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EARLINESS STUDY ON NEW EGYPTIAN COTTON GENOTYPES

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Abstract

This investigation was carried out to evaluate three genotypes of Egyptian cotton i.e., Giza 90, Giza 81 x Giza 83 and [(Giza 83 x (Giza 75 x 5844)] for early maturity using some earliness measurements during 2001 and 2002 seasons. Flowering data was collected daily, and the average of flowers of 10 plants per week was calculated to construct weekly flowering curves, each genotype was picked weekly to calculate the percentage of crop harvested (PCH). Moreover, the other earliness measurements i.e. position of first fruiting node (PFN), days to the first flower (DFF), days to first boll opening (DFB), mean maturity date (MMD) and production rate index (PRI) were estimated. Simple correlation coefficients among five of the measurements and with seed cotton yield (SCY) were calculated to evaluate these methods.

Rates of flowering followed a normal distribution curve, which was almost similar in all genotypes. The genotype (Giza 81 X Giza 83) produced total number of flowers per plant more than any other genotype. Genotypes differences were significant in the 1^{st}, 4^{th} and 5^{th} weeks for (PCH). The highest (PCH) was found in fourth and fifth weeks. The genotype (Giza 81 X Giza 83) was the earliest and produced 78.86% from the total of seed cotton yield in the first four picks. The combine of results in the two crosses indicated insignificant differences at 1% level between all genotypes for all earliness measurements while the estimates of (PFN), (DFF) and (MMD) showed significant differences at 5% level between genotypes. Correlation coefficients results showed significant correlation between earliness measurements i.e. PFN, DFB, MMD and PRI with seed cotton yield (SCY).

INTRODUCTION

Cotton breeders have special interest in developing desirable cotton genotypes characterized by early maturing and high yielding ability. The early cotton varieties can escape from insect injuries. It helps to fit the crop into a multi-cropping system. Earliness in cotton is not an easily measured character; it takes a long period of time since the cotton plant flowers and sets bolls. Earliness is influenced by the time of flowering, rapid development of flowers and the length of time required for the boll to mature.

Thus. Many breeders reported that the methods of measuring earliness in cotton are very important in cotton breeding programs. Al-Didi *et al.*, (1961). Al-Didi *et al.*, (1968) and Awaad (1994) studied the flowering behavior in Egyptian cotton varieties using flowering curves and found that the rate of weekly flowering followed a normal distribution curve, which was nearly similar in all genotypes. However, Richmond and Radwan (1962), Al-Enani and Eid, (1980), Khattab *et al.*, (1982), El-Agamy *et al* (1994), and Bader *et al.* (2001) studied the earliness by measuring the days to first flower and position of the first fruiting node. Also. Bilbro and Quisenberry (1973), El-Agamy *et al.*, (1994), and Awaad (1994), estimated the mean maturity date (MMD) and production rate index (PRI) and found that MMD and PRI considered to be the best method of estimating earliness in cotton regardless of yield. Our objectives in this study was to evaluate three Egyptian genotypes for maturity by using five earliness measurements

MATERIALS AND METHODS

This investigation was conducted during two seasons 2001 and 2002 at Giza Experimental Station, Agricultural Research Center, Egypt. The main aim was to study some earliness measurements on three Egyptian cotton genotypes (*G. barbadense L*), i.e. Giza 90, (Giza 81 X Giza 83) and [Giza 83 X (Giza 75 X 5844)]. Randomized complete block design with four replications was used in each experiment. The plots were of three rows; 4.0 meters long and 60 cm wide. Seeds were planted in hills 20cm apart and thinned to two healthy plants. All cultural practices were applied as recommended in cotton fields. Data of flowering was estimated daily on ten guarded plants, which were taken from the outer rows of each plot. The number of flowers of ten plants on each plot at the three replications was calculated weekly starting from the opening date of the first flower till the beginning of September (end of flowering). Thirty plants were used to measure the following characters:

1. Flowering behavior: the curves of flowering were constructed using the number of flowers counted weekly over the flowering period.
2. Position of first fruiting node (PFN): nodal position at which the first fruiting branch emerges on the main stem.
3. Days to the first flower (DFF): number of days from sowing to the opening of first flower.

4. Days to first boll opening (DFB): number of days from sowing to the opening of the first boll.
5. Percentage of crop harvested (PCH): cumulative weight of seed cotton at a specified date of sequential harvest periods, expressed as percentage of the total crop (Richmond and Ray, (1966).
6. Mean maturity date (MMD): weight mean of harvest date of several periodic harvests calculated according to Christidis and Harrison (1955) by the following formula:

$$MMD = (W_1H_1 + W_2H_2 + ... + W_nH_n) / (W_1 + W_2 + ... W_n)$$

Where:

W = weight of seed cotton in grams.

