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EFFECT OF RECURRENT SELECTION AND SELFING ON THE NUMBER OF SEEDS/LOCULE AND SEED INDEX IN INDUCED MUTANT LINES OF DESI COTTON (*Gossypium arboreum* L.,)

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The germinating seeds of gaorani-46 (*Gossypium arboreum* L., race *indicum*) were subjected to 5000 *r* per min of Co^{60} gamma rays and 0.001 - 0.007. M. sol. of DES separately. Breeding of the selected M_1 plants was done through selfing and recurrent selection. Some mutant lines with stablised high mean number of seeds per locule and seeds index were obtained in M_7 generation. It is inferred that recurrent selection after selfing in successive generations is useful in developing improved lines in the mutants.

The primary aim of mutation breeding is to add a useful characteristic to the delicate system of genic balance (Mackey 1956). Keeping this in view, Damayanthi Swami and Swami (personal communication) attempted to improve the plant type and yield in gaorani - 46 desi cotton (*Gossypium arboreum* L., race *indicum*) through mutation breeding involving recurrent selection after selfing.

The present paper deals with the number of seeds per locule and the seed index that contribute to the

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increase in yield of *kapas* in the mutant lines selected.

MATERIAL AND METHODS

In the mutant lines obtained by Damayanthi Swami and Swami [1986 a, b.] at the end of M_6 generation, number of seeds per locule and seed index were studied in their M_3 - M_6 generations.

Number of seeds/locule/plant :

Ten random plants producing thirty or more bolls per plant [except in control] from each line in each generation were taken. The total number of bolls, locules and seeds were counted in each plant of the mutant lines and the control separately. The mean number of seeds per locule was calculated for each line generation-wise.

Seed Index : Five fully opened bolls were randomly taken from each of the above ten plants of each mutant line and control per generation. The *kapas* of each boll was weighed, ginned and its seeds counted and weighed separately. The mean weight of seed per boll and of seed per plant were calculated for each line and control in each generation.

Analysis of variance, test of critical difference of all comparisons among means through Hartley's method [Snedecor, 1961, pp. 253], test of differences among variances and test of stability in means and variances were conducted. The values of " t " and " F " were tested at 5% level for the respective degrees of freedom.

RESULT AND DISCUSSION

Number of seeds per locule per plant : Harrell and Culp [1976] opined that lint yield could probably be improved by increasing the number of seeds per boll, which could increase the total seed surface and consequently lint production. Taking this view into consideration, the mean number of seeds per locule per plant of the mutant lines and control in M_3 -M_6 generation was analysed [Table 1].

All the mutant lines had significantly higher mean than control. The means of SRC - 255, 357, 358, 359, 362, 365, 369, 423 and 536, which did not differ significantly from one another, were singificantly higher than those of all the remaining lines. Among these, the mutant lines SRC-357, 358, 359, 362 and 365 had stabilised their means at M_3 generation.

The control had 3.00-5.00 seeds per locule per plant in 77.50% of plants in all generations together (Table 2). On the other hand, SRC-357, 358,359, 362, and 365 had 5.01 to 7.00 seeds per locule in 62.50, 70.00, 65.00, 55 00 and 55.00% of plants respectively.

Among the mutant lines with higher mean and percentage of plants with higher number of seeds per locule, the variances of SRC - 358 and 365 did not differ significantly

Table 1 Mean Number of Seeds per Locule in the Selected Mutant Lines in M_3 -M_6 Generations

