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SUITABLE AGRICULTURAL MANAGMENT PRACTICES FOR THE NEW PROMISING HYBRID COTTON [GIZA 84 (GIAZ 70 x 51B)] PIMA62

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ABSTRACT

Two field experiments were conducted at Sakha Agricultural Research Station at Kafr El-Sheikh Governorate, Egypt, during the growing seasons of 2011 and 2012 the objective of this investigation was aimed to determine the suitable agricultural managements such as planting date, planting patterns (row width + hill spacing) and nitrogen fertilizer level) for evaluation new promising hybrid cotton [Giza 84 (Giza 70 x 51B)] Pima 62. Experiment design was conducted in split-split plots design with four replications. The main plots involved the two planting dates (early on ١٥ April and late on 15 May planting), The sub plots involved four planting patterns (65 cm row width +25 cm hill space, 60 cm row width + 35 cm hill space, 90 cm row width + 35 cm hill space planted in two sides and 90 cm row width + 40 cm hill space planted in two sides) and the sub-sub plots included three nitrogen fertilizer levels (30, 45 and 60 kg N /fed.) Results indicated that early planting date on 15th April significantly increased seed cotton yield/fed due to the increase number of open bolls /plant and boll weight. The planting pattern (65 cm row width + 35 cm hill space) gave the good values of number of opining bolls and seed cotton yield per fed.. 45 kg N fertilizer levels significantly increased number of bolls per plant and gave good values of number of fruiting branches, boll weight, seed index and seed cotton yield. Early planting with planting pattern (65 cm row width + 35 hill space) gave the highest values for all growth and yield and yield components. The early planting and 45 kg N fertilizer interaction gave the highest values for boll weight, no. of bolls /plant and seed cotton yield/fed. The planting pattern 65 cm row width + 35 cm hill space and 45 kg N fertilizer gave the highest values for no. of bolls/ plant and seed cotton yield/fed. Early planting, planting pattern (65 cm row width + 35 cm hill space) and 45 kg N fertilizer interaction gave the highest values for boll weight, no. of bolls/plant and seed cotton yield/fed. The studied treatments did not exhibit significant effect on all fiber properties. It could be concluded that for maximizing seed cotton yield/fed produced from sown new promising hybrid cotton [Giza 84 (Giza 70 x 51B)] Pima 62 early on 15th April, at planting pattern (65 row width + 35 cm hill space) and fertilizing with 45 kg N/fed under Kafr El-Sheikh condition.

Keywords: Cotton, Hybrid, Planting date, Planting pattern, Nitrogen fertilizer levels.

INTRODUCTION

Planting cotton at a suitable time leads to forming the first fruiting branch at a lower node on math stem and only an optimum height, increasing No. of bolls and yield of cotton, escaping from leaf and boll-worms and aphids at the end of planting season and picking early. Boquet *et al.* (2003) showed that the excessive plant height at late planting date was partly responsible for lower yield as crop used a larger portion of its energy budget for vegetative growth and the excess plant height caused lodging. Seed cotton yield/fed was significantly decreased with delayed planting. Emara,

(2006) showed that early sowing gave shorter plants and significantly increased No. of open bolls/plant and seed cotton yield/fed. Hamoda (2006) found that late sown plants grew faster than early sown ones while, boll weight, No. of open bolls/plant and seed cotton yield/fed, were increased in early planting date.

Plant population density is one of the management practices which require attention as far as optimum yield is concerned in new cotton cultivars production. Plant population density in cotton is could be adjusted by manipulating inter and intra-row spacing as well as planting patterns. Suitable plant population density per feddan was resulting higher yield, earlier maturity and reduced cost of insect and weed control. The proper planting pattern is one of the management practices that affect canopy light interception, maturity and vegetative dry matter of the cotton plant. El- Sayed and El-Menshawi (2005) found that wider hill spacing increased No. of open bolls/ plant, boll weight and seed cotton yield. Dong *et al.* (2005) found that seed cotton yield and lint percentage were insignificantly different among the steadied three plant densities. Obasi and Msaakpa (2005) indicated that wider hill spacing increased No. of sympodia, open bolls, boll weight and seed cotton yield, While it decreased plant height and earliness percentage. Hamed (2006) indicated that increasing plant population density produced the highest seed cotton yield/fed while, decreasing population density led to a significant increase in No. of fruiting branches/plant, No. of open bolls/plant, boll weight and seed cotton yield/plant. El-Shahawy and Hamoda (2011) found that increasing hill spacing significantly increased No. of sympodia /plant, No. of open bolls /plant, boll weight and seed cotton yield /fed, while plant height, first sympodial position and lint percentage were decreased.