H = number of days from planting to harvest.

1,2...n = consecutive period harvest number (7 harvests).

7. Production rate index (PRI): calculated by dividing the total seed cotton Yield by MMD value which results in relative production rate (amount per unit time) according to Bilboro and Quisenberry (1973), the general formula for this value would be:

$$PRI = (W_1 + W_2 + ... + W_n)^2 / (W_1H_1 + W_2H_2 + ... + W_nH_n)$$

Where:

W = weight of seed cotton in grams.

H = number of days from planting to harvest.

1,2...n = consecutive period harvest number (7 harvests).

The dates of seven picking are shown in table (1).

Table 1. Date of weekly picking in 2001 and 2002 seasons.

Seasons	Picking numbers						
	P1	P2	P3	P4	P5	P6	P7
2001	8/8	15/8	22/8	29/8	5/9	12/9	19/9
2002	12/8	19/8	26/8	2/9	9/9	16/9	23/9
Days from sowing in 2001	131	138	145	152	159	166	173
Days from sowing in 2002	131	138	145	152	159	166	173

The analysis of variance was carried out for each season, and then the combined analysis of variance was performed for the tow years. Significant differences between means were carried out using LSD.

Simple correlation coefficients between different pairs of traits were calculated on data means. All above-mentioned analysis was statistically analyzed as outlined by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

1. Flowering behaviour

The data presented in table (2) reported the weekly flowering counts for all genotypes under study. The flowering season extended for 14 weeks. The genotype (Giza 81 X Giza 83) produced a total number of flowers per plant more than any of the other genotypes, followed by the genotype [Giza 83 X (Giza 75 X 5844)] and Giza 90. With respect to weekly flowering, (Figs. 1,2, 3 and 4) revealed that the curves, were nearly similar in all genotypes in both growing seasons and their combined curve. The average rate of flowering started to slow down at the fourth week in June then increased gradually reaching its maximum in the fourth week of July and then decreased gradually till it reached its minimum at the fourth week of August. The present results agreed with those reported by Atta (1970), Awaad (1994) and Badr *et al.* (2001).

2. Position of the first fruiting node (PFN):

Table (3) shows insignificant differences between the genotypes under study in the two seasons for (PFN) while the combined means were significant at 5% value indicating that there were differences between genotypes. Giza 90 had the lowest position of the first fruiting node (6.17) while (PFN) for [Giza 83 X (Giza 75 X 5844)] and (Giza 81 X Giza 83) were (6.33) and (6.83), respectively. These results were in agreement with those obtained by Awaad (1994) and El-Agamy (1994).

3. Days to the first flower (DFF):

The results in 2002 season and their combined analyses (Table 3) revealed significant differences between genotypes for days to first flower. The promising hybrid [Giza 83 X (Giza 75 X 5844)] was earliest than the other genotypes. It surpassed the two other genotypes, it had 70.00 days from planting date to the day of the first flower, followed by Giza 90 and (Giza 81 X Giza 83) which were 70.83 and 73.00 days, respectively. Awaad (1994) and Badr *et al.*, (2001), found that genotypes varied in the

days to flower period.

4. Days to the First boll opening (DFB):

It could be noted from table (3) that during 2002 season, significant differences values were found between genotypes for the first boll opening. While the combined analysis revealed that [Giza 83 X (Giza 75 X 5844)] had the lowest number of days from planting to the first boll opening. Our results were in agreement with those of Awad *et al.*, (1989) Shafshak *et al.*, (1993) and Badr *et al.*, (2001).

5. The mean maturity date. (MMD):

The results shown in table (3) indicated that the different genotypes varied significantly with respect to the mean maturity date (MMD) at 5% value. Although, the differences between the lowest and the highest period rate were 2 days only, the genotype [Giza 83 X (Giza 75 X 5844)] had the lowest MMD (146.7 days). It reached (147.3 days), and (148.0 days) for (Giza 81X Giza 83) and Giza90, respectively. Richmond and Ray (1966) pointed that MMD was considered to be the most discriminating and reliable method of estimating earliness regardless to yield.