N = 10

Mutant Line	M_3 $\bar{X} \pm$ S.E.	M_3 Range	M_4 $\bar{X} \pm$ S.E.	M_4 Range	M_5 $\bar{X} \pm$ S.E.	M_5 Range	M_6 $\bar{X} \pm$ S.E.	M_6 Range	Grand Mean $\bar{X} \pm$ S.E.	Stabilised at
CONTROL	3.89± 0.47	3.38—4.86	4.45± 0.12	3.27—6.13	4.87± 0.24	2.57—6.23	4.44± 0.21	3.76—5.47	4.21± 0.19	M_4
SRC-255	5.36± 0.19	4.53—6.29	4.90± 0.17	4.09—5.82	5.78± 0.15	4.52—6.65	5.41± 0.20	4.11—6.21	5.36± 0.0	M_6
SRC-301	5.16± 0.13	4.13—5.60	5.15± 0.08	4.73—5.52	5.20± 0.35	3.46—6.55	3.85± 0.14	3.30—4.64	4.84± 0.13	—
SRC-536	5.36± 0.18	4.53—6.24	4.71± 0.23	3.94—6.00	5.30± 0.20	3.69—5.94	5.50± 0.15	4.03—6.14	5.22± 0.11	M_6
SRC-357	5.36± 0.19	4.53—6.29	4.90± 0.18	3.17—5.82	5.26± 0.39	3.50—6.88	5.16± 0.10	4.65—5.75	5.17± 0.12	M_4
SRC-358	5.36± 0.19	4.53—6.29	5.27± 0.27	3.65—6.55	5.77± 0.25	4.60—6.99	5.34± 0.17	4.38—6.19	5.44± 0.11	M_5
SRC-359	5.36± 0.19	4.53—6.27	5.27± 0.27	3.65—6.55	5.104± 0.28	3.63—7.08	5.33± 0.20	4.26—6.13	5.27± 0.13	M_5
SRC-362	4.97± 0.19	4.25—6.29	3.25± 0.19	4.18—5.96	5.38± 0.14	4.77—6.17	5.05± 0.26	3.96—6.57	5.17± 0.01	M_6
SRC-364	5.36± 0.19	4.53—6.29	4.90± 0.18	3.17—5.82	5.20± 0.29	4.36—7.00	4.71± 0.22	4.05—5.91	4.94± 0.12	M_4
SRC-365	4.97± 0.19	4.23—6.20	5.20± 0.19	4.18—5.96	5.23± 0.19	4.44—6.57	5.28± 0.25	4.10—7.01	5.21± 0.13	M_6

Contd ....

SRC-369	4.97± 0.19	4.53—6.29	5.25± 0.19	4.18—5.96	5.62± 0.24	4.83—7.48	5.84± 0.15	5.25—6.80	5.42± 0.10	M_s
SRC-419	5.16± 0.13	4.13—5.60	5 15± 0.08	4.73—5 52	5.12± 0.17	4.50—6.23	3.79± 0.16	3.16—4.81	4.81± 0.12	—
SRC-423	4.97± 0.13	4.23—6.29	4.69± 0 26	3.61—6.58	5.06± 0.38	4.38—6.12	6.25± 0.11	—	5.25± 0.16	—
SRC-511	4.97± 0.19	4.23—6.29	4.55± 0.22	3.48—6.18	4.48± 0.34	3.13—5.80	5.21± 0.19	4.75—6.39	4.80± 0 13	—
SRC-560	4.29± 0.13	3.82—4.88	5.00± 0.30	3.55—6.39	4.49± 0.22	3.69—5.82	4.62± 0.18	3.36—5.67	4.60± C.11	M_s
SRC-561	4.29± 0.13	3.82—4.88	5.00± 0.30	3.55—6.39	4.71± 0.26	3.50—6.20	4.95± 0.32	3.16—6.23	4.74± 0.14	
SRC-562	4.29± 0.13	3.82—4.83	4.45± 0.19	3 59—5.21	4.85± 0.15	4.05—5.34	5.20± 0.16	4.59—6.10	4.70± 0.10	M_s
SRC-581	5.16± 0.13	4.13—5.60	5.46± 0.09	5.03—5.99	3.81± 0.022	—	5.00± 0.15	—	4.86± 0.08	—

C. D at 5% level for N = 40 : 40 = 0.29

10 : 10 = 0.59

Table 2 Frequency Distribution of Plants of Each Mutant Line that had Stabilised at M-for Number of Seeds/Locule

Mutant Line	N	3.00-3.50	3.51 4.00	4.01-4,50	4.51-5.00	5.01 5.50	5.51-6.00	6.01 6.50	6.51 7.00	% of plants with 3.00 5.00 Seeds/Loc.	% of plant with 5.01-7.00 Seeds/locule.
Control	40	4	11	6	10	6	2	1	—	77.50	22 50
SRC-357	40	—	1	5	9	12	9	2	2	37.50	62.50
SRC-358	40	—	1	2	9	9	9	8	2	30.00	70.00
SRC-359	40	1	2	2	9	10	8	5	3	35.00	65.00
SRC-362	40	—	1	5	12	10	8	4	—	45.00	55.00
SRC-365	40	—	—	6	12	8	11	1	2	45.00	55.00

from that of control and had stabilised at M3 generation (Table 3). On the other hand, the variances of SRC-357, 359 and 362 varied significantly from generation to generation. Hence SRC-358 and 365 with significantly higher stabilised means and not differing significantly from that of control in variances were preferred for further studies in this improved character.

Arutjunova and Gesos [1970] obtained an increase in seed number per boll after gamma irradiation and crossing with untreated parents in *G. hirsutum*. Chaturvedi and Singh [1980] and Madhava Rao [1982] observed a similar increase in seed number per fruit in mung bean (*Phaseolus mungo* L.) and green gram (*Vigna radiatus* L.,) respectively after gamma rays' treatment. Our results support these earlier observations. Contrarily, Nazir and Khan [1974] in AC-134 and Kadambavanasundaram and Menon [1975] in MCU 4 and 5 reported a decrease in seed number per boll and also increase in variability in AC-134 after irradiating with gamma rays. In the present experiment, a recurrent selection for higher mean in different mutant lines after selfing was made though M3 M6 generations. Hence there was no possibility of appearance of any line with significantly lower mean than that of control among the selected lines.