Nitrogen is one of the most important elements in cotton plants. Moderate levels of nitrogen fertilization may produce a higher yield and quality, but higher levels may result in excessive of vegetative growth with a lower yield and quality. Through cotton agronomy programs, many traits are usually assigned to determine the optimum nitrogen levels fertilization must apply for every new promising hybrid cotton and commercial varieties. In this respect, several studies were done to evaluate the response of cotton plants to different nitrogen levels, El-Ganaini *et al.* (2005) found that number of open bolls/plant, boll weight and seed cotton yield/fed were increased with increasing rates of nitrogen. Khan *et al.* (2005) found that seed cotton yield, number of bolls per plant and boll weight increased with increasing rates of N. Hamed (2006) indicated that plant height, No. of fruiting branches/plant, No. of open bolls/plant and seed cotton yield/plant significantly increased by increasing nitrogen levels. Srinivasulu *et al.* (2006) found that highest seed cotton yield was obtained with the nitrogen fertilizer at rate of 120 kg N/ha and produced higher seed cotton yield observed with fertilized at rate of 90 kg N/ha. They added that N levels did not affect the quality of the fibre. Ahmed and Kassem (2008) found that increasing N rate to 90 kg N/fed significantly increased plant height and No. of fruiting branches/plant but, it failed to exert any significant effects on yield or yield components. Increasing N rate to 90 kg N/fed failed to significantly increase seed cotton yield. Ibrahim (2008) found that plant height, No. of fruiting branches/plant, No. of open bolls/ plant,

boll weight, number of plants/fed., seed index, lint %, seed cotton yield/ plant, seed cotton yield/fed., fiber length, fiber strength, micronaire values and fiber elongation increased significantly by increased NPK fertilizers levels at 80 kg N +30 kg P205 +48 kg k20/fed. Hamoda (2010) found that increase of N level to 60 kg N/fed exhibited a significant increase in plant height, No. of fruiting branches/plant, No. of open bolls/plant, boll weight, seed index, seed cotton yield/fed and gave the good fiber quality. El-Shahawy and Hamoda (2011) found that plant height, No. of sympodia /plant, first sympodial position, No. of open bolls /plant, boll weight, seed index and seed cotton yield/fed were increased by increasing nitrogen levels. They added that the studied treatments did not exhibit any significant effect on all fiber properties

The main aims of this study was to investigate the suitable agricultural managements practices such as planting date, planting patterns (row width and hill spacing) and nitrogen fertilizer levels) of new promising hybrid cotton [Giza 84 (Giza 70 x 51B)] Pima 62.

MATERIALS AND METHODS

Two field experiments were conducted at Sakha Agricultural Research Station at Kafr El-Sheikh Governorate, Egypt, during the growing seasons of 2011 and 2012. The objective of this investigation was aimed to study the suitable agricultural managements practices such as planting date, planting patterns (row width + hill spacing) and nitrogen fertilizer levels) for new promising hybrid cotton [Giza 84 (Giza 70 x 51B)] Pima 62 belonging to *Gossypium barbadense*, L. Characterized the new promising hybrid cotton [Giza 84 (Giza 70 x 51B)] Pima 62 are showed in Table (1). Experiment conducted in a split-split plots design with four replications. The main plots was involved in two planting dates (early on 15th April and late on 15th May planting), The sub plots involved four plant patterns (65 cm row width +25 cm hill space, 60 cm row width + 35 cm hill space, 90 cm row width + 35 cm hill space planted in two sides and 90 cm row width + 40 cm hill space planted in two sides) and the sub-sub plots included three nitrogen fertilizer levels (30, 45 and 60 kg N /fed). Cotton seeds were planted on different planting dates in 2011and 2012 seasons.

Seedlings were thinned at 2 plants /hill, phosphorus fertilizer as ordinary superphosphate (15.5% P_2O_5) at the rate of 22.5 kg P_2O_5 /fed incorporated during seed bed preparation. Nitrogen fertilizer in the form of ammonium nitrate (33.5 % N) at the tested levels was applied in two equal doses, immediately before first and second irrigations. Potassium fertilizers in the form of potassium sulfate (48 % K_2O) at the rate of 24 kg K_2O/fed was side-dressed in a single dose before the second irrigation. Standard agricultural practices were followed throughout the growing seasons. Representative soil samples were taken from the experimental sites before sowing in the two seasons and were prepared for analysis, according to Chapman and Pratt (1978). The results of the soil analysis are shown in Table (2).

