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IMPACT OF PLANT POPULATION DENSITY THROUGH ROW AND HILL SPACINGS UNDER DIFFERENT NITROGEN LEVELS ON GIZA 89 COTTON CULTIVAR

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Abstract

Two field trials were carried out at Sakha Agricultural Research Station during 1996 and 1997 seasons, using the new cotton cultivar Giza 89 which was planted on ridges 60 cm x 20 cm/one side, 60 cm x 25 cm/one side, 90 cm x 20 cm/two sides and 90 cm x 25 cm/two sides as main plots and received three N levels 40, 60 and 80 kg/f. as sub-plots. Combined data revealed that growing cotton plants on ridges 60 cm at one side (low stands) increased final plant height, number of monopodia and sympodia, lateral root ranks, root volume, additional fruiting branch bolls, retained bolls, fruiting sites, earliness %, open bolls, boll weight and seed cotton yield, while it decreased numbers of aborted sites, first sympodial position, percentage of bolls on monopodia, unopen bolls and percentage of plant losses at harvest, compared with planting on ridges 90 cm at both sides either at 20 or 25 cm hill spacing.

Nitrogen application up to 80 kg/f. induced maximum values of final plant height, number of both monopodia and sympodia, aborted sites, additional fruiting branch bolls, retained bolls, fruiting ites, first sympodial position, percentage of bolls on monopodia, unopen bolls and boll weight. Adding 60 kg N/f. resulted in higher number of open bolls and seed cotton yield (Kintar/f.). N application had no influence on number of lateral root ranks, root volume and percentage of plant losses at harvest. The interaction between sowing pattern and N level had insignificant effect on all traits studied in this study.

INTRODUCTION

It is well known that cotton growth depends on complex soil, climate and plant interaction. Whatever the exact interactions which result in high vegetative/ reproductive ratio, the implication of the hypothesis is that the importance of setting the early bolls for outweighs their direct contribution to yield. In this concern, plant population density and nutritional status play an important role in consolidating this ratio. El-Hattab et al. (1976) and Eweida et al. (1983) found that boll weight and number of open bolls increased by decreasing plant population. Makram et al. (1994)

reported that the intermediate hill spacing of 25 cm increased fruiting branches/ plant, yield components and yield/fed. Final plant height, earliness percentage and percentage of plant losses at harvest were increased in favour of closer spacing. Wider spacing increased monopodia, sympodia, open bolls and boll weight. Hosny et al. (1995) using different intra and inter-row spacings, revealed that maturity was faster with high plant density and narrow row spacing. Number of open bolls/plant was highest with low plant density and narrow row spacing. Higher seed cotton yields were obtained with 35000-70000 plants/fed. and 40 cm row spacing.

As nitrogen is an essential nutrient for cotton that affects plant growth, fruiting and yield, many researches were conducted. Abou Zeid and Mohamad (1995) reported that increasing nitrogen rate from 0-60 kg/fed. increased seed cotton yield. Makram *et al.* (1994) found that final plant height, monopodial and sympodial branches; number of open bolls and boll weight were increased in favour of higher nitrogen fertilizer (90 kg/fed.), while it decreased earliness percentage. Seed cotton yield increased up to 75 kg N/fed., but number of unopen bolls did not follow a definite trend. Percentage of plant losses at the end of season did not affect by N levle. Node location of the first sympodium was insignificantly increased as N level increased. El-Debaby et al. (1995) revealed that number of fruiting branches, total and opened boll number and seed cotton yield were increased with increasing N level, while the reverse trend was true with earliness percentage.

Keeping in view the above findings, the present study was undertaken to determine the performance of the new cotton cultivar Giza 89 under various plant population densities and nitrogen levels.