Seed Index : Efimenko [1969] found that large seeds yield more lint. Hence a analysis was made to find out whether there was increase in seed weight of any of the above mutant lines. The mean seed weight per boll per plant showed that all the mutant lines except SRC-357, which did not

Table 3 Variances of Seeds/Locule in Stabilised Mutant Lines with Higher Number of Seeds/Locule not Diffring Significantly from each other in their Means

N 10

Mutant line	M_3	M_4	M_5	M_6	Mean stabilised at	6^2 from the time of stabilisation of mean
Control	—	0.4329	0.6725	0.4515	M_4	0.4428
SRC-255	—	—	1.8502	0.3969	M_5	1.0647
SRC-357	0.3602	0.3197	1.5054	0.0962	M_4	0.5566
SRC-358	0.3602	0.7124	0.6321	0.2910	M_3	0.4990
SRC-359	0.3602	0.7124	1.4815	0.4186	M_3	0.6961
SRC-362	0.3542	0.3531	0.1822	0.6557	M_4	0.3814
SRC-365	0.3452	0.3531	0.3780	0.6282	M_5	0.4121
SRC-369	—	—	0.5767	0.1517	M_6	0.3948
SRC-536	—	—	0.4027	0.2389	M_5	0.3712

"F" Value at 5% level for 9 : 9 d. f. = 3.180

differ significantly from control had significantly higher mean than control. [Table 4]. The mutant lines SRC-365 and 536 had stabilised their means at M_5 generation, while the others did not. On the other hand, the mean weight of seed per plant [Table 5] showed that SRC- 365, 536 and 562 had stabilised their means at M_3, M_4, and M_5 generations respectively with significantly higher means than the corresponding ones of control.

The boll level variance of SRC-365 in M_5 to M_6 did not differ significantly from the control and had stabilised at M_5 generation. The variance of SRC-536 from M_5 to M_6 was significantly higher than the control and its generation - wise variances differed significantly from one another. Similarly, significant differences were found in the variances of SRC - 562 from generation to generation at boll level.

The plant level vairances in seed weight of mutant lines revealed that SRC-365 had stablised lower variance in comparison with that of control in M_5 to M_6 generation, whereas the corresponding variance of SRC-536 did not significantly differ from the control This indicates that both SRC - 365 and 536 had improved the mean seed weight with significantly lower variance

Table 4 Mean weight of Seed/Boll/Plant in the selected mutant lines in M_3 - M_6 generations

N = 50, Weight in grames

Mutant Lines	M_3		M_4		M_5		M_6		Grand Mean	Stabilised at
	$\bar{x} \pm$ S. E.	Range	$\bar{x} \pm$ S. E.	Range	$\bar{x} \pm$ S. E.	Range	$\bar{x} \pm$ S. E.	Range	$\bar{x} \pm$ S. E.	
CONTROL	0.05672±	0.04931—	0.05606±	0.04205—	0.05623±	0.04205—	0.05756±	0.04096—	0.05664±	M_4
	0.001928	0.06391	0.000864	0.07981	0.000628	0.07447	0.001185	0.08313	0.000758	
SRC - 301	0.07356±	0.06224—	0.07549±	0.05707—	0.07018±	0.05625—	0.05636±	0.03318—	0.06890±	
	0.000762	0.08633	0.000706	0.07952	0.002768	0.08469	0.001719	0.08695	0.000654	—
SRC - 307	0.06691±	0.04936—	0.07236±	0.05735—	0.05502±	0.03792±	0.04650±	0.02267	0.06020±	
	0.000874	0.08004	0.001239	0.07943	0.001856	0.07003	000.1618	0.06730	0.000548	—
SRC - 357	0.05865±	0.04669—	0.05657±	0.04018	0.06146±	0.04094—	0.04779±	0.02813—	0.05612±	
	0.000624	0.06830	0.001102	0.07188	0.001510	0.07794	0.001033	0.07600	0.000632	
SRC - 365	0.05947±	0.04975—	0.05827±	0.03325—	0.06265±	0.05124—	0.06311±	0.05230—	0.06087±	
	0.001828	0.07201	0.001424	0.07570	0.030950	0.078008	0.000916	0.07485	0.000677	M_5
SRC - 420	0.06484±	0.04984—	0.06762±	0.05395—	0.06788±	0.05196—	0.05696±	0.04043—	0.06417±	
	0.001053	0.08081	0.002400	0.08686	0.00156	0.08971	0.001230	0.07198	0.000837	—
SRC - 536	0.06523±	0.05429—	0.05966±	0.04404—	0.06106±	0.04633—	0.06162±	0.05100	0.06189±	
	0.002100	0.07607	0.001050	0.08747	0.00548	0.07479	0.002608	0.07515	0.000775	M_6
SRC - 562	0.06479±	0.04386—	0.06359±	0.04414—	0.06100±	0.04190—	0.05749±	0.04822—	0.06172±	
	0.001661	0.08937	0.001675	0.08184	0.00108	0.08495	0.000719	0.08538	0.000548	—