Table 1: Characterized the new promising hybrid cotton [Giza 84 (Giza 70 x 51B)] Pima 62

Hybrid name	New promising hybrid cotton [Giza 84 (Giza 70 x 51B)] Pima 62
Species	Barbadense.
Category	Extra long staple
Pedigree	Crossing between G84 x (G70 x 51B) Pima 62
Characteristics	Extra long staple characterized by high yielding, early maturity, resistance to Fuzariam, high lint %, consider the highest Egyptian cotton variety in strength value and quality until now and higher yarn strength and fiber length more than 36 mm compared to all other Egyptian extra-long staple cotton varieties.
Botanical distinguishing characters	The stem has a medium length with polygon shape also has green color mixed by dim red with medium length internodes. The leaves have palmate shape with large size with No deep lobes and leather fell. The node of the first fruiting branch ranged from 8-9. A flower petal has Tubular shape. The boll size is large and pyramid shape with drawn summit. Seed is big-sized and the fuzz covers about fuzz less to 1/4 from the whole size and fuzz color is gray-greenish
Hybrid bred by	Breeding Res. Section, Cotton Res., Agric. Res. center, Giza, Egypt.

Table 2: Soil analysis of the experimental site in the two growing seasons

Seasons	Properties										
	Texture	pH	EC Mmhos/cm.	Ca CO_3 %	Available element (ppm)						
					N	P	K	Fe	Mn	Zn	Cu
2011	Clay loam	7.5	0.21	3.1	64	11	346	13.4	8.6	1.8	3.3
2012	Clay loam	7.6	0.34	2.9	66	14	380	14.1	19.1	1.9	3.8

All samples were taken at random in order to study the traits. At harvest, 6 guarded plants were randomly taken from the central row of each plot to determine plant height at harvest, number of fruiting branches/plant, boll weight (g), number of bolls /plant, lint % and seed index (g). Seed cotton yield (ken. /fed) was estimated as the weight of seed cotton yield by kilogram picked from the five middle rows in plot collected from two picks, then converted to yield per fed. in kentar (Kentar = 157.5 kg.). Studied fiber quality traits were upper half mean length (U.H.M|) (mm), fiber strength g/tex. and micronaire reading which were measured by using High Volume Instrument (HVI) according to A.S.T.M. (1986). All collected data were subjected to statistical analysis as proposed by Gomez and Gomez (1984) and means were compared by LSD and T test at 5% level of probability

RESULTS AND DISCUSSION

1- Effect of planting dates, planting patterns, N fertilizer levels and its interactions on growth, yield and fiber propitiates of cotton:

Results in Table (3) revealed that planting date, planting patterns and N fertilizer levels were significantly affected plant height, No. of fruiting branches /plant, No. of open bolls per plant, boll weight, seed index, lint % and seed cotton yield/fed, while fiber properties were insignificantly affected. Results showed that late planting decreased number of fruiting branches/plant, boll weight, number of open bolls per plant and seed cotton yield per fed, while increased plant height and lint % in both seasons. Plant height tented to increase as planting date was delayed. This increase could be attributed to increase in internode length not in number of fruiting

branches which took the opposite trend. Early planting increased yield and its components. Similar results were obtained by Boquet *et al.* (2003) and Emara, (2006) and such findings are in harmony with those obtained by El-Sayed and El-Menshawi (2005).

The results clearly that at planting pattern 65 cm row width + 35 cm hill space produced highest number of open bolls and seed cotton yield per fed, while decreased plant height compared with other planting patterns, Similar results were obtained by Obasi and Msaakpa (2005) and El-Shahawy and Hamoda (2011)

Results in Table (3) clearly that 45 kg N fertilizer level significantly increased number of open bolls per plant compared with other rates and gave recorded highest number of fruiting branches/plant, boll weight, seed index and seed cotton yield in both seasons. These results showed that new promising hybrid under study not responding to the N fertilizer. In this concern Hamed (2006) found that No. of fruiting branches, No. of open bolls/plant and seed cotton yield/fed significantly increased by increasing N fertilizer levels.

Results in Table (4) clearly indicated that the interaction between planting date and planting patterns gave significant effect on plant height, No. of fruiting branches /plant, No. of open bolls per plant, boll weight, seed index, lint % and seed cotton yield/fed., while fiber properties were insignificant in both seasons. Early planting and planting pattern (65 cm row width + 35 hill space) gave the highest values for all growth and yield and yield components compared with the other interactions in both seasons.

