# Evaluation of some exotic mutants derived from irradiated cotton seeds

*A.M.A. Shaheen[1], M.A. Raafat[2] and S.El-S.S. Sobieh[1]*
*[1] Plant Research Dept., Nuclear Research Center, Atomic Energy Authority, Inshas EGYPT*
*[2] Cotton Research Institute, Agricultural Research Center, EGYPT*
*Correspondence author drraafat@hotmail.com*

## ABSTRACT

*Nine Pakistani, one Russian and three Egyptian cotton genotypes were evaluated under Egyptian conditions for yield, yield components and fiber properties. These genotypes were planted on two different sowing dates at the experimental farm belonging to Plant Research Dept., Nuclear Research Center, Inshas. Practical selection was conducted in order to stain some elite variant characterized by high yielded and desirable quality traits during two seasons. The obtained results indicated that Pakistan lines NIAB 86, M24 and Chandni exhibited high yield and its components during the two seasons in comparison with the Egyptian cultivars. However, Egyptian cultivars had higher cotton qualities than the exotic mutants. Generally, the early sowing date gave higher seed cotton yield than the late once.*


## Introduction

Cotton is the most important fiber in the world. It is considered as the main source of foreign currency for Egypt. Egyptian cotton is most suitable for the manufacturing of high quality textiles. Raising cotton productivity and quality is an urgent national goal to meet the insistent demands from this crop. It can be achieved through planting the selected genotypes and by optimizing the cultural practices.

Delaying planting date decreased significantly seed cotton yield. Brar *et al.* (1990) and Shakara, *et al.* (1998) reported that lint yield can be increased lint by earlier planting dates. This in turn decreased the number of days from planting to first open boll (Bourland *et al.*, 1998). Hosny and Sgahine (1995) reported that by delaying the sowing date, the micronaire reading significantly decreased. Porter *et al.* (1995), Bradow and Bauer (1997) reported that a delayed sowing date significantly increased Stelometer and elongation readings.

## Experimental procedure

The study materials consisted of three Egyptian cotton cultivars (Giza 75, Giza 80 and Giza 81), one Russian variety (Tamcot 21), two Pakistani varieties (NIAB 78 and NIAB 86) and seven Pakistani entries produced via gamma irradiation treatments (ST 3, M 555, COD, M 186, M 33, Chandni and M 24).

Pakistani NIAB 78 seeds were produced from the gamma irradiation of a hybrid derived from a cross between the varieties Acala 34 and Deltapine). ST 3, M 555, M 186 and Chandni were derived from gamma radiation of a hybrid developed by crossing Pima x H1. COD, M24, M33 and NIAB 86 were produced by hybridization and irradiation.

The trials were planted on two sowing dates, *viz*., 8 April and 28 April 2000-2001. The trials were planted at the Experimental Farm in Nuclear Research Center, Atomic Energy Authority, Inshas. During the two seasons, trials were planted according to a split-plot design. The main plot consisted of sowing dates and the sub-plot was ascribed to the genotypes. Each sub-plot consisted of 5 rows (3 m long and 60 cm apart) with 20 cm between the planting stations. The plant population was reduced by thinning to two plants/planting station.

The following characteristics were studied for individual plants taken at random from each plot:

- Seed cotton yield/plant (g)
- Number of boll/plant
- Boll weight (g)
- Fiber quality (determined by using the fibrograph method (Digital 1530)
  - Lint percentage
  - Fiber length by reporting 50 and 2.5 percent span length
  - Uniformity ratio % 50% SL/2.5% SL× 100,
  - Breaking elongation
  - Fineness by micronaire reading

## Results and Discussion

### Cotton yield and its components

**Seed cotton yield** In the first season, the first planting date showed that seed cotton yield for Pakistani lines, i.e. Chandni, M 24, M 33 and NIAB 86 was 25.4, 28.3, 24.2 and 24.4 g/plant, respectively; compared to 16.7, 15.8, 15.7 and 15.1 g/plant for Egyptian cultivars Giza 80, Giza 75, Giza 81 and M 186, respectively. On the second planting date of the same season line 186, Giza 81, Giza 75 and Giza 80 produced 16.3, 15.2, 13.4 and 10.9 g/plant respectively. It could be noticed that there is an interaction between genotypes and sowing dates as shown in Table 1. In the second season, the first sowing date of some Pakistani lines showed significant increases in cotton yield when compared to the other genotypes. COD, M 186 and NIAB 78 yielded 21.1 g, 20.2 g and 19.9 g respectively. However, M555, NIAB86 and Chandni had a significant increase in yield as compared to the local varieties at the second sowing date (Table 1). Some of the lines studied (Tamcot 21, M24, M 186, NIAB 78 and COD) exhibited larger cotton yields for the first sowing date than for the second date. These results confirm those obtained by other investigators (Brar *et al.*, 1990; Guthrie, 1991; Abdalla, 1992; Lankkineni *et al.*, 1994; Goudreddy *et al.*, 1995; Buehring and Jones, 1995; Hosny and Sgahine, 1995; Tomar *et al.*, 1995; Assy and El-Malik, 1997; Stewart and Edmisten, 1997; Bourland *et al.*, 1998).

