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EFFECT OF PLANTING DATE, DENSITY AND NITROGEN FERTILIZATION ON SHEDDING, EARLINESS, YIELD AND FIBRE QUALITY OF EGYPTIAN COTTON

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ABSTRACT: Two field trials were performed during each of the summer season of 2001 and 2002 at the Agric. Res. Station, Fac. of Agric., Zagazig Univ., Egypt to study the effect of planting date (20th March and 20th April), planting density (70 000, 93 333 and 140 000 plant / fad) and nitrogen fertilization level (30, 60 and 90 kg N / fad) on flowering, boll shedding % and earliness criteria, yield as well as its attributes and fibre properties of Giza 85 cotton cultivar. In each season, separate trial was conducted for each planting date and the combination between planting densities and N levels (9 treatments) were arranged in a randomized complete block design replicated 4 times.

Early sowing date of 20th March reflected significant increases in each of: days to first flower appearance or boll opening, boll maturation period, earliness %, mean maturity date (MMD), production rate index (PRI), sympodia; total; open boll numbers / plant, boll weight, seed cotton yield / plant, relative photosynthetic potential of seed cotton yield / plant (RPP), seed and lint indices, lint %, seed and lint cotton as well as oil yields / fad, fibre length (at 2.5 or 50% span lengths), LUR% and Micronaire reading (fiber maturity). However, the 20th April planting date increased each of : height of the first sympodium, boll shedding %, plant height and stand / fad.

Also, the 70 000 plants / fad increased significantly RPP only. However, the medium plant stand of 93 333 plant/fad reflected considerably greater mean values respecting: earliness index, PRI , number of sympodia; total and open bolls/ plant, boll weight, seed cotton yield/plant, seed and lint indices, lint % and

the final cotton yields/ fad from seed, lint and oil. Moreover, the 140 000 plant /fad showed greater averages respecting: height of the first sympodium, days to first flower appearance and boll opening, boll period, boll shedding%, plant height and stand / fad. However, the three plant densities did not reflect any significant effect on all fibre traits tested.

The 30 kg N level exerted significant increase in RPP only. but, the medium N level of 60 kg N / fad reflected considerable increments respecting: earliness %, PRI, number of sympodia; total and open bolls / plant, seed cotton yield / plant, seed and lint indices, lint %, the final cotton yields (seed, lint and oil) / fad, fibre length (at 2.5 and 50% span lengths) and LUR% .Best of all, the 90 kg N/fad dose surpassed both 30 and 60 kg N levels respecting: height of the first sympodium, days to first flower initiation, boll period, boll shedding %, PRI and plant height at harvest.

Likewise, the three factors under study gave significant interaction effects on most studied characters. The most effective treatments which interacted strongly and induced early maturity crop, maximum yields/fad and improved fibre quality were the earlier planting date, 93333 plant / fad together with the 60 kg N level.

At last, no earliness, yield and fibre quality advantages could be obtained on Giza 85 cotton cultivar due to delaying planting till April, using the heavy population density of 140 000 plant / fad and applying excessive N level of 90 kg N/fad, especially under Zagazig conditions, Sharkia Governorate, Egypt.

INTRODUCTION

All over the world and particularly in Egypt, cotton could be considered as one of the most important fibre and oil crop contributing to National Welfare. Thus, it is necessary to consider the effect of cultural practices on earliness, yield and quality of a given cotton cultivar if the maximum advantage is to be obtained.

Delaying cotton planting date to the end of April reflected inverse effect on most of flowering and earliness parameters assembled herein as higher nodal position to first sympodium, shorter period to first flower appearance or boll opening as well as greater young

boll shedding as found by: Ali and El-Sayed (2001), Samia (2001) and Makram *et al.* (1994). In addition, late planting untill the end of April was found to decrease seed cotton yield and its attributes as documented by Hussein *et al.* (1983), Assy and Abdel-Malak (1997) and Ali and El-Sayed (2001). Likewise, most fibre properties such as fibre length (at 2.5 or 50% SL), fibre strength as well as micronaire reading showed significant decrease due to late planting date during the end of April as mentioned by Samra *et al.* (1982), Hussein *et al.* (1983), Abdalla *et al.* (1989) and El-Debaby *et al,* (1995). On the other hand, other workers recorded insignificant differences among cotton fibre properties due to varying planting dates, among them: Samia (1998) and Samia (2001).

As for plant stand effect on flowering and earliness traits, Salwa (1997) working on Giza 81, Giza 84 and Giza 85 cotton cvs, showed that height of first sympodium, flowering date, days to first boll opening, shedding %, MMD and PRI wer significantly increased due to higher plant population density of 140000 plant / fad. Reverse trend was given respecting earliness %. Similar views were seen by Ghanem and Abbas (1998) and Hamoda (2001). In addition, the plant density of 70000 or 93333 plants / fad reflected marked increment in most yield and yield attributes as demonstrated by Abuldahab and Hassanein (1991), Hosny *et al* . (1995) and Ghanem and Abbas (1998). Furthermore, lower or medium plant density of 70000 or 93333 plant /fad improved most fibre properties as shown by Hussein *et al.* (1983), Abdalla *et al.* (1989) and El-Debaby et al. (1995). On the other hand Samia (1998) and Samia (2001) recorded insignificant differences between cotton fibre characters due to varying plant densities.

Respecting N fertilization effect on flowering characters and earliness measurements, most workers reported inferior trend on such group of characters in case of higher N fertilization level over 60 kg N/fad assembled herein as

higher nodal position of first sympodium, longer period to first flower appearance or boll opening, young boll shedding % and earliness index, among them: El-Sayed and El-Menshawi (2001) and El-Shazly and El-Masri (2003). Also, N fertilization level of 60 kg N/fad detected pronounced effect on most yield and yield contributing characters of cotton as documented by: Ghaly *et al.* (1982), Samia (1998), Hamissa *et al.* (2000), El-Shazly and El-Masry (2003). In addition, the suitable N dose of 60 kg N/fad gave favourable effect on most fibre traits such as fibre length at 2.5 or 50% SL, LUR%, fibre strength, and Micronaire reading as cited by Mohamed *et al.* (1987) and Fawkia and Abdullah (2003). But, El-Shazly and El-Masry (2003) recorded insignificant effect of N fertilization levels on most cotton fibre properties.