Results in Table (5) showed that the interaction between planting date and N fertilizer levels gave significant effect on plant height, boll weight No. of open bolls per plant and seed cotton yield/fed in both seasons. The early planting on 15th April and added 45 kg N fertilizer interaction gave the highest boll weight, No. of open bolls per plant and seed cotton yield/fed compared with other interactions in both seasons. Also, the same interaction gave insignificant on fiber properties under study.

Results in Table (6) showed that the interaction between planting patterns and N fertilizer levels gave significant effect on No. of open bolls per plant, seed cotton yield/fed in both seasons. The planting pattern 65 cm row width + 35 cm hill space and 45 kg N fertilizer gave the highest values for no. of open bolls plants and seed cotton yield/fed. compared with the other interactions in both seasons.

The interaction between planting dates, planting patterns and N fertilizer levels (Table 7) had significant effect on plant height, boll weight, no. of open bolls per plant and seed cotton yield/fed in both seasons and on No. of fruiting branches/plant in first season only. Early planting, planting pattern (65 cm row width + 35 cm hill space) and 45 kg N fertilizer interaction gave the highest values for boll weight, No. of bolls/plant and seed cotton yield/fed compared with the other interactions in two seasons. From the results of this research it can be recommended that planting the new promising hybrid on early planting on 15th April under planting pattern (65 cm row width + 35 cm hill space) and 45 kg N fertilizer to obtained the high yield. When delayed planting date for this new hybrid it can planting under planting pattern (65 cm row width + 25 hill space) and 30 kg N fertilizer which gave the suitable results.

T3

T4

T5

T6

T7

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التوصيات الزراعيه المثلى لهجين القطن المبشر [جيزة ٨٤ (جيزة ٧٠ × ٥١ ب)] × بيما ٦٢

الدسوقى الدسوقى دشيش
قسم بحوث المعاملات الزراعيه – معهد بحوث القطن – مركز البحوث الزراعيه - جيزة - مصر

أجريت تجربتين حقليتين بمحطة البحوث الزراعية بسخا بمحافظة كفر الشيخ خلال موسمى ٢٠١١ و ٢٠١٢ بهدف اعداد التوصيات المثلى من ميعاد الزراعة، والكثافه النباتيه (عرض الخط + مسافات الجور) والتسميد النتروجينى) لزراعة هجين القطن المبشر [جيزة ٨٤ (جيزة ٧٠ × ٥١ ب)] × بيما ٦٢ وهذا الهجين من طبقة الاقطان فائقة الطول. وهذا الهجين انتج من قسم تربية القطن بمعهد بحوث القطن بمواصفات عالية الجودة عن الاصناف المنزرعة التجاريه وفى مرحلة اعداد التوصيات الفنيه. ولقد تمت التجربه فى تصميم القطع المنشقه مرتين حيث وضعت مواعيد الزراعه (ميعاد مبكر فى 15 ابريل وميعاد متاخر فى 15 مايو) فى القطع الرئيسيه ووضعت توزيعات النباتات متمثله فى عرض الخط ومسافه الجور (عرض الخط ٦٥ سم + ٢٥ سم بين الجور، عرض الخط ٦٥ سم + ٣٥ سم بين الجور، عرض الخط ٩٠ سم + ٣٥ سم بين الجور زرعت على الريشتين و عرض الخط ٩٠ سم + ٤٠ سم بين الجور زرعت على الريشتين) فى القطع المنشقه الاولى ووضعت مستويات التسميد الازوتى (٣٠، ٤٥ و ٦٠ كجم أزوت/فدان) فى القطع المنشقه الثانيه واهم النتائج المتحصل عليها ما يلى :

١. اوضحت النتائج ان هناك زيادة معنوبه في محصول القطن الزهر /فدان لهذا الهجين عند تبكير ميعاد الزراعة فى ١٥ ابريل ويرجع ذلك لزيادة عدد اللوز ووزن اللوزة
٢. اشارت النتائج الى ان توزيع النباتات بعرض خط ٦٥ سم و ٣٥ سم بين الجور سجل زيادة معنويه فى عدد الافرع الثمريه وعدد اللوز / النبات ووزن اللوزة ومحصول القطن الزهر بينما انخفض طول النبات و نسبة التصافى للهجين
٣. اظهرت النتائج انه لم يكن لزيادة معدلات التسميد النتروجينى أى تاثير معنوى على انتاجية الهجين مما اوضح ان هذا الهجين لا يستجيب للتسميد الازوتى العالى حيث اعطى افضل القيم للصفات المدروسه تحت مستوى التسميد ٤٥ كجم نتروجين للفدان
٤. كان للتفاعل بين مواعيد الزراعه وتوزيع النباتات ومستويات التسميد الازوتى تأثيرا معنويا على صفات وزن اللوزة وعدد اللوز ومحصول القطن الزهر للفدان حيث اعطت الزراعه المبكرة وتوزيع النباتات ٦٥ سم بين الخطوط ٣٥ سم بين الجور و٤٥ كجم نتروجين / الفدان افضل القيم لمحصول القطن الزهر ومكوناته
٥. لم يكن لجميع المعاملات المدروسه اى تاثير معنوى على صفات التيله