6. Production rate index (PRI):

Regarding the production rate index (PRI) presented in table (3), it was obvious that the differences among genotypes were insignificant in the 2001 season as well as in the combined analysis. However the genotypes showed significant and highly significant differences in 2002 season for production rate index (PRI). Bilbero and Quisenbery (1973) reported that PRI method of measuring earliness revealed the cultivars that have superior combinations of yield and earliness.

7. Percentage of crop harvested (PCH):

With respect to PCH, the genotypes varied significantly in the 1^{st}, 4^{th} and 5^{th} picks (Table 4), while the other picks were insignificant. The rate of PCH followed a normal distribution. Alow rate of seed cotton yield ranged from 9.11% for (Giza 81 X Giza 83) to 1.36 for [Giza 83 X (Giza 75 X 5844)], in the first week followed by a higher rate of PCH in the second and third week and reached the highest PCH in the fourth and fifth weeks, then the rate declined in the sixth week. The last week had the lowest

rate. Combined means showed that the hybrid (Giza 81X Giza 83) was the earliest and produced 78.86% of the total seed cotton yield in the first four picks followed by [Giza 83 X (Giza 75 X 5844)].

From the above results of earliness measurements, it could be concluded that the genotype (Giza 81 X Giza 83) was the earliest cross as it produced 78.86% of the total of SCY in the first four picks followed in order by the promising hybrid [Giza 83 X (Giza 75 X 5844)] and Giza 90. On the other hand, the combined analysis for earliness measurements i.e. (PFN), (DFF) and MMD showed significant differences at 5% values for the three genotypes under study, indicated that there were genetic differences between them.

Correlation among measurements

Simple correlation coefficients were calculated between seed cotton yield and each of the five earliness measurements. Table (5) showed positive and highly significant correlation coefficients between seed cotton yield (SCY) and production rate index (PRI) and also between position of the first fruiting node (PFN) with each of days to first boll opening (DFB) and mean maturity date (MMD). Also between days to first flower (DFF) with days to first boll opening (DFB) and mean maturity date (MMD) and between days to first boll opening (DFB) with mean maturity date (MMD). While negative and highly significant correlation coefficients were found between seed cotton yield with each of position of the first fruiting node (PFN), days to first boll opening (DFB) and mean maturity date (MMD). And between position of the first fruiting node (PFN) with production rate index (PRI). and also between days to the first flower (DFF) with production rate index (PRI).and between days to first boll opening (DFB) with production rate index (PRI).also between mean maturity date (MMD) with production rate index (PRI).

Evidently four measurements of earliness studied i.e. PFN, DFB, MMD and PRI were found to be significantly correlated in this study and therefore it was concluded that any of them could have been used with confidence to estimate earliness in cotton. Same results were obtained by Richmond and Radwan (1962), and Awaad (1994).

Table 2. Average number of flowers in the three Egyptian cotton genotypes at weekly intervals for the two growing seasons (2001, 2002) and combined plot means with10 plants each.

Weeks from planting		10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Weeks of flowering	2001	6/1-6/7	6/8-6/14	6/15-6/21	6/22-6/28	6/29-7/5	7/6-7/12	7/13-7/19	7/20-7/26	7/27-8/2	8/3-8/9	8/10-8/16	8/17-8/23	8/24-8/30	8/31-9/6	Total
	2002	6/1-6/7	6/8-6/14	6/15-6/21	6/22-6/28	6/29-7/5	7/6-7/12	7/13-7/19	7/20-7/26	7/27-8/2	8/3-8/9	8/10-8/16	8/17-8/23	8/24-8/30	8/31-9/6	
Giza 90	2001	0.40	0.17	1.33	1.17	5.40	9.67	7.47	15.60	11.17	2.90	2.83	1.57	0.67	0.07	60.42
	2002	0.00	0.27	0.77	1.70	3.67	5.00	8.20	7.70	6.53	4.33	2.90	1.10	0.53	0.07	42.77
	Comb.	0.20	0.22	1.05	1. 43	4.53	7.33	7.83	11.62	8.85	3.62	2.87	1.33	0.60	0.07	51.58
Giza 81 x Giza 83	2001	0.10	0.37	1.53	1.43	7.27	13.73	13.60	19.67	12.50	10.50	5.00	1.57	1.00	0.30	88.57
	2002	0.07	0.43	0.93	1.93	4.57	7.00	8.33	6.90	7.20	4.47	2.53	1.13	0.83	0.30	46.63
	Comb.	0.08	0.40	1.23	1.68	5.92	10.37	10.97	13.28	9.58	7.48	3.77	1.35	0.92	0.30	67.60
G. 83 x (G. 75 x 5844)	2001	0.17	0.17	2.67	2.17	8.10	13.33	10.57	21.57	12.20	10.97	2.80	1.17	0.70	0.10	86.67
	2002	0.00	0.27	1.47	2.40	4.57	5.03	7.27	6.07	4.83	3.87	3.13	1.27	0.80	0.63	41.60
	Comb.	0.08	0.22	2.07	2.28	6.33	9.18	8.92	13.82	8.52	7.42	2.97	1.22	0.75	0.37	64.13
L.S.D 2001	5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	4.12	N.S.	1.53	N.S.	N.S.	N.S.	0.20	20.57
	1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	2.54	N.S.	N.S.	N.S.	N.S.	N.S.
L.S.D 2002	5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	1.70	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
L.S.D Comb.	5%	N.S.	N.S.	0.25	0.22	N.S.	0.94	N.S.	N.S.	N.S.	0.33	N.S.	N.S.	N.S.	0.06	4.09
	1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.48	N.S.	N.S.	N.S.	N.S.	N.S.

