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EFFECT OF SEEDING RATES, NITROGEN LEVELS AND HARVESTING DATES ON GROWTH, YIELD AND QUALITY OF JUTE (*Corchorus capsularis,* L.)

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ABSTRACT

This investigation was carried out at the experimental farm of Sakha Agric. Res. Station during 2007 and 2008 seasons to study the effect of three seeding rates at 4, 5 and 6 kg/fed, three nitrogen levels 20, 30 and 40 kg/fed and two harvesting dates i.e., after 120 and 150 days from sowing on growth, yield quantity and quality of U.P.C. 94 jute cultivar. The main findings of the present study could be summarized as follows:

The seeding rate at 5 kg/fed combined with the plant age at 102 days from sowing achieved the highest mean values of dry weight/plant (g), plant height (cm) and leaf area/plant (dm^2), while, the leaf area index was in high magnitude by using 6 kg seeds/fed at 72 days old in both seasons. Planting jute with 4 kg/fed at the growth period of 87-102 days from sowing performed the highest average for CGR, RGR and NAR. The maximum contents of chlorophyll A, B and A + B occurred due to the seeding rate of 4 kg/fed at the two plant ages either 55 or 75 days from sowing, as well as, increased number of capsules/plant, seed index, seed yield/plant and fiber yield/plant in both seasons. Whereas, the highest means of capsules zone length, green yield/plant, fiber yield/fed, fiber percentage and fiber strength were obtained by sowing at the rate of 5 kg/fed, while planting with 6 kg/fed accomplished the highest estimates for technical length, fiber length and fiber fineness in both seasons.

There was gradual increase in dry weight/plant due to increasing nitrogen level from 20 up to 40 kg/fed. This trait also increased when plant age increased from 57 to 102 days old, but the maximum estimates of plant height (cm), leaf area/plant (dm^2) and leaf area index were obtained due to application of 30 kg N/fed when jute plants reached 102 days from sowing. The more estimates of CGR and NAR were obtained by applying 20 kg N/fed and at the growth period of 87-102 days old, while, the highest RGR was obtained by adding either 30 or 40 kg N/fed and during the growth period of 57-72 days old in both seasons. Gradual increment happened in each of chlorophyll A, B and A + B with increasing nitrogen level at the smallest age i.e., 55 days old. There were gradual increments for each green yield (ton), seed yield (kg) and their components in addition to fiber yield/fed (kg) with increasing N level up to 40 kg/fed, but reduction occurred in fiber percentage and fiber fineness in this case in both seasons.

Delaying harvesting date to 150 days from sowing caused remarkable increase in all studied characters except that of fiber percentage, fiber strength and fiber fineness which were decreased in this case and as compared with the harvesting date of 120 days from sowing.

Keywords: Jute, *Corchorus capsularis,* L., seeding rate, nitrogen fertilizer, harvesting date, growth, yield, quality.

INTRODUCTION

Jute is a natural fiber popularly known as the golden fiber, jute is second only to cotton in world's production of textile fibers. India, Bangladesh, China and Thailand account for over 90 percent of world

production, it is also produced in southwest Asia and Brazil. The jute fiber is also known as Pat, Kosta and Nalita.

Jute (*Corchorus* spp.) belongs to family Tiliaceae, which contains about 35 genera and 370 species; among which the more important jute species are *C. capsularis* and *C. olitorius*. During the last few years there has been growing interest in jute in Egypt because of its technological properties in comparison with the kenaf fibers. Jute fibers alone or mixed with kenaf fibers can be used to manufacture of bags, sacks, ropes, twine, hessian cloth, carpet and other products. Therefore, great efforts had been done to increase fiber quantity and quality of jute through growing more productive cultivars or by improvement of agricultural practices, such as seeding rates, nitrogen levels and harvesting dates. Hoque (1986) obtained the highest fiber yield (2.90 tons/ha) by 8 kg seeds/ha for line sowing and (2.57 tons/ha) when broadcast seeds at the rate of 12 kg/ha. Bandyopadhyay *et al.* (1991) found that fiber yield increased and basal diameter decreased with increasing seeding rate. Mishra *et al.* (1996), Mishra and Mishra (1997) and Mishra *et al.* (1998) indicated that low sowing rate gave the highest fiber and stick yields. El-Gazzar (2001b) reported that dry weight/plant, plant height, leaf area/plant, technical length, top capsules zone length, green and fiber yields/plant as well as per fed, fiber length, fiber strength, number of capsules/plant and seed yield/plant, as well as per fed, were significantly increased at 4.5 kg seeds/fed crop growth rate (CGR), relative growth rate (RGR) and fiber fineness significantly increased with increasing seeding rate from 3.5 to 5.5 kg/fed.