توصى هذه الدراسه بزراعة الهجين [جيزة ٨٤ (جيزة ٧٠ × ٥١ ب)] × بيما ٦٢ مبكرا فى ١٥ ابريل تحت مسافة ٦٥ سم بين الخطوط + ٣٥ سم بين الجور مع التسميد الازوتي بمعدل ٤٥ كجم أزوت/ فدان.

قام بتحكيم البحث

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Table 3: Effect of planting date, planting patterns and N fertilizer levels on growth traits, yield and yield components and fiber properties of cotton in 2011 and 2012 seasons

Treatments		Growth traits				Yield and yield components										Fiber properties					
		Plant height at harvest		No. of fruiting branches /plant		No. of open bolls/plant		Boll weight (g)		Lint %		Seed index		Seed cotton yield (ken./fed)		Upper half mean length		Strength g/tex.		Mic. reading	
		2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Planting dates	Early	158.6	166.5	16.1	16.8	22.9	20.1	2.47	2.38	37.54	37.97	10.74	10.59	12.73	11.60	37.09	36.76	43.22	45.15	4.33	4.37
	Late	172.2	167.7	14.7	13.8	15.6	14.0	2.22	2.15	38.88	39.09	10.84	10.17	8.41	6.97	36.93	36.51	42.54	42.68	4.26	4.28
T test		*	N.S	**	**	**	**	**	**	**	**	N.S	*	**	**	N.S	N.S	N.S	N.S	N.S	N.S
planting patterns	65+25 cm	166.8	167.6	15.6	15.8	18.5	16.3	2.31	2.24	38.08	38.45	10.66	10.31	10.27	9.33	36.66	**36.49**	41.73	44.27	4.35	4.36
	65+35 cm	159.8	162.6	14.5	13.7	20.1	16.7	2.36	2.29	38.29	38.67	10.96	10.41	10.82	9.42	37.32	36.73	43.19	44.81	4.30	4.29
	90+35 cm	170.8	172.4	16.4	16.4	18.6	16.8	2.34	2.25	38.13	38.34	10.81	10.38	10.60	9.30	37.06	36.68	43.38	43.26	4.27	4.35
	90+40 cm	164.0	165.8	14.9	15.1	19.6	18.3	2.38	2.26	38.33	38.67	10.73	10.41	10.59	9.09	37.00	36.63	43.24	43.33	4.26	4.30
LSD at 0.05		0.99	2.24	0.28	0.41	0.16	N.S	N.S	N.S	N.S	0.12	0.09	0.03	0.09	0.19	N.S	N.S	N.S	N.S	N.S	N.S
N fertilizer	30 N	162.0	163.7	15.4	15.1	19.6	17.2	2.38	2.28	38.05	38.45	10.76	10.36	10.77	9.42	36.94	**36.90**	43.45	43.83	4.25	4.27
	45 N	165.3	167.5	15.2	15.3	19.9	17.3	2.38	2.28	38.24	38.50	10.86	10.40	10.77	9.38	36.97	36.72	42.82	44.06	4.28	4.31
	60 N	168.8	170.1	15.5	15.3	18.2	16.6	2.29	2.23	38.34	38.64	10.75	10.37	10.17	9.06	37.12	36.28	42.39	43.86	4.35	4.39
LSD at 0.05		1.32	1.50	N.S	N.S	0.26	0.21	0.04	N.S	N.S	0.09	0.07	0.02	0.08	0.19	N.S	N.S	N.S	N.S	N.S	N.S

Table 4: Effect of the interaction between planting date and planting patterns on growth traits, yield and yield components and fiber properties of cotton in 2011 and 2012 seasons