Table 3. Mean number of position of the first fruiting node (PFN), days to first flower (DFF), mean maturity date (MMD) and production rate index (PRI) for three Egyptian cotton genotypes in (2001, 2002) and combined.

Genotypes	PFN			DFF			DFB			MMD			PRI		
	2001	2002	Comb.	2001	2002	Comb.	2001	2002	Comb.	2001	2002	Comb.	2001	2002	Comb.
Giza 90	6.33	6.00	6.17	73.33	68.33	70.83	131.0	131.0	131.0	147.7	149.3	148.5	1.24	1.43	1.33
Giza 81 x Giza 83	7.00	6.67	6.83	75.67	70.33	73.00	133.3	133.0	133.2	148.2	146.5	147.3	0.94	1.79	1.37
Giza 83 x (Giza 75 x 5844)	6.67	6.00	6.33	72.33	67.67	70.00	131.0	130.7	130.8	147.9	145.4	146.7	1.02	1.76	1.39
Mean	6.67	6.22	6.44	73.78	68.78	71.28	131.8	131.6	131.7	147.9	147.1	147.5	1.07	1.66	1.36
L.S.D.															
5%	N.S.	N.S.	0.20	N.S.	1.51	0.81	N.S.	1.51	N.S.	N.S.	2.72	0.55	N.S.	0.17	N.S.
1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.29	N.S.

Table 4. Mean average of PCH measures over seven picks in the three Egyptian cotton genotypes at the two growing seasons 2001, 2002 and their combined.

Genotypes	Season	Picking number						
		P_1	P_2	P_3	P_4	P_5	P_6	P_7
Giza 90	2001	11.40	36.44	50.28	73.42	92.91	97.03	100
	2002	12.12	31.52	50.53	67.77	81.79	95.31	100
	Comb.	11.76	33.98	50.41	70.59	87.35	96.17	100
Giza 81 x Giza 83	2001	5.39	33.11	55.02	76.22	93.92	97.47	100
	2002	12.83	35.06	58.74	81.50	92.33	98.68	100
	Comb.	9.11	34.09	56.88	78.86	93.13	98.08	100
G. 83 x (G. 75 x 5844)	2001	8.17	31.44	50.02	77.15	93.32	98.00	100
	2002	16.55	46.21	64.26	79.55	88.76	97.58	100
	Comb.	12.36	38.83	57.14	78.35	91.04	97.79	100
L.S.D. for genotypes								
2001	5%	3.01	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
	1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
2002	5%	N.S.	10.44	8.22	9.95	N.S.	2.40	N.S.
	1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Comb.	5%	0.93	N.S.	N.S.	2.54	1.63	N.S.	N.S.
	1%	1.35	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table 5. Simple correlation coefficients between seed cotton yield and between the earliness measurements.

Measurements	PFN	DFF	FBO	MMD	PRI
SCY	-0.244**	-0.019	-0.147**	-0.337**	0.497**
PFN		0.028	0.160**	0.182**	-0.233**
DFF			0.142**	0.044*	-0.204**
DFB				0.222**	-0.051**
MMD					-0.351**

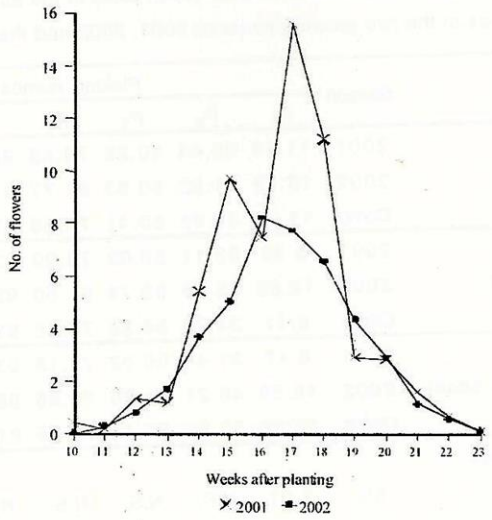

Fig. 1. The flowering curve of Giza 90 in the two seasons 2001 and 2002.