Ultimately, this investigation aimed to study the effect of planting date, plant stand and N fertilization on flowering as well as boll shedding % and earliness parameters, yield as well as its related traits and fibre technological properties of Giza 85 cotton cultivar.

MATERIALS AND METHODS

This study was excuted in 2001 and 2002 seasons at the Agric. Res. Station, Fac. of Agric., Zagazig Univ., Egypt, to investigate the effect of planting date, plant density and N fertilization on earliness, yield and fibre properties of Giza 85 cotton cultivar.

Studied factors:

The 3 studied factors were as below:

A- Planting date (time), T:

20^{th} March and 20^{th} April.

B- Planting density, stand, D:

Three planting densities were tried as follows:

Three planting densities (70000, 93333 and 140000 plants / fad) were tried through varying hill spacing (20 , 15 and 10cm) on ridges 60 cm apart and leaving two plants / hill at thinning.

C- Nitrogen fertilization level:

Three N levels were used in this work, being 30, 60 and 90 kg N/fad.

Separate experiments were devoted for each planting date where the three hill spacings along

with the three N levels were arranged in a randomized complete block design replicated 4 times. Each experimental plot ($16.8m^2$) included 7 ridges 60 cm apart wide and 4.0 meter long. The two outer ridges were left as a border and the other internal five ridges were used for the determination of boll shedding %, earliness parameters and yield as well as its attributes.

The soil analysis of the experimental fields was done on samples taken from the upper 30 cm soil surface and showed that the soil was clay loam textured having 21.5, 20.5 and 165 ppm of available N, P and K, respectively with pH of 7.4 and 2.06 mmhos/cm^2 electrical conductivity. The organic matter and $CaCO_3$ contents were 1.35 and 2.35%, orderly (averages of both seasons).

The preceding crop was maize in both trials. Acid - delinted seeds of Giza 85 cotton cv were sown at the rate of 40 kg /fad on March and April 20th according to the studied planting dates. Phosphorus and Potassium fertilizers were added fully for all treatments at seed - bed preparation at a rate of 31.0 kg P_2O_5 and 25 kg K_2O/fad in the form of calcium - superphosphate (15.5% P_2O_5) and potassium sulphate (50% K_2O), respectively. Nitrogen fertilizer as urea (46.5% N) was applied in 2 equal splits, the first was added after thinning (before the second irrigation) and the second was applied 2 weeks later. The other cultural practices were conducted as usual. The seed cotton yield/2.4 m^2 was collected in 2 pickings, i.e Sept. 1st and Sept. 15th for the first picking, whereas the second picking was made 3 weeks later.

Studied characters :

A- Flowering, boll shedding % and earliness attributes :

Six guarded plants from the third ridge of each experimental unit were labeled and the flowers were tagged daily from the first flower appearance till the first boll opening, then the following characters were recorded:

1- Height (nodal position) of the first sympodium (cm).
2- Number of days to the appearance of the first flower.
3- Number of days to the first boll opening.
4. Boll maturation period in days (3 - 2).
5- Boll shedding% =

$$\frac{\text{Total No. of flowers / plant - total No. of bolls / plant}}{\text{Total No. of flowers / plant}} \times 100$$

6- Earliness % (earliness index) =

$$\frac{\text{Yield of seed cotton for the first picking}}{\text{Total yield of seed cotton for the 2 pickings}} \times 100$$

7- Mean maturity date (MMD), days (Christides and Harrison, 1955).

8- Production rate index (PRI), amount of seed cotton produced per unit time: It was determined according to Bilbro and Quisenberry (1973).

B- Yield and yield attributes:

At maturity, 6 consecutive plants were picked from the fifth ridge in each experimental unit, then the following characters were determined:

1- Plant height (cm).
2- Number of sympodia / plant.
3- Number of total bolls / plant.
4- Number of open bolls / plant.
5- Boll weight (gm).
6- Seed cotton yield / plant (gm).
7-Relative photosynthetic potential (RPP):

$$= \frac{\text{Seed cotton yield / plant (gm)}}{\text{LAI at 105 day - age}} \text{ gm / LAI.}$$

Thereafter, the cotton plants of the centeral ridge (2.4 m^2) were counted and picked twice according to the planting date tested, then the following traits were recorded:

8- Number of plants / 2.4 m^2, then converted to number of plants /fad (thousand).
9- Seed index, 100 - seed weight , gm.
10- Lint index, weight of lint / 100 seeds (gm).
11- Lint percentage =

$$\frac{\text{Weight of lint in gm}}{\text{Weight of seed cotton in gm}} \times 100$$

12- Seed cotton yield / fad (kentar), one kentar = 157.5 kg seed cotton.
13- Lint cotton yield / fad (kentar), one kentar = 50 kg lint cotton.
14- Oil yield /fad (kg). = was estimated by multiplying seed cotton yield / fad with seed oil % and dividing by 100.

C- Fibre technological properties:

Lint samples were taken at random from each treatment for all replicates to determine the following fibre properties:

A- Fiber length parameters:

1- Fibre length at 2.5% span length, (SL), mm.
2- Fibre length at 50% span length, (SL), mm.
3- Length uniformity ratio (LUR %).
4- Fibre bundle strength, Pressley index (P I).

5- Micronaire value or reading (fiber fineness and maturity).

All fibre property tests were carried out by following the procedure mentioned by A.S.T.M. (1976).