Treatments		Growth traits				Yield and yield components										Fiber properties					
		Plant height at harvest		No. of fruiting branches /plant		No. of open bolls/plant		Boll weight (g)		Lint %		Seed index		Seed cotton yield (ken./fed)		Upper half mean length		Strength g/tex.		Mic. reading	
Planting dates	Planting patterns	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Early	65+25 cm	158.3	163.3	16.2	17.3	19.5	17.0	2.33	2.27	38.13	38.38	10.28	10.42	10.85	10.45	36.42	36.43	41.36	45.70	4.46	4.39
	65+35 cm	153.7	163.1	15.0	14.7	26.8	21.4	2.58	2.53	36.98	37.58	11.19	10.68	14.47	12.64	37.47	36.93	43.38	45.87	4.31	4.37
	90+35 cm	165.1	171.9	17.8	18.1	21.1	19.1	2.44	2.32	37.55	38.03	10.84	10.60	12.32	11.38	37.19	36.92	44.09	44.32	4.27	4.37
	90+40 cm	157.1	167.6	15.2	17.0	24.1	23.0	2.52	2.38	37.49	37.89	10.64	10.65	13.28	11.93	37.29	36.73	44.08	44.72	4.30	4.34
Late	65+25 cm	175.4	172.0	14.9	14.7	17.5	15.5	2.29	2.22	38.04	38.52	11.04	10.20	9.69	8.21	36.90	36.54	42.11	42.83	4.24	4.33
	65+35 cm	165.9	162.0	14.0	12.7	13.4	12.1	2.14	2.06	39.60	39.76	10.74	10.13	7.18	6.21	37.18	36.53	43.00	43.76	4.29	4.21
	90+35 cm	176.5	172.9	15.1	14.8	16.2	14.6	2.23	2.18	38.70	38.66	10.79	10.16	8.88	7.22	36.92	36.44	42.67	42.20	4.28	4.33
	90+40 cm	170.9	164.0	14.6	13.3	15.1	13.6	2.23	2.13	39.17	39.45	10.81	10.06	7.91	6.26	36.72	36.52	42.40	41.94	4.21	4.26
LSD at 0.05		**1.39**	**3.17**	**0.39**	**0.5 8**	**0.23**	**0.35**	**0.08**	**0.09**	**0.68**	**0.17**	**0.13**	**0.05**	**0.13**	**0.27**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**

Table 5: Effect of the interaction between planting date and N fertilizer levels on growth traits, yield and yield components and fiber properties of cotton in 2011 and 2012 seasons

Treatments		Growth traits				Yield and yield components										Fiber properties					
		Plant height at harvest		No. of fruiting branches /plant		No. of open bolls/plant		Boll weight (g)		Lint %		Seed index		Seed cotton yield (ken./fed)		Upper half mean length		Strength g/tex.		Mic. reading	
Planting dates	N fertilizer	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Early	30 N	154.6	162.5	16.2	16.6	23.3	20.1	2.49	2.39	37.41	37.92	10.69	10.58	12.75	11.54	37.08	37.08	44.76	45.12	4.28	4.34
	45 N	158.5	166.0	15.9	16.9	23.8	20.7	2.52	2.40	37.47	37.84	10.85	10.63	13.14	11.86	36.92	36.75	43.18	15.48	4.32	4.35
	60 N	162.6	171.0	16.1	16.8	21.5	19.5	2.40	2.33	37.73	38.15	10.67	10.55	12.30	11.39	37.27	36.44	41.73	44.86	4.4	4.41
Late	30 N	169.5	165.0	14.6	13.7	15.9	14.3	2.27	2.17	38.68	38.99	10.83	10.14	8.80	7.30	36.80	36.73	42.13	42.55	4.22	4.20
	45 N	172.1	169.0	14.6	13.7	16.0	13.9	2.23	2.15	39.01	39.15	10.87	10.18	8.41	6.90	37.02	36.68	42.45	42.64	4.25	4.28
	60 N	174.9	169.2	14.8	13.9	14.8	13.7	2.17	2.13	38.94	39.13	10.83	10.18	8.03	6.72	36.97	36.12	43.05	42.86	4.29	4.38
LSD at 0.05		1.56	2.18	N.S	N.S	0.37	0.30	0.03	0.04	N.S	0.13	N.S	0.03	0.12	0.28	N.S	N.S	N.S	N.S	N.S	N.S

Table 6: Effect of the interaction between planting patterns and N fertilizer levels on growth traits, yield and yield components and fiber properties of cotton in 2011 and 2012 seasons