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agricutural Research Station to study the effect of sowing patterns; nitrogen levels and their interaction on growth characters; fruiting pattern, earliness parameters and seed cotton yield and its components using Giza 89 cotton cultivar (G. barbadense L.) Cotton seeds were planted on 25 March 1996 and 1 April 1997 in a split plot design with four replications. The main plots were assigned for sowing patterns i.e., ridges 60 cm width with 20 cm hill spacing on one side (60 cm x 20 cm/one side); ridges 60 cm width with 25 cm hill spacing on one side (60 cm x 25 cm/one side); ridges 90 cm with 20 cm hill spacing on two sides (90 cm x 20 cm/two sides) and ridges 90 cm with 25 cm hill spacing on two sides (90 cm x 25 cm/two sides). The sub plots were devoted for nitrogen levels of 40, 60 and 80 kg/f. divided into two equal doses before the second and third irrigations. Plot size was 32.4 m^2 (5.4 m width x 6.0 m long).

Phosphorous fertilizer was added at the rate of 15.5 kg P_2O_5/f. during land preparation, besides 24 kg K_2O was soil dressed before the third irrigation. Seedlings were hand-thinned to two plants/hill 40 days after sowing. All other cultural practices were applied as recommended in cotton production. Samples of ten plants (5 graded hills) were randomly chosen from each plot at the end of season to estimate the following traits.

1) Growth characters: final plant height (cm), number of monopodia, and number of sympodia/plant.
2) Fruiting pattern: number of aborted sites, additional fruiting branch bolls (bolls arise on a short sympodium besides the principal bolls, or from the axillary buds on the bottom of sympodial branches), number of retended bolls and number of fruiting sites.
3) Earliness parameters: first sympodial position, percentage of bolls on monopodia and earliness percntage = $\frac{\text{First picking}}{\text{1st + 2nd picking}} \times 100$
4) Yield components: number of open bolls and number of unopen bolls and boll weight Picking was done twice for all plants in each plot and then transformed into corresponding values in kintar per feddan. Also, all plants of each plot of three replicates were counted to calculate percentages of plant losses relative to one feddan. The soil surrounding a hill of two cotton plants in each plot of three replicates was intensively wetted in order to facilitate pulling out the root system to determine the root volume of 40 cm depth starting from the cotyledonary nodes using water replacement method. In the same time, number of lateral root rank were estimated.

The statistical and combined analysis of the two seasons seasons were done and performed according to Little and Hills (1978). The mean values were compared at the 5% level of significance by the L.S.D. (Snedecor and Cochran, 1967).

Table 1. Soil mechanical and chemical analysis in 1996 and 1997 seasons.

Soil characteristics	1996	1997
Soil structure	Clay	Clay
pH (1: 25)	8.94	8.60
Organic matter %	1.80	1.90
Total S.S %	0.54	0.57
Bicarbonate %	1.80	1.70
Chloride %	7.48	7.50
Sulfuric %	4.86	4.89
Ca %	1.40	1.50
Mg %	1.30	1.40
Na %	4.55	4.50
Available N (ppm)	12.50	13.10
Available P (ppm)	9.00	9.20
Available K (ppm)	720.00	700.00

RESULTS AND DISCUSSION

A. Growth characters

Table (2) shows the effect of sowing pattern on final plant height, monopodia, sympodia, number of lateral root ranks and root volume (combined of 1996 and 1997 seasons).

1. Final plant height (cm)

Sowing pattern had a significant effect on this trait, whereas cotton plants grown on ridges 60 cm x 20 cm/one side gave the highest final plant height followed descendingly by both those grown on ridges 90 cm x 25 cm/two sides and ridges 60 cm x 20 cm and 90 cm x 25 cm/two sides and ridges 60 cm x 25 cm / one side. It is well noticeable that ridges of two planted sides had more plant population than ridges of single planted side which increases within plants competition with continued development especially at boll load stage. So, the availability of water and nutrients to individual plants decreases and that reflects its drastic effect on final plant size. This conclusion appear to differ from those of Makram et al. (1994) but agrees with those of Hussein et al. (1983), Ziadah (1983), Yasseen (1986) and El-Shahawy et al. (1993).

As for N level, final plant height increased significantly as nitrogen level increased from 40 to 80 kg/fed. The previous trend might be due to soil being low in organic matter and available nitrogen as presneted in Table 1. Similar results were obtained by El-Shahawy et al. (1993) and Makram et al. (1994).