Data of each season and over seasons were subjected to statistical analysis according to Das and Giri (1986). Because of the homougenity of the results of the two seasons, the combined data of all traits will be presented and discussed only in this paper. Also, the mean values were compared by Duncans, Multiple Range Test (Duncan, 1955). In interaction Tables of the pooled data, capital and small letters were used to compare both row and column averages, orderly.

RESULTS AND DISCUSSION

A- Flowering and earliness parameters:

A-I - Planting date effect:

Data recorded in Table (1) indicate significant variation between 20th March and 20th April planting dates, where the former produced greater mean values than the latter in each of: days to first flower appearance as well as boll opening, boll maturation period, earliness %, MMD and PRI. Reversable trend was seen as for height of the first sympodium and shedding %, as they showed marked increase in favour of April planting date. These results clearly indicate that the growth and development of cotton plants were favoured by early planting in March. Similar views were documented by Makram *et al.* (1994) El-Sayed and El-Menshawi (2001) and Samia (2001).

A-2- Planting density effect:

Significant changes could be observed among the three planting densities, where the 140 000 plant stand possessed greater averages than 93 333 and 70 000 plant densities / fad as for: height of the first sympodium, days to first flower appearance and boll opening, boll period, boll shedding % and MMD. On the other hand, the medium plant stand excerted considerable increases in earliness index and PRI (Table 1). It is obvious that, the cotton plants of wider hill spacing (15 to 20) had more advantage with land use and solar radiation use, thus faster maturity took place. Similar results were given by Salwa (1997),

Table (1): Flowering and earliness parameters of cotton as affected by planting date, planting density and N level and their interactions (pooled data).

Main effects and interactions	Height of the first sympodium (cm)	Days to first flower appearance	Days to first boll opening	Boll maturation period (days)	Boll shedding percentage (%)	Earliness index, (percentaeg) (%)	Mean maturity date(MMD), (days)	Production rate index (gm/day)
Planting date, T:								
20th March	22.91^{b}	88.64^{a}	141.30^{a}	52.66^{a}	9.55^{b}	70.50^{a}	164.30^{a}	9.29^{a}
20th April	26.81^{a}	77.22^{b}	128.80^{b}	51.58^{b}	12.77^{a}	67.30^{b}	160.00^{b}	7.53^{b}
F. test	*	*	**	*	*	*	**	*
Planting density, plant /fad, D:								
70 000	23.26^{c}	81.75^{c}	133.29^{c}	51.54^{c}	9.70^{b}	69.15^{b}	161.14^{b}	8.07^{b}
93 333	24.48^{b}	83.07^{b}	135.13^{b}	52.06^{b}	10.31^{b}	71.70^{a}	159.08^{c}	9.88^{a}
140 000	26.84^{a}	83.97^{a}	136.73^{a}	52.76^{a}	13.47^{a}	65.85^{c}	166.23^{a}	7.28^{c}
F. test	**	*	**	*	**	**	**	**
Nitrogen levels (kg N/fad), N:								
30	21.94^{c}	82.04^{c}	133.31^{c}	51.27^{c}	10.02^{b}	68.95^{b}	161.40^{b}	7.65^{b}
60	23.90^{b}	82.83^{b}	135.08^{b}	52.25^{b}	10.28^{b}	71.00^{a}	160.40^{c}	11.15^{a}
90	28.74^{a}	83.92^{a}	136.76^{a}	52.84^{a}	13.18^{a}	66.75^{c}	164.65^{a}	6.43^{c}
F.test	**	*	**	*	*	**	**	**
Interactions:								
T x D	*	*	*	*	*	*	*	N.S
T x N	N.S	N.S	N.S	N.S	N.S	*	N.S	*
D x N	N.S	N.S	N.S	N.S	*	*	N.S	*

Ghanem and Abbas (1998) and Hamoda (2001).

A-3- Nitrogen fertilization level effect:

Table (1) indicates significant differences amongst the three N levels as for all flowering and earliness characters, since the highest N level of 90 kg N / fad exceeded both 60 and 30 kg ones in : height of first sympodium, days to first flower appearance or boll opening, boll maturation period, shedding % and MMD. It means that such heavy N level pushed cotton plants to vegetative growth and delayed cotton maturation. At the same - time, the medium N level of 60 kg N/fad gave the best earliness trend expressed herein as greater earliness index and PRI. The results of other researchers, being El-Sayed and El-Menshawi (2001) and El-Shazly and El-Masry (2003) emphasized such trend.

A-4- Interaction effect:

Significant interactions effects between planting dates and planting densities as for height of the first sympodium, days to first flower appearance or boll opening, boll period, shedding %, earliness index and MMD is shown in Tables (1-a) and (1-b). It is obvious that planting during March along with 93333 plant stand gave greater value in earliness index. Also, such earlier planting date interacted strongly with 140000 plant / fad regarding days to first flower appearance or boll opening, boll period and MMD. On the other hand, late planting during April recorded higher greater mean averages in height of the first sympodium and shedding % when the denser planting stand of 140000 plant / fad was considered.

In addition, earliness % and PRI had greater mean records when the cotton plants were sown during March and received 60 kg N level (Table 1-c).

Moreover, earliness % and PRI were greatly favoured due to the interaction effect between 93 333 plant stand along with 60 kg N dose / fad. At the same - time, the 140 000 plant stand together with 90 kg N level produced greater mean averages in shedding % as found from the combined data of Table (1-d).

B- Yield and its related characters :

B-1- Planting date effect:

Tables (2 and 3) indicate that

Table (1-a): Boll shedding %, earliness index and mean maturity date of cotton due to the T x D interaction (pooled data).

Plant stand / fad, D:	Boll shedding %		Earliness index		Mean maturity date	
	Planting date (T)					
	20th March	20th April	20th March	20th April	20th March	20th April
70 000	B 8.50^{c}	A 10.90^{c}	A 70.00^{b}	B 68.30^{b}	A 162.00^{b}	B 160.28^{b}
93 333	B 9.12^{b}	A 11.50^{b}	A 74.00^{a}	B 69.40^{a}	A 160.00^{c}	B 158.16^{c}
140 000	B 11.03^{a}	A 15.91^{a}	A 67.50^{c}	B 64.20^{c}	A 170.90^{a}	B 161.56^{a}

Table (1-b): Height of the first sympodium (cm) and other traits of cotton for the TxD interaction (pooled data).