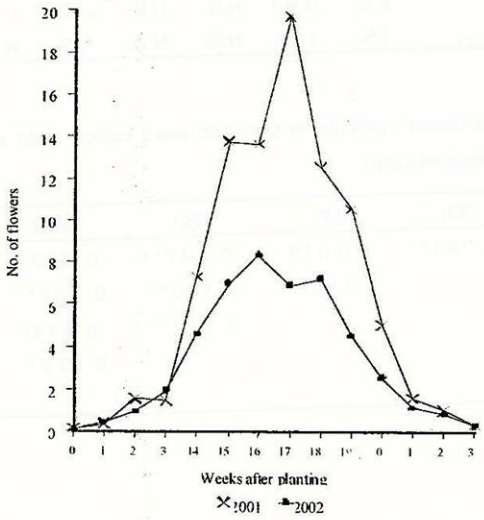

Fig. 2. The flowering curve of Giza 81 x Giza 83 in the two seasons 2001 and 2002.

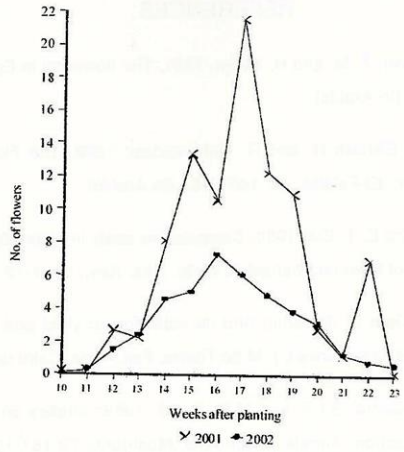

Fig. 3. The flowering curve of Giza 83 x (Giza 75 x 5844) in the two seasons 2001 and 2002.

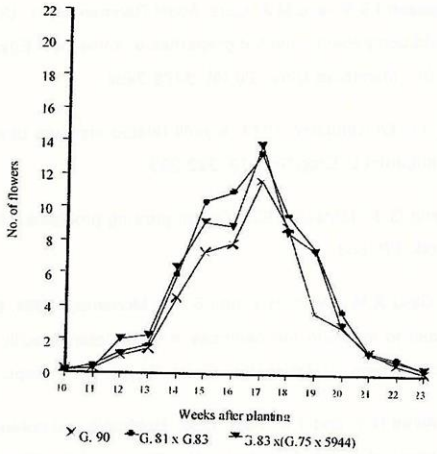

Fig. 4. The flowering curve of the studied genotypes (combined means of two seasons).

REFERENCES

1. Al-Didi, M.A.; Badawi, A. M. and H. Helmi. 1961. The flowering in Egyptian cotton. El-Felaha, 41:17-44. (In Arabic).

2. Al-Didi, M.A., Abd-Elkhalik H. and R. Mohamadain. 1968. The Flowering curves of Upper Egypt cotton. El-Felaha, 48: 149 - 164 (In Arabic).

3. Al-Enani, F A. A. and E .T. Eid. 1980. Comparative study in some Egyptian cotton varieties. 1- A study of flowering behavior. Agric. Res. Rev., 58: 1-12.

4. Atta, Y.M. 1970. Data of flowering and its selaction to yield and lint properties in Egyptian cotton (*G.barbadense L.*). M.Sc.Thesis, Fac. Agric. Cairo univ. Egypt.

5. Awad, H.Y., Abou-Zahra, S.I.S. and M.O. Ismail. 1989. Studies on gene action in a cross of Egyptian cotton. Annals of Agric.Sci.,Moshtohor,72:161-168.

6. Awaad, M. M. 1994. Studies of earliness in some Egyptian cotton genotypes. Proc.6th conf. Agron, Al-Azhar Univ, Cairo, Egypt, Vol 1: Sept. 1994.