2. Number of monopodia/plant

Combined data clear that sowing cotton plants on ridges 60 cm x 25 cm/one side gave the highest number of monopodial branches followed by both those sown on ridges 90 cm x 25 cm/two sides and 60 cm x 20 cm/one side and 90 cm x 20 cm/ two sides in descending order. It is interesting that, in higher populations, the development of monopodia is depressed throughout the season, suggesting that axillary buds in lower stem nodes may still dormant as it exposed to excessve shade. Respondent results were obtained by El-Shahawy et al. (1993) and Makram et al. (1994).

Number of monopodial branches per plant was increased in favour of nitrogen level increase. This result could be ascribed on the fact that nitrogen is essential for

Table 2. Effect of sowing patterns, N-level and their interaction on some growth characters of Giza 89 cotton cultivar (1996, 1997 seasons and their combined data).

Growth character	Season	Sowing Pattern (S) Sig.	Ridges 60 cm width 20 cm hill spacing one side 70000 Pl. /fd.	Ridges 60 cm width 25 cm hill spacing one side 56000 Pl. /fd.	Ridges 90 cm width 20 cm hill spacing two sides 93333 Pl. /fd.	Ridges 90 cm width 25 cm hill spacing two sides 74666 Pl.fed.	Nitrogen level (kg/fed.) (N) Sig.	40	60	80	S x N interaction Sig.
Final Plant height (cm)	1996	NS	123.72	123.17	123.44	123.06	**	121.96c	123.29b	124.79a	N.S.
	1997	**	149.11 a	139.06c	147.83b	148.06b	**	143.83c	145.79b	148.42a	N.S.
	Comb.	*	136.42a	131.12c	135.64b	135.56b	**	132.90c	134.54b	136.61a	N.S.
Number of monopodia	1996	**	0.20b	0.36a	0.19b	0.37a	**	0.19b	0.28ab	0.37a	N.S.
	1997	**	0.37b	0.52a	0.13d	0.29c	**	0.24c	0.33b	0.41a	N.S.
	Comb.	**	0.29b	0.44a	0.16c	0.33b	**	0.22c	0.31b	0.39a	N.S.
Number of sympodia	1996	**	16.51a	15.24b	13.15c	13.79c	**	14.25c	14.62b	15.15a	*
	1997	**	19.80a	18.90b	14.62c	15.48c	**	16.40c	17.14b	18.07a	N.S.
	Comb.	**	18.16a	17.07b	13.89c	14.64c	**	15.33c	15.88b	16.61a	N.S.
Number of lateral root ranks	1996	**	4.00a	4.00a	2.22b	2.56b	N.S.	3.08	3.25	3.25	N.S.
	1997	**	4.00a	4.00a	2.11b	2.33b	N.S.	3.08	3.08	3.17	N.S.
	Comb.	**	4.00a	4.00a	2.17b	2.45b	N.S.	3.08	3.17	3.21	N.S.
Root volume (cm^3) (40 cm depth)	1996	**	53.89a	56.11a	23.33c	32.78b	N.S.	42.08	41.25	41.25	N.S.
	1997	**	61.11a	55.00b	28.33d	37.22c	N.S.	42.25	45.83	45.17	N.S.
	Comb.	**	57.50a	55.56a	25.83c	35.00b	N.S.	43.17	43.54	43.71	N.S.

Means designated by the same letter are not significantly different at the 0.05 level according to L.S.D. test.
*, ** and N.S. indicates P<0.05, 0.01 and not significant., respectively.

active vegetative growth. Similar results were obtained by El-Shahawy et al. (1993) and Makram et al. (1994).