Plant stand (plant/fad), D:	Height of the first sympodia (cm)		Days to first flower appearance		Days to first boll opening		Boll maturation period (days)	
	Planting date (T)							
	20th March	20th April	20th March	20th April	20th March	20th April	20th March	20th April
70 000	B 21.52^{c}	A 25.00^{c}	A 88.00^{b}	B 75.50^{c}	A 140.58^{b}	B 126.00^{b}	A 51.74^{c}	B 51.34^{b}
93 333	B 22.96^{b}	A 26.00^{b}	A 88.20^{b}	B 77.94^{b}	A 140.26^{b}	B 130.00^{a}	A 52.90^{b}	B 51.22^{b}
140 000	B 24.25^{a}	A 29.43^{a}	A 89.72^{a}	B 78.22^{a}	A 143.06^{a}	B 130.40^{a}	A 53.34^{a}	B 52.18^{a}

Table (1-c): Earliness index and production rate index (PRI) of cotton for the T x N interaction (pooled data).

Nitrogen levels (kg/fad), N:	Earliness percentage (index)		Production rate index (PRI)	
	Planting date			
	20th March	20th April	20th March	20th April
30	A 70.00^{b}	B 67.90^{b}	A 8.30^{b}	B 7.00^{b}
60	A 73.00^{a}	B 69.00^{a}	A 12.00^{a}	B 10.30^{a}
90	A 68.50^{c}	B 65.00^{c}	A 7.57^{c}	B 5.29^{c}

Table (1-d): Boll shedding %, Earliness index and production rate index (PRI) of cotton for the D X N interaction (pooled data).

Nitrogen levels (kg/fad), N:	Boll shedding percentage %			Earliness index			Production rate index (PRI)		
	Plant population (pant /fad)								
	70 000	93 333	140 000	70 000	93 333	140 000	70 000	93 333	140 000
30	C 8.50^{c}	B 9.50^{c}	A 12.06^{b}	B 70.00^{b}	A 71.00^{b}	C 65.85^{b}	B 6.95^{b}	A 9.50^{b}	B 6.50^{b}
60	C 9.00^{b}	B 10.03^{b}	A 11.81^{c}	B 72.00^{a}	A 74.00^{a}	C 67.00^{a}	B 11.00^{a}	A 12.45^{a}	C 10.00^{a}
90	B 11.60^{a}	B 11.40^{a}	A 16.54^{a}	B 65.45^{c}	A 70.10^{c}	C 64.70^{c}	B 6.26^{c}	A 7.69^{c}	C 5.34^{c}

Table (2): Plant height, number of sympodia and bolls /plant, boll weight, seed cotton yield/plant and relative photosynthetic potential of cotton as affected by planting date, planting density and N level (pooled data).

Main effects and interactions	Plant height (cm)	Number of sympodia /plant	Number of total bolls / plant	Number of open bolls / plant	Boll weight (gm)	Seed cotton yield/plant (gm)	Relative photosynthetic potential (RPP)
Planting date, T:							
20th March	95.69^{b}	9.17^{a}	12.16^{a}	11.07^{a}	2.53^{a}	28.11^{a}	4.64^{a}
20th April	103.87^{a}	6.61^{b}	10.34^{b}	8.73^{b}	2.13^{b}	19.63^{b}	3.48^{b}
F. test	**	**	**	**	*	**	*
Planting density, plant/fad, D:							
70 000	95.53^{c}	7.94^{b}	11.84^{b}	10.04^{b}	2.40^{b}	24.71^{b}	5.77^{a}
93 333	99.97^{b}	9.42^{a}	12.87^{a}	11.31^{a}	2.54^{a}	28.78^{a}	4.22^{b}
140 000	103.84^{a}	6.31^{c}	9.04^{c}	8.35^{c}	2.05^{c}	18.12^{c}	2.19^{c}
F. test	**	**	**	**	*	**	**
Nitrogen levels (kg N/fad), N:							
30	92.65^{c}	7.92^{b}	11.42^{b}	9.70^{b}	2.29^{b}	25.67^{b}	6.14^{a}
60	98.30^{b}	9.21^{a}	12.30^{a}	11.68^{a}	2.53^{a}	27.81^{a}	3.31^{b}
90	108.39^{a}	6.54^{c}	10.03^{c}	8.32^{c}	2.17^{c}	18.13^{c}	2.73^{c}
F.test	**	**	**	**	*	**	**
Interactions:							
T x D	N.S	*	N.S	*	N.S	*	N.S
T x N	*	N.S	*	N.S	N.S	*	N.S
D x N	*	*	*	*	*	*	**

Table (3): Seed cotton and oil yields / fad and some yield attributes of cotton as affected by date of planting, plating density and N level (pooled date).