**Number of bolls** The Chandni genotype showed the highest number of bolls for both sowing dates during the first season. ST3 also exhibited a significant increase in the number of bolls for the second sowing date compared to the other genotypes as shown in Table 1. However, in the second season, NIAB78 and COD had the highest number of bolls for the first sowing date; the same trend was also demonstrated by M555 and Chandni for the second sowing date. The early sowing date increased the number of bolls/plant for COD in both growing seasons. The same trend was earlier reported for Shahean (El-Kalla *et al.*, 1994).

**Boll weight (g)** Bigger bolls were found on M24 and Tamcot 21 for the early sowing, as well as in M555, ST3 and NIAB 86 for the second sowing date at the first season (Table 1). The highest boll weight in the second season was detected in line 186 for early sowing and Tamcot 21 in the late sowing. It could be noticed from the interaction between genotypes and sowing dates. These results are in harmony with those obtained by El-Kalla *et al.* (1994) and Shaheen (1990).

**Lint percentage** M 24 had the highest lint percentage for the first sowing date during both seasons (Table 1) Tamcot 21 and Chandni exhibited the highest value for both sowing dates during both seasons. COD, which had the lowest lint percentage in the first season, had the highest lint percentage in the second season for the second sowing date (Table 1). It means that this line is greatly affected by seasonal environmental conditions. This is in agreement with Porter *et al.* (1995) who mentioned that the environmental conditions affected the lint percentage.

## *Fiber properties*

**Span length at 2.5%** In the first season, NIAB 86 and Chandni showed significant increase for this trait over all Pakistani genotypes in the first and second sowing dates, respectively as shown in Table 2. In the second season, NIAB 86 also exhibited the highest value for the early sowing, while the Egyptian cultivars showed high values in the early and late sowing dates compared to the other genotypes through the two successive seasons. On the other hand the interaction between genotype and sowing date was significant. These results are similar to those reported by Porter *et al.* (1995) and Porter *et al.* (1996).

**50% S.L** The Egyptian cultivars surpassed the all introduced genotypes either in first or second sowing date in the both seasons, except NIAB 86 which showed an increase over Giza 81 and Giza 75 in the first sowing date at one season as showing in Table 2. However, line ST 3 exhibited the highest determination in the second date of the first season compared to the other Pakistani lines. Late sowing of Egyptian cultivar decreased the 50% S.L. (Table 2). A seasonal tendency was also shown for this trait.

**Micronaire data** Giza 75 showed the lowest value (fine fiber) for both sowing dates during both seasons, followed by NIAB 86 for the early sowing date for both seasons. The Egyptian cultivars, as well as the most of the other genotypes, showed lower micronaire values for late sowing date than for the early sowing date. This tendency was also demonstrated by Guthrie (1991) and Porter *et al.* (1996).

**Prissily reading** NIAB According to this trait the genotypes have been ranking in the first sowing date in THE first season from high to low as follows: 86, Giza 75, Giza 80, Tamcot 21, ST 3 and M 186, respectively. However, the second season showed that the Egyptian cultivars had the highest values followed by NIAB 86 for the early sowing date (Table 2). Porter *et al.* (1995) and Porter *et al.* 1996) found an increase in prissily for early sowing dates. At the late sowing date, the Egyptian cotton genotypes Giza 81 and Giza 75, as well as NIAB 78, M 33 and NIAB 86, exhibited high prissily reading in both growing seasons.

**Uniformity ratio** Relatively high uniformity was found in ST 3, Chandni and M 24 for the first sowing date during the two seasons (Table 2). The uniformity did not differ significantly at late of sowing date, except for lines Chandni, Tamcot 21 and Giza 75 as shown in Table 2.

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***Table 1.*** *The mean performance of ten entries at the first and second sowing dates compared to that of three Egyptian cotton varieties for two seasons.*