Several workers investigated the effect of nitrogen fertilization on jute yield and its attributes and recorded a positive response of jute plant to nitrogen fertilizer levels. Jayaraman and Asokaraja (1995) reported that the highest jute yields were obtained with applying 60 kg N/ha and harvesting 100 days after sowing. Mishra *et al.* (1996) concluded that jute fiber yields increased from 0.56 ton with no N to 1.98 ton with 80 kg N/ha, but the economic rate was 40 kg/ha (1.34 ton). Nayak *et al.* (1996) stated that the mean fiber dry matter yield was the highest with 60 kg N/ha (2.72 ton/ha). El-Sweify and Abd El-Rasoul (2002) found that yield, as well as its components and fiber length significantly increased by increasing nitrogen level up 50 kg/fed, while, applying N rate more than 25 kg/fed decreased fiber percentage. Alamgir *et al.* (2008) tried three harvesting times viz. 90, 105 and 120 days after emergence and three population densities of 3.0, 3.5 and 4.0 Lac ha-1 as treatments on two white jute (*Corchorus capsularis,* L.). They reported that the highest fiber yield was recorded due to 3.5 Lac plants ha-1 when the crop was harvested at 120 days after emergence.

The main target of this work is to study the response of growth, yield, as well as its components and fiber quality of jute under different seeding rates, nitrogen levels and harvesting times.

MATERIALS AND METHODS

Two field experiments were conducted at the experimental farm of Sakha Agricultural Research Station during 2007 and 2008 growing seasons to study the effect of three seeding rates 4, 5 and 6 kg/fed, three nitrogen fertilizers levels 20, 30 and 40 kg/fed in the form of urea (46.5%) at two equal doses (after 30 and 45 days from sowing), in addition to two harvesting dates at 120 and 150 days after sowing and their interactions on growth, yield and quality of jute cv, U.P.C. 94 introduced from Bangladesh.

The split-split plot design with four replications was used since the three seeding rates were allocated in the main plots, while nitrogen fertilizer levels were allocated in the sub-plots and harvesting times in the sub-sub plots.

Planting was done on 13th and 25th of June, for the first and second seasons, respectively. The sub-sub-plot size was 4.2 m^2 (1.05 x 4.0 m) , and drilling machine was used for seeding, where seeds were sown in 8 rows, 15 cm apart. Previous crop was clover in both seasons. Other cultural practices were performed as usual. Four random samples, each of ten guarded plants, were taken from each sub-sub-plot at 57, 72, 87 and 102 days from planting to determine growth parameters and attributes. At each of two harvest times (120 and 150 days after sowing), ten individual plants were uprooted from each sub-sub-plot to determine yield components. Seed and green yields of jute were estimated from area basis of 3.0 m^2 for each sub-sub-plot.

Soil samples were collected from the experimental sites before planting and subjected to mechanical and chemical analysis and the results were presented in Table 1.

Table 1:Soil chemical and mechanical analysis of the experimental site in 2007 and 2008 seasons.

Year	Mechanical analysis			Chemical analysis				
	Sand %	Silt %	Clay %	OM %	N ppm	P ppm	EC dS/m	pH
2007	13.01	23.74	66.07	1.79	22.31	9.16	2.77	8.21
2008	12.76	21.93	64.68	1.86	21.57	10.07	2.50	8.30

Characters studied:

I. Growth parameters:

1. Dry weight/plant (g).
2. Plant height (cm).
3. Leaf area/plant: calculated in square decimeter (dm^2) using Portable Area Meter Mode Li-CoR.
4. Leaf area index: Unit leaf area/unit ground area.

II. Growth attribute parameters:

1. Crop growth rate (CGR) = W_2-W_1/T_2-T_1 g/m^2/week.
2. Relative growth rate (RGR) = LnW_2-LnW_1/T_2-T_1 g/g/week.
3. Net assimilation rate (NAR) = (W_2-W_1) (LnA_2-LnA_1)/ (A_2-A_1) (T_2-T_1) g/m^2/week.

Where, W_1 and W_2 refer to dry weight, A_1 and A_2 refer to leaf area per plant at time T_1 and T_2 in week, respectively and Ln natural log according to Watson (1952).

III. For chlorophylls determination (a, b and total), fresh leaves were extracted with dimethyl formamid solvent as described by Moran (1982).

IV. Yield and its components:

1. Technical length (cm).
2. Top capsules-zone length (cm).
3. Stem diameter (mm).
4. Green yield/pant (g).
5. Green yield/fed (ton).
6. Number of capsules/plant.
7. Seed index (g/1000 seeds).
8. Seed yield/plant (g).
9. Seed yield/fed (kg).

V. Fiber yield and quality:

1. Fiber yield/plant (g). 2.Fiber yield/fed (kg).
3. Fiber percentage. 4.Fiber length (cm).
5. Fiber strength, was tested by using pressley tester and expressed as pressley index which indicates the breaking strength weight ratio based on zero gauge spacing.

$$\text{Pressley index} = \frac{\text{Breaking load in Ib}}{\text{Bundle weight in mg}}$$

The fiber properties testes were conducted, according to the American Society for Testing and Materials (ASTM), 1976.