Main effects and interactions	Number of plants / fad at harvest (thousand)	Seed index (gm)	Lint index (gm)	Lint percentage (%)	Seed cotton yield / fad (kentar)	Lint cotton yield / fad (kentar)	Oil yield / fad (kg)
Planting date, T:							
20th March	87.60^{b}	11.66^{a}	5.90^{a}	38.56^{a}	8.78^{a}	10.44^{a}	219.43^{a}
20th April	93.80^{a}	9.80^{b}	4.80^{b}	36.46^{b}	7.22^{b}	8.50^{b}	173.31^{b}
F. test	**	*	*	*	*	**	**
Planting density, plant/fad, D:							
70 000	67.60^{c}	10.69^{b}	5.13^{b}	37.21^{b}	7.87^{b}	9.06^{b}	198.80^{b}
93 333	81.60^{b}	12.13^{a}	6.32^{a}	38.87^{a}	9.46^{a}	11.50^{a}	221.89^{a}
140 000	122.90^{a}	9.37^{c}	4.60^{c}	36.45^{c}	6.67^{c}	7.85^{c}	168.42^{c}
F. test	**	*	*	*	**	*	**
Nitrogen levels (kg N/fad), N:							
30	88.80^{c}	10.45^{b}	5.30^{b}	37.28^{b}	7.58^{b}	8.92^{b}	203.53^{b}
60	92.80^{a}	12.39^{a}	6.10^{a}	39.06^{a}	9.85^{a}	11.66^{a}	218.73^{a}
90	90.50^{b}	9.35^{c}	4.65^{c}	36.19^{c}	6.57^{c}	7.83^{c}	166.85^{c}
F.test	**	**	*	**	**	**	**
Interactions:							
T x D	**	N.S	*	N.S	*	*	**
T x N	N.S	*	N.S	N.S	*	*	**
D x N	N.S	*	*	*	**	**	*

the two studied planting dates i.e. 20th March and 20th April varied significantly in their yield and its related traits, since the former exceeded the later as to: number of sympodia, total as well as open bolls / plant, boll weight, and seed cotton yield / plant, RPP, seed as well as lint indices, lint % and the final yields/ fad from seed, lint and oil. Reversible trend was seen regarding plant height and stand /fad as they were favoured in case of April planting date. Such planting date difference may be due the environmental conditions either climatic or edaphic prevailing during the different cotton growth stages. These results are in a good line with those documented by Hussein *et al.* (1983) and Assy and Abdel - Malak (1997).

B-2- Planting density effect:

The three hill spaces of different plant densities detected marked changes in all yield and its related characters, where the 20 cm hill space (70 000/ fad) increased RPP only. Meanwhile, plant height, and plant stand /fad showed significant increase due to 140 000 plant / fad. In addition, the intermediate hill spacing (93333 plant/fad) gave considerable mean averages in the rest yield attributes and yield , being: numbers of sympodia, total as well as open bolls/ plant, boll weight, seed cotton yield/ plant, seed and lint indices, linting % and the final yields per unit land area from seed, lint cotton and oil (Tables 2 and 3). It could be concluded that the increase in plant height as well as plant stand / fad in relation to the closed hill spacing may be due to the intensive competition among dense sown plants on the growth element factors. At the same - time, the intermediate hill spacing of 15 cm proved to be more suitable for cotton plants where they carried more fruiting parts due to exploiting the available environmental factors existed in the surrounding media to the better and this was prone positively to the final yields per unit land area. Analogous results have been proposed by Abuldahab and Hassanin (1991), Hosny *et al.* (1995) and Ghanem and Abbas (1998).

B-3- Nirtogen fertilization level effect:

The results listed in Tables (2) and (3) further indicate that the

three N levels examined reflected considerable changes in seed cotton and oil yields and their related attributes. The plants of 30 kg N dose got greater averages from RPP, while the others of 90 kg N level were taller, but the plants receiving 60 kg N level / fad possessed superior or better mean averages in the rest traits, being: numbers of sympodia, total and open bolls / plant, boll weight, as well as seed cotton yield /plant, seed and lint indices, linting rate, and the final yields per unit land area from seed, lint cotton or oil. In general, the stimulative effect of N nutrient may be ascribed to its role in enhancing photosynthesis and the other biochemical processes of cotton plants which contributed much for such improvement of yield and its attributes. These findings corroborate the results put forward by Ghaly *et al.* (1988), Samia (1998) and Hamissa *et al.* (2000).

B-4- Interaction effect:

The interactions effects among the different factors on such group of characters would be confined only on the final yields / fad as shown from the pooled data listed in Tables (3-a, b and c). It is evident that the early sown cotton plants in March gained greater final yields from seed, lint and oil when were grown at 15 cm hill spacing or fertilized with 60 kg N level/ fad. Into the bargin, the plants spaced by 15 cm and received medium N level of 60 kg N/fad accrued higher yields/fad from seed, lint cotton and oil when compared with the lower or higher N doses under study. It means that planting dates, planting densities and N levels played interactive roles to maximize the final cotton yields from seed, lint and oil per unit land area for Giza 85 cotton cultivar.

C- Fibre technological properties:

C-1- Planting date effect:

The combined data in Table (4) reveal that the two planting dates: viz., 20th March and 20th April reflected significant differences regarding the five fibre traits studied, being fibre length either at 2.5 or 50% span lengths, LUR%, fibre strength and micronaire reading, where the former planting date was superior in this regard. It could be seen that the 20 March planting not only maximized the final cotton yields/ fad, but also improved their fibre properties.

Table (3-a): Seed, lint cotton and oil yields / fad of cotton due to the Tx D interaction (combined date).

Planting density, (plant /fad), D:	Seed cotton yield / fad (kentar)		Lint cotton yield / fad (kentar)		Oil yield /fad (kg)	
	Planting date (T)					
	20th March	20th April	20th March	20th April	20th March	20th April
70 000	A 8.70^{b}	B 7.04^{b}	A 10.00^{b}	B 8.12^{b}	A 210.00^{b}	B 187.60^{b}
93 333	A 10.00^{a}	B 8.92^{a}	A 12.50^{a}	B 10.50^{a}	A 240.00^{a}	B 203.78^{a}
140 000	A 7.64^{c}	B 5.70^{c}	B 8.82^{c}	A 6.88^{c}	A 208.29^{c}	B 128.55^{c}

Table (3-b): Seed, lint cotton and oil yields / fad due to the TxN interaction (pooled data).