| | Yield (g/plant) | | No. of bolls/plant | | Boll weight (g) | | Lint (%) | |
|---|---|---|---|---|---|---|---|---|
| Season | I | II | I | II | I | II | I | II |
| First sowing date | | | | | | | | |
| ST 3 | 22.0 | 14.1 | 7.9 | 5.0 | 2.966 | 2.695 | 35.940 | 34.794 |
| M 555 | 19.7 | 18.8 | 7.2 | 6.7 | 2.677 | 2.856 | 36.079 | 33.856 |
| COD | 20.3 | 21.1 | 7.5 | 8.6 | 2.614 | 2.458 | 36.094 | 34.748 |
| NIAB 78 | 20.7 | 19.9 | 8.5 | 8.7 | 2.328 | 2.271 | 34.238 | 33.335 |
| M 186 | 15.1 | 20.2 | 5.8 | 6.0 | 2.652 | 2.968 | 34.950 | 35.309 |
| M 33 | 24.3 | 16.4 | 8.2 | 6.2 | 2.845 | 2.703 | 35.425 | 34.507 |
| Chandni | 25.4 | 15.8 | 9.9 | 6.4 | 2.612 | 2.524 | 36.311 | 34.575 |
| NIAB86 | 24.4 | 15.9 | 8.8 | 5.7 | 2.886 | 2.825 | 35.735 | 33.814 |
| M 24 | 28.3 | 17.1 | 9.6 | 6.6 | 3.095 | 2.806 | 36.650 | 36.176 |
| Tamcot 21 | 21.2 | 22.0 | 6.8 | 7.6 | 3.110 | 2.780 | 35.757 | 34.656 |
| Giza 80 | 16.7 | 12.4 | 7.9 | 6.6 | 2.064 | 1.862 | 36.614 | 35.083 |
| Giza 81 | 15.7 | 12.3 | 7.1 | 8.9 | 2.112 | 1.581 | 36.604 | 34.402 |
| Giza 75 | 15.8 | 13.2 | 8.3 | 7.3 | 2.023 | 1.838 | 36.031 | 34.421 |
| Second sowing date | | | | | | | | |
| ST3 | 25.8 | 14.4 | 8.4 | 5.3 | 3.068 | 2.703 | 36.382 | 34.725 |
| M 555 | 20.5 | 20.0 | 6.6 | 7.1 | 3.088 | 2.694 | 36.682 | 36.175 |
| COD | 18.2 | 14.1 | 6.3 | 5.3 | 2.916 | 2.361 | 33.191 | 36.755 |
| NIAB 78 | 21.2 | 14.9 | 7.7 | 5.7 | 2.594 | 2.361 | 36.463 | 35.949 |
| M 186 | 16.3 | 11.8 | 5.8 | 4.4 | 2.868 | 2.645 | 35.822 | 35.515 |
| M 33 | 21.1 | 17.0 | 7.2 | 6.4 | 2.939 | 2.722 | 35.404 | 36.149 |
| Chandni | 27.0 | 18.7 | 9.4 | 7.3 | 2.892 | 2.660 | 35.849 | 36.759 |
| NIAB86 | 24.5 | 19.2 | 8.2 | 6.7 | 3.044 | 2.839 | 36.011 | 35.421 |
| M 24 | 18.7 | 14.7 | 6.8 | 6.1 | 2.759 | 2.551 | 36.224 | 34.510 |
| Tamcot 21 | 20.6 | 18.3 | 7.1 | 5.9 | 2.909 | 2.959 | 37.413 | 36.448 |
| Giza 80 | 10.9 | 9.9 | 6.3 | 5.8 | 1.634 | 1.079 | 35.857 | 36.775 |
| Giza 81 | 15.2 | 11.8 | 7.7 | 6.7 | 1.858 | 1.790 | 36.726 | 35.238 |
| Giza 75 | 13.4 | 13.4 | 6.7 | 6.1 | 1.884 | 20.32 | 35.679 | 35.227 |
| Interaction | | | | | | | | |
| A[1] | | | | | | | | |
| LSD 0.05 | 1.548 | 1.002 | 0.427 | 0.346 | 0.102 | 0.119 | 0.542 | 0.552 |
| LSD 0.01 | 2.063 | 1.336 | 0.569 | 0.461 | 0.136 | 0.158 | 0.723 | 0.736 |
| B[2] | | | | | | | | |
| LSD 0.05 | 3.945 | 2.555 | 1.008 | 0.882 | 0.259 | 0.303 | 1.382 | 1.408 |
| LSD 0.01 | 5.261 | 3.407 | 1.452 | 1.172 | 0.346 | 0.405 | 1.843 | 1.877 |
| A x B | | | | | | | | |
| LSD 0.05 | 1.094 | 0.709 | 0.245 | 0.245 | 0.072 | 0.084 | 0.383 | 0.390 |
| LSD 0.01 | 1.459 | 0.945 | 0.323 | 0.326 | 0.096 | 0.112 | 0.511 | 0.521 |