6. Fiber fineness in metrical number (Nm), was determined using Radwan and Momtaz metod (1966) using the following formula.

$$Nm = \frac{N \times L}{G}$$

N = Number of fiber (20 fiber each 10 cm long).
L = Length of fiber in mm = (2000)
G = Weight of fiber in mg.

All the data collected were subjected to statistical analysis for each season, and the homogeneity of experimental error, in both seasons, was tested. Then, the results fo each season are discussed separately, as described by Snedecor and Cochran (1982). The mean values were compared according to Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

I.Growth parameters:

Data in Tables 2 and 3 showed that dry weight/plant was significantly affected by seeding rates at 72 and 87 days after sowing in the first season, however the differences did not reach the level of significance between the four sampling dates in the second season.

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Table 3: Means of dry matter accumulation, plant height (cm), leaf area per plant (dm^2) and leaf area index of jute, as affected by seeding rates and nitrogen levels at different stages in 2008 season.

Variable	Days after sowing	Seeding rate kg/fed				Nitrogen level kg/fed				Interaction
		Sig.	4	5	6	Sig.	20	30	40	
Dry weight/plant (g)	57	NS	4.39	4.79	4.59	NS	4.48	4.69	4.61	**
	72	NS	7.21	8.05	7.56	NS	7.42	7.62	7.77	NS
	87	NS	9.81	11.40	10.49	NS	10.16	11.16	10.38	**
	102	NS	14.77	15.49	14.89	NS	14.79	15.55	14.81	NS
Plant height (cm)	57	NS	90.72	94.75	94.32	*	89.05 b	96.78 a	93.95 ab	NS
	72	NS	127.21	127.17	123.97	NS	127.13	127.65	123.56	NS
	87	**	147.74 ab	155.67 a	145.15 b	NS	148.68	149.68	150.19	NS
	102	NS	163.72	166.54	165.08	NS	163.08	167.83	164.43	NS
Leaf area/plant, (dm^2)	57	NS	2.67	3.27	3.12	NS	2.96	3.23	2.87	*
	72	NS	4.06	4.08	3.84	NS	3.79	4.26	3.94	NS
	87	**	3.16 b	4.17 a	3.52 ab	NS	3.50	3.71	3.64	NS
	102	NS	2.41	2.70	2.56	NS	2.34	2.80	2.53	NS
Leaf area index	57	**	7.31 b	10.95 a	12.59 a	NS	10.24	10.98	9.63	NS
	72	*	10.79 b	13.63 ab	15.80 a	NS	12.09	14.68	13.44	NS
	87	**	8.42 b	14.18 a	14.47 a	NS	11.82	12.73	12.51	NS
	102	**	6.41 b	9.19 a	10.55 a	NS	8.09	9.61	8.45	NS

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**

Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

Data illustrated that the dry weight/plant reached maximum estimates by using the seeding rate of 5 kg/fed in all the sampling dates under study in both seasons. Meanwhile, slight decrements had happened regarding these samples by using the highest seeding rate of 6 kg/fed and remarkable reduction occurred at 4 kg seeds/fed in this case. Moreover, this result may be due to the suitable environmental conditions in both growing seasons for the plant population when sown by the intermediate seeding rate (5 kg/fed) which favoured the dry matter accumulation in jute plants. Dry weight/plant increased with increasing the plant age from 57 towards 102 days old as all the three studied seeding rates were concerned.

These results are in agreement with those of Mishra *et al.* (1998) and El-Gazzar (2001a).

The effect of nitrogen levels led to an increase in dry matter accumulation at all sampling dates in the two seasons. However, these differences were significant at 87 and 102 days after sowing date only in the first season. There was gradual increment in this character as the plant age increased from 57 to 102 days from sowing in relation to the three nitrogen levels in both seasons. It must be mentioned here, that nitrogen is an essential element for jute growth by building up protoplasm and proteins which induce cell division and meristematic activity, in addition to an increase in cell number and cell size with an overall increase in plant growth. These results are in harmony with those of Das *et al.* (1996) and Sarkar *et al.* (1997).

Data, also, showed that the interaction between seeding rates(S) correspond and nitrogen levels (N) significantly affected the dry weight/plant at 57 days from planting in the two seasons and at 87 day from planting only in the second one. In this connection, the highest mean value of dry matter (16.342 g) was obtained by seeding rate at 5 kg/fed combined with sample date of 102 day old, while, the greatest average (16.203 g) was achieved by applying 30 kg N/fed at the oldest sample (102 day) in the first season. While, the respective means was 15.490 and 15.550 g which was found in the second one, respectively. Increasing seeding rates did not exert any significant effect on plant height at all growth stages in the two seasons except at the first and third growth stages in both seasons, respectively.