Nitrogen levels (kg N/fad), N:	Seed cotton yield / fad (kentar)		Lint cotton yield / fad (kentar)		Oil yield /fad (kg)	
	Planting date (T)					
	20th March	20th April	20th March	20th April	20th March	20th April
30	A 8.16^{b}	B 7.00^{b}	A 10.00^{b}	B 7.84^{b}	A 220.00^{b}	B 187.06^{b}
60	A 10.70^{a}	B 9.00^{a}	A 12.72^{a}	B 10.60^{a}	A 230.00^{a}	B 207.46^{a}
90	A 7.48^{c}	B 5.66^{c}	A 8.60^{c}	B 7.06^{c}	A 208.29^{c}	B 125.41^{c}

Table (3-c): The final yields/ fad from seed, lint and oil of cotton in response to the Dx N interaction (pooled data).

Nitrogen levels (kg/fad), N:	Seed cotton yield / fad (kentar)			Lint cotton yield / fad (kentar)			Oil yield /fad (kg)		
	Plant population (palnt / fad), D:								
	70 000	93 333	140 000	70 000	93 333	140 000	70 000	93 333	140 000
30	B 7.50 b	A 9.00 b	C 6.24 b	B 8.00 b	A 11.26 b	C 7.50 b	B 200.00 b	A 230.00 b	C 180.59 b
60	B 9.80 a	A 11.00 a	C 8.75 a	B 12.00 a	A 13.48 a	C 9.50 a	B 220.00 a	A 240.00 a	C 196.19 a
90	B 6.31 c	A 8.38 c	C 5.02 c	B 7.18 c	A 9.76 c	C 6.55 c	B 176.40 c	A 195.67 c	C 128.48 c

The present trend is in a general agreement with those cited by Samra *et al.* (1982), Hussein *et al.* (1983), Abdalla et al. (1989) and El-Debaby *et al.* (1995). However, other workers reported insignificant variations among the different cotton planting dates regarding cotton fibre properties, of them: Samia (1998) and Samia (2001).

C-2- Planting density effect:

The three hill spacings of 20, 15 and 10 cm apart which realized theoretical number of plants/ fad at sowing being, 70 000, 93 333 and 140 000 plant / fad reflected insignificant variations among their cotton fibre properties tested, (Table 4). Similar views were expressed by Abedel-Fattah (1979) and Samia (2001). Other workers recorded significant distinctions among the different hill spacings as for some physical fibre properties, of them: Abdalla *et al.* (1989) and Hamoda (2001).

C-3- Nitrogen fertilization level effect:

The three N levels: i.e, 30, 60 and 90 kg N /fad detected significant changes in cotton fibre lengths (at 2.5 or 50% span lengths) and LUR%, being more obvious in response to the 60 kg N level than the two other ones. At the same-time, both Pressley index and micronaire reading showed insignificant response to the three N levels tested (Table (4). The stimulatory effect of N fertilization on cotton fibre properties was also

Table (4): Fibre length and other fibre properties of cotton as affected by planting date, planting density and N level (pooled data).

Main effects and interactions	Fibre length at 2.5% span length (mm)	Fibre length at 50% span length (mm)	Length uniformity ratio % (LUR%)	Fibre strength (pressley index)	Micronaire reading
Planting date, T:					
20th March	30.22[a]	18.22[a]	60.32[a]	11.03[a]	4.35[a]
20th April	28.20[b]	16.12[b]	57.13[b]	9.15[b]	3.07[b]
F. test	*	*	**	*	*
Planting density, plant / fad. D:					
70 000	29.03	17.10	58.80	10.06	3.91
93 333	29.22	17.24	59.01	10.40	3.71
140 000	29.38	17.17	58.38	9.81	3.51
F. test	N.S	N.S	N.S	N.S	N.S
Nitrogen levels (kg N/fad), N:					
30	28.51[b]	16.60[b]	57.80[b]	10.08	3.56
60	30.98[a]	19.06[a]	62.08[a]	10.45	3.62
90	28.14[b]	15.85[b]	56.31[c]	9.74	3.95
F.test	*	*	*	N.S	N.S
Interactions:					
T x D	N.S	N.S	N.S	N.S	N.S
T x N	*	**	**	N.S	N.S
D x N	N.S	N.S	N.S	N.S	N.S

documented by : Mohamed et al. (1987) and Fawkia and Abdullah (2003). However, El-Shazly and El-Masri (2003) recorded insignificant effects for the different N levels respecting their fibre properties. It could be observed that the discrepancy between the studied results and those recorded by others as for the effect of planting date, planting density and N fertilization level on cotton fibre properties may be due to differences in seasonal and / or soil conditions beside the cultivar used.

C-4- Interaction effect:

It is clear from the data of Table (4-a) that the cotton plants sown early during March and fertilized with 60 kg N dose produced significantly greater mean values as for fibre length at 2.5 or 50% span lengths as well as LUR %, relative to the plants sown late during April and fertilized with 30 or 90 kg N levels.

In breif: It could be concluded that, sowing Giza 85 cotton cultivar at 20th of March with planting density of 93333 plant/fad and addition of 60 kg N/fad are considered the most recommended treatments as they improved growth and development of cotton plants and ensured greater production at the first picking. These improvements were reflected in seed, lint cotton and oil yields/ fad as well as fibre quality, especially under the poorly fertility soil of Zagazig locality, Sharkia Governorate, Egypt.

Table (4-a): Cotton fibre lengths at 2.5 and 50% span length (SL) and length uniformity ratio (LUR%) due to the T x N interaction (integrated data).

Nitrogen levels (kg N/fad.) (N)	Fibre length at 2.5% SL (mm)		Fibre length at 50% SL (mm)		Length uniformity ratio (LUR %)	
	Sowing dates (S)					
	20th March	20th April	20th March	20th April	20th March	20th April
30	A 29.50^{b}	B 27.52^{b}	A 17.50^{b}	B 15.70^{b}	A 59.60^{b}	B 56.00^{b}
60	A 32.00^{a}	B 29.96^{a}	A 20.12^{a}	B 18.00^{a}	A 64.00^{a}	B 60.16^{a}
90	A 29.16^{b}	B 27.12^{b}	A 17.04^{b}	B 14.66^{c}	A 57.39^{c}	B 55.23^{b}

REFERENCES

Abdalla, E.H.; E.M. Shalaby; A.M. Eissa and K.K.T. Abdel - Malak (1989). Effect of planting systems, planting dates and distance between hills on seed and fibre properties and net return of cotton. Assiut J. Agric. Sci., 20 (2) : 267 - 278.