3. Number of sympodia/plant

From Table 2, it is clear that cotton planted on ridges 60 cm x 20 cm/one side (70000 plants/f.) surpassed those on ridges 60 cm x 25 cm/one side (56000 plants/f.) followed by those on ridges 90 cm width at either 20 or 25 cm hill spacing (93333 or 74666 plants. f., respectively). These results might be due to that the development of new nodes up the plants is slower in dense stands (more than 70000 plants/f.) and consequently associated with minimum sympodia numbers. The increment of monopodia in thinner stands (lower 70000 plants/f.) may reduce fruiting branches along the main stem. These findings are in agreement with Abdel Kader (1986), El-Shahawy et al. (1993) and Makram et al. (1994).

Regarding the effect of N-level, The increment of number of sympodia was positively combined with that essential element up to 80 kg/f. Adding N fertilizer specially in soil suffering from lack of organic matter and/or available N-content (Table 1) optimized efficency of the element. Similar results were obtained by El-Shahawy et al. (1993), Makram et al. (1994) and Abd El-Mailk and Abdel-Aal (1998).

4. Number of lateral root ranks/plant and Root volume (cm^3)

Sowing cotton on ridges at one side caused full development of lateral roots that arise on the tap root in four corresponding ranks with more root volume compared to those grown on ridges at two sides whether at 20 or 25 cm hill spacing. These results could be ascribed on the bases that one or more rank of lateral roots become more prone to damage during consequent hoeings through the narrow furrows between the nearby wide ridges of two planted sides.

In relation to N-fertilization, neither number of lateral root ranks nor root volumve appear to differ by this factor.

B. Fruiting pattern

As presented in Table 3, combined data of the effect of sowing patterns and N-levels could be discuseed as follows:

Table 3. Effect of sowing patterns, N-level and their interaction on some fruiting patterns of Giza 89 cotton cultivar (1996; 1997 seasons and their combined data).

Growth character	Season	Sig.	Sowing pattern (S): Ridges 60 cm width 20 cm hill spacing one side 70000 Pl. /fd.	Ridges 60 cm width 25 cm hill spacing one side 56000 Pl. /fd.	Ridges 90 cm width 20 cm hill spacing two sides 93333 Pl. /fd.	Ridges 90 cm width 25 cm hill spacing two sides 74666 Pl.fed.	Sig.	Nitrogen level (kg/fed.) (N): 40	60	80	S x N interaction Sig.
Number of aborted sites	1996	**	11.92c	10.89d	15.81a	14.92b	**	13.00b	13.06b	14.11a	N.S.
	1997	**	13.66c	12.90c	18.69a	15.87b	**	14.96c	15.25b	15.63a	N.S.
	Comb.	**	12.79c	11.90d	17.25a	15.40b	**	1398c	14.16b	14.87a	N.S.
Additional fruiting branch bolls	1996	**	4.67b	6.22a	1.78d	4.00c	**	3.24c	4.02b	5.25a	N.S.
	1997	**	6.34b	7.87a	2.93d	4.83c	**	4.79c	5.62b	6.08a	*
	Comb.	**	5.51b	7.05a	2.36d	4.42c	**	4.02c	4.82b	5.67a	N.S.
Number of retended bolls	1996	**	17.19b	20.75a	14.10d	16.42c	**	15.12c	17.40b	18.85a	N.S.
	1997	**	26.51b	32.58a	18.47d	20.98c	**	22.99b	25.76a	25.15a	N.S.
	Comb.	**	21.85b	26.67a	16.29d	18.70c	**	19.06b	21.58a	22.00a	N.S.
Number of fruiting sites	1996	**	29.11d	31.63a	29.91c	30.34b	**	28.12c	30.46b	32.96a	N.S.
	1997	**	40.18b	45.37a	37.16c	36.85c	**	37.87b	41.01a	40.78a	N.S.
	Comb.	**	34.65b	38.50a	33.54c	33.60c	**	32.99c	35.74b	39.87a	N.S.

Means designated by the same letter are not significantly different at the 0.05 level according to L.S.D. test.
*, ** and N.S. indicates $P<0.05$, 0.01 and not significant., respectively.