The nitrogen levels significantly affected plant height due to trait applying 30 kg N/fed which approximately produced highest estimates and surpassed other two levels in plant height but these differences did not reach the level of significance at the second sampling date in 2007 season and at the last three sampling dates in 2008 one. Similar results were reported by Patel and Thakur (2003).

The interaction between seeding rates and nitrogen levels had significant effect on plant height character at only the smallest plant age (57 day old) in the first season.

With regard to seeding rates and their effect on leaf area/plant, it could be noticed that the differences were significant at 87 and 102 days form sowing in the first season, while, it was at only 87 days in the second one. The leaf area/plant reached relatively highest estimates at the age of 72 days from sowing and gradual decrement had occurred with increasing plant age till 102 days old.

Application of 30 kg N/fed caused maximum leaf area/plant in the two successive seasons since, it was superior to the other two nitrogen levels i.e., 20 and 40 kg/fed and failed to exert any significant differences at any of growth stages through the two growing seasons. The interaction between seeding rates and nitrogen levels significantly affected the leaf area/plant at 57 days from planting in the two seasons.

The effect of seeding rates on leaf area index had significant effects concerning all growth stages in 2007 and 2008 seasons. Leaf area index was increased as seeding rate increased up to 6 kg/fed insignificant differences were obtained between the two seeding rates viz. 5 and 6 kg/fed for all growth stages in the two seasons.

Increasing nitrogen level up to 30 kg/fed led to a slight increase in leaf area index at all growth stages in both seasons. These increases were only significant at the third stage (87 days old) in 2007 season. No significant differences were obtained with the interaction between two factors under study on leaf area index at all growth stages in the two seasons except at the age of 57 days in the first season. These results are in line with those obtained by El-Gazzar (2001a and b) and El-Sweify and Abd El-Rasoul (2002).

II. Growth attributes parameters:

Tables 4 and 5 show growth attributes means as affected by seeding rates and nitrogen levels throughout the two growing seasons of study. Crop growth rate was significantly influenced by seeding rate for the three age periods only in the first season. Insignificant differences in CGR due to nitrogen levels were detected at all growth periods except at the second period in both seasons. The interaction between seeding rates and nitrogen levels had significant effect on CGR at the three growth periods in both seasons except at the third growth stage in the first season.

Seeding rates exerted insignificant effects on relative growth rate at all growth periods in both seasons except at the growth period of 72-87 day after sowing in 2007 season and at 87-102 days in 2008 season. No significant differences were detected in RGR values as affected by nitrogen level at all growth stages in both seasons except at the second growth stage in 2007 season. The interaction between seeding rates and nitrogen levels had significant effect on this trait at the first period (57-72 days) of the first season and at all the three periods in the second one.

Table 4: Means of crop growth rate (CGR), relative growth rate (RGR) and net assimilation rate (NAR) of jute as affected by seeding rates and nitrogen levels at different stages in 2007 season.

Variable	Days after sowing	Seeding rate kg/fed				Nitrogen level kg/fed				Interaction
		Sig.	4	5	6	Sig.	20	30	40	
Crop growth rate (CGR) (g/cm^2/week)	57-72	**	1.464 ab	1.665 a	1.265 b	NS	1.381	1.471	1.542	**
	72-87	**	1.314 c	1.876 b	2.380 a	**	1.264 b	2.107 a	2.200 a	**
	87-102	*	2.300 a	2.064 a	1.650 b	NS	2.258	1.920	1.835	NS
Relative growth rate (RGR) (g/g/week)	57-72	NS	0.249	0.242	0.206	NS	0.230	0.234	0.233	**
	72-87	**	0.141 b	0.183 b	0.248 a	**	0.143 b	0.207 a	0.223 a	NS
	87-102	NS	0.182	0.162	0.112	NS	0.173	0.139	0.143	NS
Net assimilation rate (NAR) (g/m^2/week)	57-72	*	0.419 a	0.408 ab	0.346 b	NS	0.394	0.366	0.414	**
	72-87	**	0.341 b	0.390 b	0.587 a	**	0.322 b	0.496 a	0.499 a	*
	87-102	**	0.788 a	0.645 ab	0.457 b	NS	0.726	0.574	0.590	NS

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**

Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

Table 5: Means of crop growth rate (CGR), relative growth rate (RGR) and net assimilation rate (NAR) of jute as affected by seeding rates and nitrogen levels at different stages in 2008 season.