Abed El-Fattah, M.Kh. M. (1979). Effect of plant population density and sowing date on some Egyptian cotton cultivars. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Abuldahab, A. and M.A. Hassanin (1991). Analytical study of yield and its components of Egyptian cotton under different N levels and plant population densities. Res.Bull. Fac. of Agric. Univ. of Cairo, 42 (3) : 1029 - 1047.

Ali, S.A. and A.E. El-Sayed (2001). Effect of sowing dates and nitrogen levels on growth, earliness and yield of Egyptian cotton cultivar Giza 88. Egypt . J. Agric. Res., 79 (1): 221 - 232.

A.S.T.M. (1976). American Society for Testing and Materials. Designation, D - 2253 - 66, D - 1447 - 67, D - 3818 - 79, D- 1578- 67 and D - 2225 - 64.

Assy, K.G. and K.K.I. Abdel - Malak (1997). Response of the Egyptian cotton cultivar Giza 83 to nitrogen rates and time of application under different sowing dates. Egypt J. Agric. Res., 75 (4): 1097 - 1112.

Bilbro, S.D. and J.E. Quisenberry (1973). A yield related to earliness for cotton, *Gossypium hirsutum*, L.Crop Sci., 13: 392- 393.

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

Das, MN. and N.C. Giri (1986). Design and Analysis of the Experiments. 2nd Eddition, John Wiley and Sons. Inc., New York, USA.

Duncan, D.B. (1955). Multiple Range and Multiple F-Tests. Biometrics, 11: 1 - 42.

El-Debaby, A.S.; G.Y. Hammam and M.A. Nagib (1995). Effect of planting date, N and P application levels on growth characters of Giza 80 cotton cultivar. Annals of Agric. Sc.; Moshtohor, 33 (2): 441 - 454.

El-Sayed, E.A. And M. El-Menshawi (2001). Response

of late sowing cotton cultivar Giza 88 to times of potassium application under different levels of nitrogen. J. Agric. Sci., Mansoura Univ., Egypt 26 (9): 5177 - 5188.

El-Shazly, W.M.O. and M.F. El-Masri (2003). Response of cotton (cultivar Giza 89) to mineral nitrogen fertilization and growth retardant (uniconazole). Minufiya J. Agric. Res., 28 (3) : 821-856.

Fawkia, K. El-Khatib and S.Sh Abdullah, (2003). Cotton yield and quality as affected by nitrogen fertilization and drop defoliant Egypt J. Appl. Sci., 18 (4A) : 167 - 182.

Ghaly, F.M.; H.A. Abd El-Aal an A.M. El-Shinnawy (1988). Effect of topping dates and nitrogen levels on yield and yield components of Giza 75 cotton cultivar. Annals of Agric. Sci., Moshtohor, 26 (3): 1483 - 1492.

Ghanem, S.A.I. and M.A. Abbas (1998). Yield and its attributable characters of cotton as impacted by planting pattern, time of nitrogen fertilizer application and indole butyric acid treatment. Zagazig J. Agric. Res., 25 (3): 365 - 383.

Hamissa, A.M.; K.A. Ziadah and M.F. El-Masri (2000). Response of cotton to biofertilizer and nitrogen fertilization. Minufiya J. Agric. Res., 25 (2): 371 - 388.

Hamoda, S.A.F. (2001). Study on boll retention and yield of some cotton (*Gossypium barbadense*, L.) genotypes. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Hosny, A.A.; H.M. Eid and K.A. Ziadah (1995). Prediction of optimum population density and row spacing for cotton in different regions of Egypt. Annals of Agric. Sci., Moshtohor, 33 (1): 1 - 20.

Hussein, M.A.; E.A. El-Shaer; F.A. Makram and M.Kh. M. Abed El-Fattah (1983). Effect of planting date on growth and some properties in 2 Egyptian cotton cultivars. 1st Conf. Agron. Egyptian Soc. of Crop. Sci., 2: 709 - 717.

Makram, E.A.; H.A. Abd El-Aal; K.A. Ziadah and A.A. Darwish (1994). The interrelationship between planting date and each of hill spacing and nitrogen fertilization doses for the Egyptian cotton cultivar Giza

75. Annals Agric. Sci. Ain - Shams Univ., Cairo, 39 (2): 609 - 622.

Mohamed M.K.; H.R.A. El-Deepah and A.A. El-Hosary (1987). Effect of fertilization on yield and fibre properties of some cotton cultivars. Annals of Agric. Sci.; Moshtohor, 25 (2): 645 - 657.

Salwa, M.A.I. Ash-Shormillesy, (1997). Effect of some agronomic practices on earliness in Egyptian cotton. M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

Samia, El-B.S., Ali (1998). Study of some factors affecting over growth in Egyptian cotton. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Samia, Sh. El-Tabbakh, (2001). Effect of sowing date and plant density on seed cotton yield and its components, earliness criteria and fibre properties of two cotton cultivars (Gossypium spp.). Alex. J. Agric. Res., 46 (3): 47 - 60.

Samra, A.M.; E.L. Hefni and M.E. Saleh (1982). Effect of sowing and defoliant application date on cotton yield and quality. Res. Bull. No. 543 April.

تأثير ميعاد وكثافة الزراعة والتسميد النيتروجينى على التساقط والتبكير والمحصول وصفات الجودة فى القطن المصرى

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أقيمت هذه الدراسة خلال الموسم الصيفى ٢٠٠١ و ٢٠٠٢ بالمزرعة التجريبية - كلية الزراعة - جامعة الزقازيق وذلك بغرض دراسة تأثير ميعاد الزراعة (٢٠ مارس و ٢٠ إبريل)، وكثافة الزراعة (٧٠٫٠٠٠ ، ٩٣٫٣٣٣ ، ١٤٠٫٠٠٠ نبات / فدان) ومستوى التسميد النيتروجينى (٣٠، ٦٠ ، ٩٠ كجم ن / فدان) على التساقط والتبكير والمحصول ومساهماته وصفات الجودة للألياف فى صنف القطن جيزة ٨٥.