Sowing patterns

It is generally evident that planting cotton plants on ridges 60 cm at one side with low or moderate stands (56000 pl./f or 70000 pl./f., respectively), gained significantly lower number of aborted sites while produced higher values of additional fruiting branch bolls; number of retended bolls and total number of fruiting sites as compared with planting on ridges 90 cm at both sides (denser stands i.e. 74666 or 93333 pl./f.). However, the highest number of aborted sites was combined with the highest plant population, but the maximum values of the remainder traits were assigned for the lowest one. The above results might be due to the fact that plants growing in dense population will have a reduced root volume (Table 2) to replenish water lost to evaportranspiration and reduced leaf area and sympodia predisoposing it to a lower carrying capacity.

Nitrogen levels

All criteria studied in this group highly significantly tended to increase in favour of increasing N-level up to 80 kg/f. Although nitrogen is very important for chlorophyll formation for commenced photosynthesis, cell division and enlargent and boll load, soils with high N-level and moisture availability will tend to produce abundant vegetation whereas leaves of numerous monopodia deep in the canopy may not be sufficiently illuminated to support the development of earliest bolls and almost will be shed.

C. Earliness parameters

Table 4 shows the effect of sowing patterns and N-levels on some earliness parameters.

Sowing pattern

The general trend of results reveals that cotton plants sown on ridges 90 cm at both sides (dense stands) were significantly more susceptible to delay in maturation based on higher magnitudes of first sympodial position, percentage of bolls on monopodia and lower earliness percentage comparing with 20 or 25 cm hill spacing (thin stands).

Delay in maturation of dense stands might be due to that in crowded planting, boll retention on the lowest sympodia may be reduced from excessive shading, higher attractiveness to insects or both. The end result was unthrifty plants that ma-

Table 4. Effect of sowing patterns, N-level and their interaction on some earliness parameters of Giza 89 cotton cultivar (1996; 1997 seasons and their combined data).

Growth character	Season	Sowing Pattern (S) Sig.	Ridges 60 cm width 20 cm hill spacing one side 70000 Pl. /fd.	Ridges 60 cm width 25 cm hill spacing one side 56000 Pl. /fd.	Ridges 90 cm width 20 cm hill spacing two sides 93333 Pl. /fd.	Ridges 90 cm width 25 cm hill spacing two sides 74666 Pl.fed.	Nitrogen level (kg/fed.) (N) Sig.	40	60	80	S x N interaction Sig.
First sympodial position	1996	**	5.68c	5.67c	8.39a	6.16b	**	6.21c	6.46b	6.75a	N.S.
	1997	**	5.51c	5.31d	8.47a	5.72b	**	6.00c	6.22b	6.54a	*.
	Comb.	**	5.60c	5.49c	8.43a	5.94b	**	6.11c	6.34b	6.65a	N.S.
percentage of bolls on monopodia	1996	**	6.38d	6.94c	9.22b	11.10a	**	8.13b	8.34ab	8.77a	N.S.
	1997	**	8.08c	8.61c	12.68b	14.21a	**	10.10c	10.86b	11.73a	N.S.
	Comb.	**	7.23d	7.78c	10.95b	12.66a	**	9.12c	9.60b	10.25a	N.S.
Earliness percentage	1996	**	68.57a	66.22b	51.65d	52.73c	**	61.60a	59.55b	58.23c	*
	1997	**	72.07a	71.37a	52.40b	52.84b	**	63.35a	62.14b	61.02c	N.S.
	Comb.	**	70.32a	68.80b	52.03c	52.79c	**	62.48a	60.85b	59.62c	N.S.

Means designated by the same letter are not significantly different at the 0.05 level according to L.S.D. test.
* ** and N.S. indicates P<0.05, 0.01 and not significant., respectively.

tured late. These results agree with those obtained by Imam (1984) for first sympodial position, and Abdel-Kader (1986) for earliness percentage.

Nitrogen level

The results indicate that delay in maturation due to both higher values of first sympodial position and percentage of bolls on vegetative branches as well as lower earliness percentage was markedly detected when cotton plants received maximum N-rate (80 kg/f). From the previous trend of results, both increase in plant height and monopodia explains this decrease in earliness. Such findings were obtained by El-Shahawy et al. (1993), El-Debaby et al. (1995) for first sympodial position and earlines percentage and Makram et al. (1994) for both characters.