C. D. at 5% for N=200 : 200=0.001128
N=50 : 50 =0.002255

Table 5 Mean Weight of Seed/plant (g) in the Selected Mutant Lines in M_3-M_6 Generations

N = 10

Mutant Line	M_3		M_4		M_5		M_6	Grand Mean	Stabilised at
	$\bar{X} \pm$ S. E.	Range	$\bar{X} \pm$ S.E.	Range	$\bar{X} \pm$ S. E.	Range	$\bar{X} \pm$ S. E.	Range $\bar{X} \pm$ S. E.	
CONTROL	0.05685 ±	0.04376 –	0.05607 ±	0.04136 –	0.05625 ±	0.04987 –	0.05756 ±	0.05092 – 0.5666 ±	
	0.001811	0.06167	0.001682	0.06464	0.001523	0.06482	0.001253	0.06612 0.0005271	M_3
SRC-301	0.07356 ±	0.06943 –	0.06901 ±	0.05977 –	0.07017 ±	0.06028 –	0.05436 ±	0.04304 – 0.06678 ±	
	0.000776	0.07715	0.004958	0.07653	0.001831	0.07917	0.002203	0.06460 0.0001757	—
SRC-307	0.06690 ±	0.06142 –	0.07236 ±	0.06145 –	0.05502 ±	0.04809 –	0.04649 ±	0.03623 – 0.08019 ±	
	0.001211	0.06975	0.001521	0.07713	0.001156	0.06038	0.002728	0.06249 0.001844	—
SRC-357	0.05865 ±	0.05657 –	0.05657 ±	0.04901 –	0.06146 ±	0.04592 –	0.01780 ±	0.03844 – 0.03612 ±	
	0.000532	0.06063	0.001477	0.08240	0.002458	0.06844	0.007813	0.06337 0.001232	—
SRC-365	0.05947 ±	0.04602 –	0.05825 ±	0.04753 –	0.06267 ±	0.05735 –	0.06291 ±	0.05882 – 0.06083 ±	
	0.001622	0.06401	0.002067	0.06627	0.001472	0.07245	0.000833	0.06599 0.000168	M_4
SRC-420	0.06503 ±	0.05558 –	0.06862 ±	0.06154 –	0.06787 ±	0.05945 –	0.05696 ±	0.04603 – 0.06462 ±	
	0.001993	0.07660	0.002366	0.08149	0.001692	0.07640	0.002035	0.06806 0.001268	—
SRC-536	0.06523 ±	0.05586 –	0.05967 ±	0.05414 –	0.05926 ±	0.05110 –	0.06142 ±	0.05040 – 0.06139 ±	
	0.001459	0.07109	0.001285	0.06533	0.001253	0.06286	0.001981	0.07104 0.000827	M_4
SRC-582	0.06479 ±	0.04934 –	0.06359 ±	0.04798 –	0.061004 ±	0.04864 –	0.05749 ±	0.05230 – 0.06172 ±	—
	0.003206	0.08264	0.002276	0.07397	0.003280	0.08186	0.001373	0.06545 0.001350	M_6

C. D. at 5% for N = 10 : 10 = 0.00530
20 : 20 = 0.00375
30 : 30 = 0.00308
40 : 40 = 0.00265

at plant level in the former and with variance not significantly different from that of control in the latter. Further, SRC - 562 had the highest mean. ($\overline{X}$ = 0. 06172 $\pm$ 0. 001350, Control $\overline{X}$ = 0. 05665 $\pm$ 0. 00052) with no stabilised variance. It is likely that it may stabilise its variance with higher mean on further breeding.

Attempts to increase the seed weight in cotton were but few. However Kadambavanasundaram and Menon (1975) observed a decrease in seed index after treating MCU 4 and 5 with gamma rays. In the present experiment, careful selection after selfing made in M3 - M6 generations for higher mean has probably eliminated all mutant lines with lower means.

The present experiment indicates that a careful selection of improved desirable characters after selfing in successive generations is likely to give mutant lines with stabilised improved characters with higher means and lower - variances.

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