خصصت تجربة مستقلة لكل ميعاد زراعة في كل موسم ووزعت معاملات كثافة الزراعة ومستوى التسميد النيتروجيني التسع في نظام القطاعات الكاملة العشوائية في اربع مكررات .

أوضحت النتائج أن ميعاد الزراعة المبكر في ٢٠ مارس قد أعطى زيادة معنوية في كل من: تاريخ ظهور أول زهرة وتفتح أول لوزة ، عمر اللوزه، نسبة التبكير، متوسط تاريخ النضج (يوم) ، دليل معدل الإنتاج، عدد الأفرع الثمرية، عدد اللوز الكلى والمتفتح/ نبات، وزن اللوزه ، محصول القطن الزهر / نبات، الكفاءة التمثيلية لمحصول القطن الزهر / نبات ، دليلى البذرة والشعر، تصافى الحليج، المحصول النهائى / فدان (من الزهر، الشعر والزيت) ، طول التيلة عند ٢,٥ ٪ و ٥٠ ٪، درجة انتظام الطول، متانة التيلة وقراءة الميكرونير (نسبة نضج الشعيرات) ، ومن ناحية أخرى، فقد نتج عن الزراعة المتأخرة في ٢٠ إبريل زيادة معنوية في كل من: ارتفاع اول فرع ثمرى (عقدة أول فرع ثمرى) ، نسبة التساقط، ارتفاع النبات عند الحصاد واخيراً عدد النباتات / فدان عند الحصاد.

أيضاً ، نتج عن الزراعة بكثافة ٧٠٫٠٠٠ نبات / فدان زيادة معنوية في الكفاءة التمثيلية لمحصول النبات من القطن الزهر فقط. ومع ذلك، فقد أعطت الكثافة النباتية المتوسطة (٩٣٫٣٣٣ الف نبات / فدان) زيادة معنوية في كل من: نسبة التبكير ، دليل معدل الإنتاج، عدد الافرع الثمرية واللوز الكلى، والمتفتح / نبات، وزن اللوزة ، محصول القطن الزهر/نبات، دليلى البذرة والشعر، تصافى الحليج وأخيراً المحصول النهائى / فدان من القطن الزهر، الشعر ومحصول الزيت. بينما، أعطت الكثافة الأعلى ١٤٠٫٠٠٠ نبات / فدان أعلى القيم معنوياً في كل من: ارتفاع اول فرع ثمرى، تاريخ ظهور اول زهرة وتفتح اول لوزة، عمر اللوزه، نسبة التساقط في اللوز، ارتفاع النبات عند الحصاد، وأخيراً عدد النباتات / فدان عند الحصاد. ومع ذلك، لم تؤثر كثافة الزراعة تحت الدراسة معنوياً على صفات الجودة في الالياف.

بالمثل نتج عن اضافة المستوى ٣٠ كجم ن /فدان زيادة معنوية في الكفاءة

التمثيلية لمحصول النبات من القطن الزهر فقط. ومع ذلك، فقد نتج عن التسميد النيتروجينى بمعدل ٦٠ كجم ن /فدان زيادة معنوية فى كل من: نسبة التبكير، دليل مُعدل الإنتاج، عدد الفروع الثمرية واللوز الكلى والمتفتح / نبات، وزن اللوزه، محصول القطن الزهر / نبات، دليلى البذرة والشعر، تصافى الحليج والمحصول النهائى فى وحدة المساحة (زهر ، شعر ومحصول الزيت)، طول التيلة عند ٢ر٥ أو ٥٠ ٪ وأخيراً نسبة انتظام الطول. كما اعطى المستوى الأعلى من السماد النيتروجينى وهو ٩٠ كجم ن /فدان زيادة معنوية فى كل من: ارتفاع اول فرع ثمرى ، تاريخ ظهور اول زهرة وتفتح اول لوزة / نبات، عمر اللوزه، نسبة التساقط فى اللوز ، دليل معدل الانتاج وأخيراً ارتفاع النبات عند الحصاد.

أظهرت النتائج أيضاً وجود تداخل فعل معنوى بين العوامل تحت الدراسة وذلك على معظم صفات التبكير، المحصول ومساهماته وأيضاً صفات الجودة فى الألياف ، وقد أظهرت الدراسة أن الزراعة فى الميعاد المبكر بالكثافة النباتية ٩٣ر٣٣٣ الف نبات للفدان وباستخدام ٦٠ كجم ن /فدان تعتبر من المعاملات الأكثر كفاءة فى زيادة دليل التبكير ، والمحصول النهائى / فدان وأيضاً فى تحسين بعض صفات الجودة للألياف، وقد ظهر تأثير هذه المعاملات بصورة واضحة اما فى حالة اختبارها فردياً أو فى حالة تداخلها مع بعضها فى صورة تداخل فعل ثنائى بين أى أثنين من هذه المعاملات.

أخيراً ، فقد أوضحت الدراسة أن ميعاد الزراعة المبكر (٢٠ مارس) والكثافة النباتية ٩٣٣٣٣ نبات/فدان والتسميد بمعدل ٦٠كجم ازوت /فدان قد أثبتت كفاءتها الكبيرة فى خفض نسبة تساقط اللوز وبالتالى المساهمة فى إعطاء محصول مبكر وعالى من القطن الزهر والشعر والزيت /فدان ذو صفات جودة عالية وذلك للصنف جيزة ٨٥ وتحت ظروف مزرعة كلية الزراعة بالزقازيق ، محافظة الشرقية.