D. Seed cotton yield and its components

Results in Table (5) reveal the effect of sowing patterns and nitrogen levels on these traits.

Sowing pattern

It is realized that cotton plants grown on ridges 60 cm at one side and 20 or 25 cm hill spacing (70 000 or 56000 pl./f. respectively) resulted in higher number of open bolls, boll weight and seed cotton yield (kintar/f.), and lower number of unopen bolls and percentage of plant losses at the end of season compared with those sown on ridges 90 cm at both sides and 20 or 25 cm hill spacing (93333 or 74666 pl./f., respectively). These results could be ascribed to that both loading on a small crowded plant will exceed boll loading on a large crowded plant. Instead, the reduced leaf area and fruiting branches of a crowded plant, resulted from high plant-to-plant competition for nutrition, water and solar radiation, will predispose it to a lower carrying capacity, premature cutout and reduced yield. Similar findings were obtained by El-Hattab et al. (1976), Eweida et al. (1983) El-Shahawy et al. (1993) and hosny et al. (1995) for number of open bolls and yield, El-Shahawy et al. (1993) and Makram et al. (1994) for percentage of plant losses.

Nitrogen level

Seed cotton yield and most yield components studied herein except percentage of plant losses at harvest significantly differed as N-levels diverged. In this connection, cotton plants received the internediaate N rate (60 kg/f.) produced higher open boll numbers and seed cotton yield (kintar/f.) followed descendingly by those ferti-

Table 5. Effect of sowing patterns, N-level and their interaction on seed cotton yield and its components of Giza 89 cotton cultivar (1996, 1997 seasons and their combined data).

Growth character	Season	Sig.	Sowing pattern (S): Ridges 60 cm width 20 cm hill spacing one side 70000 Pl. /fd.	Ridges 60 cm width 25 cm hill spacing one side 56000 Pl. /fd.	Ridges 90 cm width 20 cm hill spacing two sides 93333 Pl. /fd.	Ridges 90 cm width 25 cm hill spacing two sides 74666 Pl.fed.	Sig.	Nitrogen level (kg/fed.) (N): 40	60	80	S x N interaction Sig.
Final Plant height (cm)	1996	**	8.19b	11.40a	7.49d	7.93c	**	8.16c	9.24a	8.85b	*
	1997	**	15.21b	20.04a	7.77d	9.47c	**	12.51b	14.19a	12.67b	N.S.
	Comb.	*	11.70b	15.72a	7.63d	8.71c	**	10.34c	11.72a	10.76b	N.S.
Number of monopodia	1996	**	4.33c	3.12d	6.83a	6.49b	**	4.73c	5.17b	5.69a	N.S.
	1997	**	4.96c	4.68c	7.77a	6.68b	**	5.69b	5.96b	6.41a	N.S.
	Comb.	**	4.65c	3.90d	7.30a	6.59b	**	5.21c	5.57b	6.05a	N.S.
Number of sympodia	1996	**	2.38ab	2.41a	2.21c	2.33b	N.S.	2.30	2.33	2.37	N.S.
	1997	**	2.34ab	2.39a	2.23c	2.30b	**	2.27b	2.31b	2.38a	N.S.
	Comb.	**	2.36ab	2.40a	2.22c	2.32b	*	2.29b	2.32b	2.38a	N.S.
Number of lateral root ranks	1996	**	18.37c	17.33d	24.82a	19.46b	N.S.	19.91	20.04	20.04	N.S.
	1997	**	17.92c	16.80d	24.11a	19.06b	N.S.	19.12	19.75	19.55	N.S.
	Comb.	**	18.15c	17.07d	24.47a	19.26b	N.S.	19.52	19.90	19.80	N.S.
Root volume (cm^3) (40 cm depth)	1996	**	7.04b	8.19a	6.37c	6.25c	**	6.41c	7.69a	6.79b	N.S.
	1997	**	13.07b	14.54a	7.42d	8.449c	**	10.15c	11.73a	10.76b	N.S.
	Comb.	**	10.06b	11.37a	6.90d	7.37c	**	8.28c	9.71a	8.78b	N.S.