Variable	Days after sowing	Seeding rate kg/fed				Nitrogen level kg/fed				Interaction
		Sig.	4	5	6	Sig.	20	30	40	
Crop growth rate (CGR) (g/cm^2/week)	57-72	NS	1.198	1.529	1.321	NS	1.353	1.279	1.416	**
	72-87	NS	1.528	1.737	1.587	*	1.707	1.808	1.337	**
	87-102	NS	2.553	2.150	2.344	NS	2.369	2.498	2.180	**
Relative growth rate (RGR) (g/g/week)	57-72	NS	0.228	0.254	0.236	NS	0.226	0.229	0.263	**
	72-87	NS	0.168	0.181	0.182	NS	0.196	0.184	0.151	**
	87-102	*	0.206 a	0.159 b	0.196 a	NS	0.185	0.197	0.180	**
Net assimilation rate (NAR) (g/m^2/week)	57-72	NS	0.407	0.430	0.424	N S	0.392	0.375	0.494	*
	72-87	NS	0.412	0.428	0.433	*	0.456 a	0.448ab	0.369 b	**
	87-102	*	0.775 a	0.536 b	0.756 a	*	0.725 a	0.596 b	0.746 a	**

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**

Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

Seeding rates had significant effects on NAR values during the two seasons of study except at the first and second growth stages in the second season. Significant difference were found in net assimilation rate due to increasing the nitrogen level at the second growth stage in the first season and at the second and third growth stages in the second one. These results confirmed the findings of Hoque (1986).

The interaction effect was significant at all sampling dates in both seasons, except at the third period for NAR in 2007 season. Similar results were reported by (El-Gazzar, 2001a and b). It must be mentioned here, that the results of crop growth rate (CGR), relative growth rate (RGR) and net assimilation rate (NAR) revealed unconsistent trend among the three growth periods and either the effect of seeding rates or nitrogen levels.

III.Chlorophyll:

Data presented in Table (6) exhibited insignificant differences among the mean values of chl. a, chl. b and the total of both (a + b) two pigments as affected by seeding rates at 55 days of plant old in only the first season however there was significant effect in this case regarding chl. a and chl. a + chl. b at 75 days after sowing in the first season and at either 55 or 75 days old in the second one. Moreover, the highest estimates for chl. a, chl. b and the summation of them were noticed at the younger age (at 55 days) than in the oldest one (at 75 days from sowing) in each of two successive seasons.

Concerning nitrogen levels effect, results indicated significant differences in the mean values of chl. a and chl. a + chl. b at 55 days plant old in both seasons, while, the same two pigments were significantly differed at 75 days in the first season, in addition to the three studied pigments showed significance in the second one. It can be observed that the estimates of chl. a, chl. b and chl. a + chl. b contents were increased with increasing nitrogen level from 20 to 40 kg/fed. This effect of nitrogen might be attributed to the encouragement of N to vegetative growth and delayed chlorophyll degradation (Faisal, 1989).

Table 6:Effect of seeding rates and nitrogen levels on chlorophyll a, b and total chlorophyll in 2007 and 2008 seasons.

Variable (mg/dm^2)	Days after sowing	Seeding rate kg/fed				Nitrogen level kg/fed				Interaction
		Sig.	4	5	6	Sig.	20	30	40	
		2007 season								
Chl. a	55	NS	3.25	3.18	3.14	*	3.08 b	3.12 b	3.37 a	NS
Chl. b		NS	0.83	0.82	0.89	NS	0.78	0.88	0.88	NS
Chl. a + Chl. b		NS	4.07	3.98	4.03	*	3.86 c	4.01 b	4.22 a	NS
Chl. a	75	*	3.09 a	2.84 b	2.84 b	*	2.80 b	2.90 b	3.07 a	NS
Chl. b		NS	0.73	0.80	0.76	NS	0.79	0.86	0.64	NS
Chl. a + Chl. b		*	3.83 a	3.64 b	3.60 b	*	3.60 b	3.74 a	3.71 a	NS
		2008 season								
Chl. a	55	*	3.08 a	2.83 b	2.62 b	*	2.62 b	2.75 b	3.16 a	NS
Chl. b		NS	0.86	0.70	0.69	NS	0.67	0.77	0.81	NS
Chl. a + Chl. b		*	3.94 a	3.54 b	3.30 b	*	3.29 c	3.52 b	3.98 a	NS
Chl. a	75	*	2.98 a	2.71 b	2.60 b	**	2.52 c	2.71 b	3.06 a	NS
Chl. b		NS	0.79	0.73	0.71	*	0.68 b	0.74 b	0.80 a	NS
Chl. a + Chl. b		*	3.78 a	3.44 b	3.31 b	**	3.20 c	3.46 b	3.86 a	NS

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**

Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

The interaction between seeding rates and nitrogen levels had insignificant effect on the contents of chl. a, chl. b and chl. a + chl. b for the two plant ages i.e., 55 and 75 days old in both seasons meaning thereby that each of the two studied factors act its effect separately.