[1] Genotypes

[2] Sowing dates

***Table 2.*** *Fiber properties of 13 cotton genotypes at two sowing dates for two seasons.*

| | Yield (g/plant) | | No. of bolls/plant | | Boll weight (g) | | Lint (%) | |
|---|---|---|---|---|---|---|---|---|
| Season | I | II | I | II | I | II | I | II |
| First sowing date | | | | | | | | |
| ST 3 | 28.1 | 27.67 | 14.3 | 14.00 | 9.13 | 8.67 | 50.77 | 50.90 |
| M 555 | 27.6 | 27.33 | 13.9 | 13.67 | 8.10 | 9.00 | 50.37 | 50.00 |
| COD | 28.3 | 28.37 | 14.1 | 14.20 | 8.87 | 9.23 | 49.90 | 50.07 |
| NIAB 78 | 27.0 | 27.33 | 13.4 | 13.83 | 8.40 | 8.97 | 49.77 | 50.27 |
| M 186 | 27.2 | 27.03 | 13.7 | 13.77 | 8.97 | 9.27 | 50.43 | 50.87 |
| M 33 | 28.7 | 27.97 | 14.4 | 14.07 | 8.77 | 8.77 | 50.27 | 50.37 |
| Chandni | 27.8 | 27.67 | 13.9 | 14.03 | 7.95 | 9.53 | 50.37 | 51.00 |
| NIAB 86 | 30.6 | 38.70 | 15.3 | 14.41 | 10.10 | 9.63 | 49.80 | 50.43 |
| M 24 | 27.7 | 27.10 | 13.8 | 13.57 | 8.77 | 8.80 | 50.57 | 50.03 |
| Tamcot 21 | 28.4 | 27.07 | 14.4 | 14.07 | 9.33 | 9.27 | 49.93 | 51.30 |
| Giza 80 | 32.7 | 30.40 | 16.3 | 15.97 | 9.47 | 9.87 | 49.00 | 49.87 |
| Giza 81 | 30.2 | 30.23 | 14.7 | 14.97 | 8.47 | 10.43 | 47.93 | 49.77 |
| Giza 75 | 30.8 | 30.77 | 15.2 | 14.97 | 9.50 | 10.87 | 50.07 | 48.50 |
| Second sowing date | | | | | | | | |
| ST 3 | 29.3 | 28.63 | 14.5 | 13.90 | 8.53 | 8.70 | 49.73 | 50.23 |
| M 555 | 27.4 | 26.55 | 13.7 | 13.40 | 8.3 | 8.50 | 49.97 | 50.40 |
| COD | 27.8 | 26.67 | 13.8 | 13.40 | 8.6 | 8.73 | 49.80 | 50.33 |
| NIAB 78 | 27.9 | 27.27 | 13.9 | 13.67 | 9.47 | 9.07 | 49.87 | 50.10 |
| M 186 | 27.8 | 26.90 | 14.1 | 13.67 | 9.90 | 8.47 | 50.70 | 50.80 |
| M 33 | 26.8 | 27.63 | 13.5 | 13.93 | 8.67 | 8.17 | 50.43 | 50.40 |
| Chandni | 29.5 | 27.50 | 14.3 | 13.73 | 9.63 | 8.23 | 49.97 | 50.03 |
| NIAB 86 | 26.4 | 27.00 | 13.2 | 13.60 | 8.87 | 9.40 | 50.13 | 50.27 |
| M 24 | 27.7 | 26.57 | 14.0 | 13.47 | 9.20 | 8.83 | 50.57 | 50.27 |
| Tamcot 21 | 27.4 | 27.57 | 13.9 | 13.37 | 8.83 | 7.77 | 50.27 | 50.27 |
| Giza 80 | 29.3 | 28.13 | 14.6 | 14.07 | 9.67 | 8.80 | 49.67 | 50.03 |
| Giza 81 | 31.6 | 30.70 | 15.9 | 15.10 | 10.43 | 9.37 | 50.23 | 49.40 |
| Giza 75 | 31.5 | 28.07 | 15.8 | 14.07 | 9.40 | 9.50 | 49.90 | 50.13 |
| Interaction | | | | | | | | |
| A[1] | | | | | | | | |
| LSD 0.05 | 0.536 | 0.475 | 0.258 | 0.193 | 0.232 | 0.252 | 0.247 | 0.233 |
| LSD 0.01 | 0.711 | 0.634 | 0.344 | 0.258 | 0.309 | 0.336 | 0.329 | 0.311 |
| B[2] | | | | | | | | |
| LSD 0.05 | 1.366 | 1.212 | 0.659 | 0.492 | 0.592 | 0.643 | 0.630 | 0.595 |
| LSD 0.01 | 1.821 | 1.615 | 0.878 | 0.657 | 0.789 | 0.857 | 0.840 | 0.794 |
| A x B | | | | | | | | |
| LSD 0.05 | 0.379 | 0.336 | 0.183 | 0.137 | 0.164 | 0.178 | 0.175 | 0.165 |
| LSD 0.01 | 0.584 | 0.448 | 0.244 | 0.182 | 0.219 | 0.238 | 0.233 | 0.220 |

[1] Genotypes

[2] Sowing dates