Means designated by the same letter are not significantly different at the 0.05 level according to L.S.D. test.
*, ** and N.S. indicates P<0.05, 0.01 and not significant, respectively.

lized with 80 kg N/f. The highest number of unopen bolls and boll weight were associated with 80 kg N/f. application. On the other hand, percentage of plant losses at harvest did not react with N application. Seed cotton yield and most its components responded positively to the additional amount of nitrogen was the resultant expression for the reduction of the soil content of organic matter and available N (Table 1). Similar results were obtained by Abou Zied and Mohamad (1985) concerning yield, El-Shahawy et al. (1993) for percentage of plant losses, Makram et al. (1994) for open bolls, boll weight and yield, El-Debaby et al. (1995) for open bolls and yield and Abd El-Malik, and Abdel-Aal (1998) for boll weight, plant losses and yield.

Effect of the interaction between sowing pattern and nitrogen level

The analysis of variance indicated non significant interaction between sowing pattern and N-level revealing the independent effect of both factors on all traits studied herein.

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تأثير الكثافة النباتية من خلال المسافات بين الخطوط والجور تحت مستويات مختلفة من النيتروجين لصنف القطن جيزة ٨٩

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أجريت تجربتان حقليتان بمحطة البحوث الزراعية بسخا عامي ١٩٩٦ / ١٩٩٧ علي صنف القطن الجديد جيزة ٨٩ حيث زرع علي خطوط ٦٠ سم x ٢٠ سم/ريشة واحدة، ٦٠ سم x ٢٥ سم /ريشة واحدة، ٩٠ سم x ٢٠ سم علي الريشتين، ٩٠ سم x ٢٥ سم علي الريشتين كقطع رئيسية وثلاثة معدلات تسميد أزوتي (٤٠ ، ٦٠ ، ٨٠ كجم/فدان) كقطع منشقة.

وتشير نتائج التحليل المشترك للبيانات إلي مايلي:

١. أدت زراعة نباتات القطن علي خطوط ٦٠سم /ريشة واحدة (كثافة منخفضة) إلي زيادة ارتفاع النبات النهائي، وعدد الأفرع الخضرية والثمرية ومحاور الجذور الجانبية وحجم الجذور واللوز المحمول علي أفرع ثمرية إضافية واللوز العاقد والمواقع الثمرية والنسبة المئوية للتبكير بينما قللت عدد المواقع الغائبة وموقع أول فرع ثمري ونسببة اللوز علي الأفرع والخضرية واللوز غير المتفتح ونسبة الفقد في عدد النباتات نهاية الموسم مقارنة بالزراعة علي خطوط ٩٠ سم /الريشتين سواء عند ٢٠ أو ٢٥ سم بين الجور.

٢. أعطي التسميد الأزوتي حتي ٨٠ كجم/فدان أعلي قيم لارتفاع النبات النهائي وكلا الأفرع الخضرية والثمرية والمواقع الغائبة واللوز المحمول علي أفرع ثمرية إضافية واللوز العاقد والمواقع الثمرية والنسبة المئوية للوز علي الأفرع الخضرية واللوز غير المتفتح ووزن اللوزة.

وجد أن إضافة ٦٠ كجم ن/فدان أعطت أعلي عدد لوز متفتح ومحصول قطن زهر (قنطار/فدان). لم يكن لمعدلات التسميد الآزوتي تأثير معنوي علي عدد محاور الجذور الجانبية وحجم الجذر ونسبة الفقد في عدد النباتات نهاية الموسم .

٣. لم يكن للتفاعل بين نظم الزراعة (الكثافة النباتية) ومعدلات التسميد الأزوتي أي تأثير معنوي علي أي من الصفات تحت الدراسة.