IV.Yield and its components:

Data presented in Tables 7 and 8 showed that seeding rate significantly affected all the studied nine characters in both seasons. In general, seeding rate of 6 kg/fed, gave the highest values for technical length while the lowest values obtained for stem diameter, green yield/plant, No. of capsules/plant, seed index and seed yield/plant in both seasons. The medium seeding rate (5 kg/fed) gave the highest values for top capsule zone length and green yield/plant as well as per fed. On the other hand, the lowest seeding rate of 4 kg/fed surpassed the other two rates for stem diameter, number of capsules/plant, seed index and seed yield/plant as well as per fed with insignificant differences between 5 and 6 kg/fed for seed index and seed yield/plant in both seasons.

This may be attributed to the fact that high seeding rate created high competition among plants for moisture, nutrients and light. The trend of results was similar to that of growth, yield and yield components. This finding is in line with that of Nayyar *et al.* (1983), Idris (1989), Mishra *et al.* (1998), Bandyopadhyay *et al.* (1991) and El-Gazzar (2001a and b).

There were significant differences among the three N levels in all studied characters, except for stem diameter and seed index in both seasons. Data indicated significant increase in all characters by application of 40 kg N/fed with significant differences between 30 and 40 kg/fed for green yield/fed and seed yield/plant. It is well known that nitrogen is an essential element for jute growth to build up protoplasm and proteins, which induce cell division and meristimatic activity and furtherly increase cell number and size with an overall increase in jute growth and its yield. Similar results were reported by Idris (1989), Mishra *et al.* (1996), Das and Chowdhury (1997) and El-Sweify and Abd El-Rasoul (2002). Owing to the harvesting dates, data indicated that the last harvest date (150 days after sowing) revealed significant increases in each of technical length, top capsule zone length, stem diameter, green yield per plant and per fed, number of capsules/plant, seed index and seed yield/plant and per fed in both seasons of jute plants in comparison to the first harvesting date (120 days after sowing). These results show that the highest values of second harvesting date may be attributed to the prolonged growth period of more accumulated metabolites and, in turn, the significant increases seen in yield and its attributive characters were more expected. These results were found to be similar to those mentioned by several workers among them. Mishra and Jena (1987), Jayaraman and Asokaraja (1995) and Alamgir *et al.* (2008).

Table 7: Means of yield and its components of jute as affected by seeding rates, nitrogen levels and harvesting dates in 2007 season.

Variable	Seeding rate, kg/fed (S)				Nitrogen level, kg/fed (N)				Harvesting date (H)		
	Sig.	4	5	6	Sig.	20	30	40	Sig.	120 days old	150 days old
Technical length (cm)	**	155.4 c	174.8 b	178.1 a	**	167.4 b	168.9 b	172.0 a	**	165.0 b	173.8 a
Top capsules zone length (cm)	**	47.3 c	58.6 a	55.7 b	**	52.0 c	54.3 b	55.3 a	**	52.8 b	55.0 a
Stem diameter (mm)	**	6.75 a	5.91 b	5.44 c	NS	6.05	6.02	6.03	**	5.96 b	6.10 a
Green yield/plant (g)	**	55.7 b	58.7 a	52.3 c	**	53.9 c	55.4 b	57.5 a	**	54.5 b	56.7 a
Green yield/fed (ton)	**	10.51 c	12.19 a	11.51 b	**	11.16 b	11.46 a	11.59 a	**	10.92 b	11.89 a
No. of capsules/plant	**	37.6 a	35.0 b	33.48 c	**	34.6 c	35.2 b	36.3 a	**	33.9 b	36.8 a
Seed index (g/1000 seeds)	**	3.59 a	3.52 b	3.49 b	Ns	3.52	3.52	3.54	**	3.30 b	3.76 a
Seed yield/plant (g)	**	1.88 a	1.69 b	1.67 b	**	1.66 b	1.76 a	1.82 a	**	1.57 b	1.92 a
Seed yield/fed (kg)	**	380.1 a	347.0 b	288.8 c	**	327.5 c	337.1 b	351.3 a	**	327.6 b	349.7 a

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**
Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

Table 8: Means of yield and its components of jute as affected by seeding rates, nitrogen levels and harvesting dates in 2008 season.

Variable	Seeding rate, kg/fed (S)				Nitrogen level, kg/fed (N)				Harvesting date (H)		
	Sig.	4	5	6	Sig.	20	30	40	Sig.	120 days old	150 days old
Technical length (cm)	**	146.3 c	165.9 b	169.8 a	**	157.9 c	160.2 b	163.9 a	**	156.1 b	165.2 a
Top capsules zone length (cm)	**	44.6 c	55.2 a	52.3 b	**	48.7 c	51.2 b	52.3 a	**	49.5 b	51.9 a
Stem diameter (mm)	**	6.63 a	5.78 b	5.34 c	NS	5.92	5.92	5.91	**	5.84 b	5.99 a
Green yield/plant (g)	**	52.5 b	55.5 a	49.2 c	*	50.7 c	52.2 b	54.2 a	**	51.4 b	53.3 a
Green yield/fed (ton)	**	9.89 c	11.53 a	10.94 b	**	10.55 c	10.83 b	10.98 a	**	10.28 b	11.29 a
No. of capsules/plant	**	35.4 a	33.9 b	32.5 c	**	32.9 c	33.8 b	35.0 a	**	32.5 b	35.4 a
Seed index (g/1000 seeds)	**	3.58 a	3.49 b	3.44 b	NS	3.51	3.51	3.49	**	3.29 b	3.71 a
Seed yield/plant (g)	**	1.78 a	1.59 b	1.57 b	**	1.56 b	1.67 a	1.70 a	**	1.46 b	1.83 a
Seed yield/fed (kg)	**	359.8 a	333.6 b	272.2 c	**	315.1 b	318.9 b	331.7 a	**	311.3 b	332.5 a