Treatments		Growth traits				Yield and yield components										Fiber properties					
		Plant height at harvest		No. of fruiting branches /plant		No. of open bolls/plant		Boll weight (g)		Lint %		Seed index		Seed cotton yield (ken./fed)		Upper half mean length		Strength g/tex.		Mic. reading	
Planting patterns	N fertilizer	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
65 + 25 cm	30 N	164.2	166.3	15.6	15.8	18.7	16.3	2.37	2.27	37.95	38.33	10.63	10.31	10.68	9.60	36.58	36.72	43.52	44.75	4.35	4.32
	45 N	166.6	167.0	15.5	15.9	20.1	16.8	2.35	2.25	38.17	38.37	10.79	10.34	10.37	9.61	36.40	36.60	42.45	44.77	4.32	4.33
	60 N	169.7	169.6	15.7	15.7	16.8	15.7	2.22	2.22	38.12	38.63	10.57	10.29	9.75	8.78	37.00	36.15	39.23	43.28	4.38	4.43
65 +35 cm	30 N	156.4	158.3	14.8	13.7	20.8	17.1	2.37	2.32	38.09	38.83	10.97	10.35	10.99	9.57	37.27	36.98	42.47	44.22	4.28	4.30
	45 N	159.5	162.9	14.2	13.9	20.1	16.8	2.40	2.32	38.35	38.63	10.99	10.45	11.11	9.56	37.30	36.70	43.40	45.28	4.28	4.25
	60 N	163.5	166.5	14.6	13.5	19.5	16.3	2.32	2.25	38.42	38.55	10.93	10.42	10.37	9.15	37.40	36.52	43.70	44.93	4.33	4.32
90 + 35 cm	30 N	166.4	167.6	16.2	16.1	18.8	16.9	2.40	2.25	37.90	38.23	10.69	10.39	10.70	9.27	37.08	36.98	43.80	43.22	4.17	4.25
	45 N	171.1	173.8	16.4	16.4	19.1	17.2	2.37	2.27	38.14	38.34	10.90	10.38	10.82	9.36	37.18	36.78	42.97	42.88	4.28	4.35
	60 N	174.9	175.8	16.8	16.8	18.1	16.4	2.25	2.23	38.34	38.45	10.85	10.36	10.28	9.25	36.90	36.28	43.37	43.68	4.37	4.45
90 + 40 cm	30 N	161.1	162.8	15.0	14.9	20.0	18.5	2.38	2.28	38.24	38.43	10.76	10.40	10.73	9.22	36.83	36.93	44.00	43.15	4.22	4.22
	45 N	163.9	166.2	14.9	15.2	20.5	18.6	2.38	2.27	38.31	38.66	10.77	10.43	10.79	9.00	37.01	36.78	42.45	43.32	4.25	4.32
	60 N	167.0	168.5	14.9	15.3	18.3	17.9	2.37	2.22	38.45	38.93	10.66	10.39	10.27	9.06	37.17	36.17	43.27	43.53	4.30	4.37
LSD at 0.05		N.S	N.S	N.S	N.S	0.52	N.S	N.S	N.S	N.S	0.19	N.S	N.S	0.16	0.39	N.S	N.S	N.S	0.71	N.S	N.S

Table 7: Effect of the interaction between planting date, planting patterns and N fertilizer levels on growth traits, yield and yield components and fiber properties of cotton in 2011 and 2012 seasons

