents the most important agronomic trait, the fiber lengths of the selected variants were identical to that measured in Ashor 1 except in the variants ASH 4, ASH 11 which were 26.6 and 27.2 mm while it was 30.5 in Ashor 1. Fiber lengths of the other variants ranged from 29.0 to 33.6 mm.

Table 1. Earliness and fiber lengths of cotton induced variants from late mature cultivar Ashor 1 by gamma rays.*

Cotton Variants**	Cotton Flowers(Fiber) per Plant (g) at***		Total Yield per plant (g)	Percent of Picking 1/ Total	Fiber Lengths (mm)****
	First Picking	Second Picking			
ASH 1	85.0 d	11.0 c	96.0	85.5	30.6
ASH 2	93.2 cd	14.6 bc	107.8	86.4`	31.6
ASH 3	107.5 bcd	17.6 bc	125.1	85.9	33.6
ASH 4	108.3 bcd	16.6 bc	124.9	86.6	26.6
ASH 6	106.6 bcd	16.6 bc	123.2	86.4	32.0
ASH 7	95.0 cd	14.4 bc	109.4	86.8	31.0
ASH 8	116.6 abc	21.6 b	138.2	84.3	29.0
ASH 11	95.4 cd	15.6 bc	111.0	85.9	27.2
ASH 15	120.0 ab	18.7 bc	138.7	86.4	29.4
ASH 17	133.3 a	16.6 bc	149.9	88.8	30.2
Ashor 1 (Origin)	49.2 e	31.7 a	80.9	60.8	30.5

Each number represents mean of 10 plants
Means with the same letter within a column are not significantly different according to (P=0.05) Duncan's multiple range test (Snedecor and Cochran, 1978); *Seeds of late maturity cotton cultivar were irradiated with 250 Gy
of gamma rays and sown in April 2^{nd}. **Induced variants were selected from M2 progeny
First and second picking were conducted on Sep. 10^{th} and Oct. 10^{th} , * Fiber lengths were hand measured**.**

The promising variants obtained in this study were quite similar in their earliness to those obtained in previous study on Race 5 (AL-Hamdany *et al*., 2001; 2008). The use of nuclear techniques for crop improvements in Iraq was initiated in 1980s and resulted in developing many new cultivars having agronomic traits in barley (AL-Khalisii, 1981), broad bean (AL- Hamdany *et al.* 1998; 2008),), Soy bean (Al-Mahdawi *et al*., 2002) and Wheat (Ibrahim *et al*., 1989). In barley for instance, slow mildewing barley mutant D/31 (AL-Hamdany, *et al*., 1997) was induced from highly susceptible Arivat by Sodium Azide (AL-Khalisii, 1981). Therefore, the nuclear techniques are successfully enriched the agriculture sectors in particular the plant breeders a genetic resources which might be utilized in any breeding program for crop improvement in Iraq or elsewhere.

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