7. Badr, S.S. M., Hassan I.S.M. and M.A. Laila. Abdel-Rahman. 2001. Comparative study on flowering, yield components and lint properties of some new Egyptian cotton cultivars. J. Agric. Sci. Mansoura Uinv., 26 (6) :3473-3486 .

8. Bilbro, S.O. and J.e. Quisenberry. 1973. A yield related measure of earliness for cotton Gossypium hirsutum L. Crop Sci., 13: 392-393.

9. Christidis, B.G. and G.J. Harrison. 1955. Cotton growing problems. McGrow-Hill Book Co., Inc., New York, PP. 633.

10. El-Agamy, A.I., Okaz A.M., Awad H.Y. and S.A.S. Mohamed. 1994. Evaluation of the six methods used to measure the earliness in some interspeecific crosses of cotton. Proc. 6th conf Agron, Al-Azhar Univ, Cairo, Egypt, Vol 1: Sept. 1994.

11. Khattab, A.M., Awad H.Y. and Y.M. Atta. 1982. Heterosis and potency ratio in some interspecific crosses of cotton. Fac. Agric. Ain. Shames Univ., Res. Bull., No. 1846, PP. 12.

12. Richmond, T.R. and S.A.H. Radwan.1962. A comparative study of seven methods of measuring earliness of crop maturity in cotton. Crop Sci. 6: 397- 400.

13. Richmond, T.R. and L.L. Ray. 1966. Product quantity measures of earliness of crop maturity in cotton. Crop Sci., (6): 235-239

14. Snedecor, G.W. and W.G. Cochran.1967. Statistical methods. Iowa state univ., press, Ames, Iowa, U.S.A.

دراسة صفات التبكير للتراكيب الوراثية الجديدة فى القطن المصرى

حسن حسين العدلى

معهد بحوث القطن - مركز البحوث الزراعية

تهدف الدراسة الى تقييم ثلاثة تراكيب وراثية جديدة وهى الصنف المبشر جيزة ٩٠ والهجينين المبشرين (جيزة ٨١ × جيزة ٨٣) و جيزة ٨٣ × (جيزة ٧٥ ×٥٨٤٤) وذلك بالمقارنة بينهم من حيث صفة التبكير فى النضج باستخدام سبع طرق مختلفة لقياس التبكير خلال موسمى ٢٠٠١،٢٠٠٢ هى:

وقد تم أخذ قراءات التزهير اليومى وذلك لعمل منحنى التزهير الأسبوعى كذلك اخذت جنيات أسبوعية لحساب النسبة المئوية للجنيات الاسبوعية PCH و متوسط تاريخ النضج MMD ومعدل الانتاجية فى وحدة الزمن PRI بالإضافة إلى قياس إرتفاع عقدة أول فرع ثمرى وتاريخ تفتح أول زهرة وكذلك تاريخ تشقق أول لوزة . وقد تم حساب معامل الارتباط البسيط لخمس طرق للتبكير مع محصول القطن الزهر. وكانت النتائج المتحصل عليها هى :

١- أعطى الهجين المبشر جـ ٨١ × جـ ٨٣ عدد أزهار أكثر من الهجين المبشر [جـ٨٣ × (جـ٧٥ ×٥٨٤٤)] والصنف المبشر جـ٩٠ .

٢- هناك اختلافات معنوية لطريقة حساب الجنيات الاسبوعيةPCH فى الاسبوع الاول والرابع والخامس . وقد كان التركيب الوراثى جـ٨١ × جـ ٨٣ هو أكثر التراكيب الوراثية تبكيرا حيث اعطى ٧٨،٨٦٪ من محصول القطن الزهر خلال الأربعة جنيات الاولى .

٣- أظهرت النتائج عدم وجود اختلافات عالية المعنوية عند مستوى ١٪ بين التراكيب الوراثية الثلاث وذلك لصفات التبكير المدروسة بينما أظهرت اختلافات معنوية عند مستوى ٥٪ وذلك لارتفاع عقدة أول فرع ثمرى و تاريخ تفتح أول زهرة ومتوسط تاريخ النضج .

٤- هناك ارتباط معنوى بين أربع طرق وذلك من طرق قياس التبكيروهى موقع اول فرع ثمرى وتاريخ تشقق اول لوزة ومتوسط تاريخ النضج MMD ومعدل الانتاجية PRI مع صفة محصول القطن الزهر لذا يمكن الاعتماد على أى طريقة منهم لقياس التبكير فى النضج وبالتالى المقارنة بين التراكيب الوراثية المختلفة.