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**
Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

From Table (9), the interaction between seeding rates (S) and nitrogen levels (N) had significant effect on technical length, top capsules zone length as well as green yield/fed in both seasons, while, seed yield/fed

was affected significantly only in the second season. The respective highest mean values for the same arrangement of the above mentioned traits were 179.20 and 171.69 cm for technical length, 60.43 and 56.94 cm for top capsules zone length and 12.54 and 11.86 ton for green yield/fed in the first and second seasons, respectively. These estimates were performed due to seeding rate of 5 kg/fed combined with applying 40 kg N/fed. Meanwhile, seed yield/fed reached maximum yield (370.88 kg) due to sowing rate of 4 kg/fed and N level of 40 kg/fed.

Table 9:Summary of the significant interaction effects among seeding rates(S), nitrogen levels (N) and harvesting dates (H) on yield and its components of jute in 2007 and 2008 seasons.

Variables	Season	S x N		S x H		N x H		S x N x H	
		Highest value	Treatment	Highest value	Treatment	Highest value	Treatment	Highest value	Treatment
Technical length (cm)	2007	179.20	S_2 x N_3	183.13	S_2 x H_2	NS	-	NS	-
	2008	171.69	S_2 x N_3	175.04	S_2 x H_2	NS	-	NS	-
Top capsules zone length (cm)	2007	60.43	S_2 x N_3	60.01	S_2 x H_2	56.22	N_3 x H_2	NS	-
	2008	56.94	S_2 x N_3	NS	-	NS	-	NS	-
Stem diameter, (mm)	2007	NS	-	NS	-	NS	-	NS	-
	2008	NS	-	6.72	S_1 x H_2	NS	-	NS	-
Green yield/plant, (g).	2007	NS	-	60.47	S_2 x H_2	58.76	N_3 x H_2	NS	-
	2008	NS	-	NS	-	NS	-	NS	-
Green yield/fed (ton).	2007	12.54	S_2 x N_3	12.82	S_2 x H_2	NS	-	NS	-
	2008	11.86	S_2 x N_3	12.13	S_2 x H_2	11.44	N_3 x H_2	12.84	S_2 x N_2 x H_2
No. of capsules/plant	2007	NS	-	39.43	S_1 x H_2	NS	-	NS	-
	2008	NS	-	37.24	S_1 x H_2	NS	-	NS	-
Seed index (g/1000 seeds)	2007	NS	-	NS	-	NS	-	NS	-
	2008	NS	-	3.76	S_1 x H_2	NS	-	NS	-
Seed yield/plant (g)	2007	NS	-	NS	-	1.94	N_3 x H_2	NS	-
	2008	NS	-	NS	-	NS	-	NS	-
Seed yield/fed (kg)	2007	NS	-	393.54	S_1 x H_2	NS	-	NS	-
	2008	370.88	S_1 x N_3	372.06	S_1 x H_2	338.24	N_3 x H_2	NS	-

S_1: 4 kg seeds/fed S_2: 5 kg seeds/fed N_2: 30 kg N/fed
N_3: 40 kg N/fed H_2: The second harvesting date

The interaction between seeding rates and harvesting dates was significant for technical length, green yield/fed, number of capsules/plant and seed yield/fed in both seasons, in addition to top capsules zone length and green yield/plant in only the first season, while, stem diameter and seed index characters were affected significantly in the second one. The highest estimates for technical length (183.13 and 175.04 cm), top capsules zone length (60.01 cm) in the first season, green yield/plant (60.47 g) in the first season and green yield/fed (12.82 and 12.13 ton in both seasons, respectively) were obtained due to seeding rate of 5 kg/fed when harvested at the latest date. Meanwhile, stem diameter (6.72 mm) in second season and number of capsules/plant (39.43 and 37.29 in both seasons,

respectively), seed index (3.76g in the second season) and seed yield/fed (393.54 and 372.06 kg in both seasons, respectively), were achieved due to the lowest seeding rate (4 kg/fed) when the harvesting was delayed to the latest date of sowing.