Treatments			Growth traits				Yield and yield components										Fiber properties					
			Plant height at harvest		No. of fruiting branches /plant		No. of open bolls/plant		Boll weight (g)		Lint %		Seed index		Seed cotton yield (ken./fed)		Upper half mean length		Strength g/tex.		Mic. reading	
Planting dates	Planting patterns	N fertilizer	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Early	65 + 25 cm	30 N	155.6	161.4	16.3	17.1	20.2	16.9	2.40	2.30	38.12	38.27	10.30	10.43	10.90	10.32	36.40	36.60	45.03	46.00	4.40	4.37
		45 N	157.4	160.3	16.1	17.4	20.5	17.9	2.40	2.27	38.02	38.20	10.42	10.44	11.35	10.84	35.93	36.53	43.83	46.10	4.47	4.37
		60 N	161.9	168.2	16.4	17.4	17.8	16.2	2.20	2.23	38.24	38..67	10.13	10.38	10.30	10.19	36.93	36.17	35.20	45.00	4.50	4.43
	65 +35 cm	30 N	149.4	158.4	15.6	14.6	27.1	21.4	2.57	2.57	36.95	37.62	11.01	10.67	14.67	12.73	37.37	37.27	43.83	45.53	4.33	4.47
		45 N	153.5	163.1	14.8	15.1	27.2	21.6	2.63	2.57	36.87	37.48	11.33	10.71	14.99	12.76	37.43	36.57	42.83	46.37	4.27	4.30
		60 N	158.2	167.8	14.7	14.4	26.1	21.2	2.53	2.47	37.12	37.63	11.23	10.66	13.74	12.42	37.60	36.97	43.47	45.70	4.33	4.33
	90 + 35 cm	30 N	159.7	165.7	17.0	17.6	21.0	19.1	2.50	2.30	37.06	37.97	10.82	10.60	12.20	11.36	37.20	37.27	44.83	44.30	4.13	4.27
		45 N	165.6	172.6	17.7	18.4	22.0	19.8	2.50	2.37	37.61	37.91	10.91	10.64	12.74	11.46	37.30	37.00	43.53	44.43	4.27	4.40
		60 N	170.1	177.3	18.6	18.2	20.2	18.3	2.33	2.30	37.99	38.20	10.79	10.55	12.03	11.30	37.07	36.50	43.90	44.23	4.40	4.43
	90 + 40 cm	30 N	153.5	164.5	15.8	16.9	24.7	23.1	2.50	2.40	37.52	37.81	10.65	10.63	13.22	11.75	37.37	37.17	45.33	44.63	4.23	4.27
		45 N	157.6	167.8	15.0	16.8	25.6	23.7	2.53	2.40	37.39	37.78	10.74	10.72	13.47	12.38	37.03	36.90	42.53	45.03	4.23	4.33
		60 N	160.3	170.7	14.9	17.1	22.1	22.2	2.53	2.33	37.57	38.09	10.53	10.62	13.14	11.65	37.47	36.13	44.37	44.50	4.37	4.43
Late	65 + 25 cm	30 N	172.8	171.3	14.9	14.4	17.1	15.7	2.33	2.23	37.78	38.40	10.95	10.19	10.47	8.89	36.77	36.83	42.00	43.50	4.30	4.27
		45 N	175.9	173.8	14.9	14.3	19.7	15.7	2.30	2.23	38.33	38.55	11.16	10.23	9.40	8.38	36.87	36.67	41.07	43.43	4.17	4.30
		60 N	177.5	170.9	14.9	13.9	15.8	15.2	2.23	2.20	38.00	38.60	11.00	10.19	9.20	7.36	37.07	36.13	43.27	41.57	4.27	4.43
	65 +35 cm	30 N	163.4	158.2	13.9	12.8	14.5	12.8	2.17	2.07	39.23	40.03	10.93	10.03	7.31	6.41	37.17	36.70	41.10	42.90	4.23	4.13
		45 N	165.5	162.7	13.6	12.7	12.9	11.9	2.17	2.07	39.83	39.77	10.64	10.19	7.23	6.35	37.17	36.83	43.97	44.20	4.30	4.20
		60 N	168.7	165.3	14.6	12.6	12.8	11.5	2.10	2.03	39.73	39.47	10.63	10.18	7.00	5.87	37.20	36.07	43.93	44.17	4.33	4.30
	90 + 35 cm	30 N	173.0	169.5	15.3	14.6	16.5	14.7	2.30	2.20	38.74	38.50	10.57	10.17	9.20	7.18	36.97	36.70	42.77	42.13	4.20	4.23
		45 N	176.7	175.0	15.0	14.4	16.1	14.5	2.23	2.17	38.67	38.77	10.89	10.13	8.91	7.27	37.07	36.57	42.40	41.33	4.30	4.30
		60 N	179.8	174.2	14.9	15.4	15.9	14.4	2.17	2.17	38.70	38.70	10.90	10.18	8.53	7.20	36.73	36.07	42.83	43.13	4.33	4.47
	90 + 40 cm	30 N	168.7	161.1	14.2	12.9	15.4	13.9	2.27	2.17	38.97	39.04	10.86	10.18	8.23	6.70	36.30	36.70	42.67	41.67	4.17	4.17
		45 N	170.2	164.5	14.8	13.5	15.4	13.5	2.23	2.13	39.22	39.53	10.79	10.15	8.10	5.62	36.99	36.67	42.37	41.60	4.23	4.30
		60 N	173.6	166.3	14.9	13.5	14.6	13.5	2.20	2.10	39.33	39.77	10.79	10.17	7.40	6.46	36.87	36.20	42.17	42.57	4.23	4.30
LSD at 0.05			N.S	N.S	0.61	N.S	0.74	0.53	0.04	0.06	0.21	0.07	N.S	0.26	0.25	0.55	N.S	N.S	N.S	N.S	N.S	N.S