The interaction between nitrogen levels and harvesting dates had significant effect on the top capsules zone length (56.22 cm), green yield/plant (58.76 g) and seed yield/plant (1.94 g) in the first season. While, green yield/fed (11.44 ton) and seed yield/fed (338.24 kg) were significantly affected in the second season. The maximum estimates between brackets which previously mentioned were performed due to applying 40 kg N/fed combined with the latest harvesting date.

The second order interaction (S x N x H) had significant effect on green yield/fed (12.84 ton) which accomplished by 5 kg seeds/fed, 30 kg N/fed and the latest harvesting date in only the second season.

V.Fibre yield and quality:

Tables 10 and 11 illustrate the mean values of fiber yield and quality of jute as affected by seeding rates, nitrogen levels and harvesting dates in 2007 and 2008 seasons. The differences between seeding rates were highly significant for fiber yield/plant and per fed, fiber percentage, fiber length, fiber strength and fiber fineness in both seasons. Concerning the effect of seeding rates, results showed that 5 kg/fed significantly outyielded the other rates for fiber yield/fed, fiber percentage and fiber strength in both seasons, while, 4 kg/fed gave the highest values for fiber yield/plant in both seasons. In general, the trend of results was similar to that of growth analysis, leaf area/plant and yield and its components. Whereas, increasing seeding rate up to 6 kg/fed significantly increased fiber length and fiber fineness in both seasons. Such effect could be attributed to increases in CGR, RGR and NAR. Similar results were reported by Hoque (1986) and El-Gazzar (2001a and b).

Results presented in Tables 10 and 11 revealed that nitrogen levels gave significant effect on fiber yield/plant, fiber length and fiber fineness in both seasons, while fiber percentage was significantly affected in only the second season. On the other hand, fiber yield/fed and fiber strength did not reach the level of significance in both seasons. Fiber yield/plant as well as per fed and fiber length gave the highest values with 40 kg N/fed, while, there was a trend of coarseness of fiber due to the increased nitrogen level, which decrease cellulose and increased lignin contents. Similar results were obtained by Nayak *et al.* (1996), Das and Chowdhury (1997), Idris (1989), El-Shimy and El-Sweify (2000) and Patel and Thakur (2003).

There were significant differences among the two harvesting dates in all studied characters in both seasons, except for fiber yield/fed and fiber length in the first season only. These results indicated that the 1st, harvesting date (120 days after sowing) gave the highest values of fiber percentage, fiber strength and fiber fineness in both seasons. The decline in fiber quality which was recorded by plants harvested at the 2nd date (150 days after sowing), may be due to lignifications which takes place when jute plants were left too long before harvesting. Therefore, late harvesting date gave superior

fiber yield/plant with lower quality grades. In this respect, confirmed results were reported by Mishra and Jena (1987) and Alamgir *et al.* (2008).

The interactions among the experimental factors were insignificant for most characters under study as shown in Table (12). The highest values of fiber yield/fed was recorded by seeding rate of 5 kg/fed and 30 kg N/fed, while fiber length was obtained by seeding rate 6 g/fed and 40 kg N/fed in both seasons.

The interaction between seeding rates and harvesting dates was significant for fiber yield/fed, fiber percentage and fiber length in both seasons, while, fiber yield/plant, fiber strength and fiber fineness in only the first season. On the other hand, N x H interaction had significant effect on fiber yield/plant in the first season only.

The second order interaction (S x N x H) had significant effect on fiber fineness in both seasons.

According to these results, it could be concluded that under the conditions of this study the highest jute production from fiber yield/fed was obtained by using 5 kg seeds/fed, 30-40 kg N/fed and harvesting at 150 day from sowing.

Table 10:Means of fiber yield and quality of jute as affected by seeding rates, nitrogen levels and harvesting dates in 2007 season.

Variable	Seeding rate, kg/fed				Nitrogen level, kg/fed				Harvesting date		
	Sig.	4	5	6	Sig.	20	30	40	Sig.	120 days old	150 days old
Fiber yield/plant, g.	**	3.07 a	2.69 b	2.56 c	**	2.70 b	2.77 b	2.85 a	**	2.66 b	2.89 a
Fiber yield/fed, kg	**	765.6 c	932.2 a	826.7 b	NS	829.9	843.3	851.4	NS	832.9	850.1
Fiber percentage	**	7.34 b	7.78 a	7.19 b	NS	7.54	7.39	7.38	**	7.66 a	7.21 b
Fiber length, cm.	**	148.5 c	154.8 b	160.1 a	**	153.6 b	153.7 b	156.1 a	NS	154.3	154.6
Fiber strength	**	15.58 b	16.43 a	15.57 b	NS	15.87	15.89	15.82	**	16.90 a	14.81 b
Fiber fineness	**	257.0 c	282.4 b	294.3 a	**	283.3 a	276.7 b	273.8 b	**	284.8 a	270.9 b

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**
Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

Table 11:Means of fiber yield and quality of jute as affected by seeding rates, nitrogen levels and harvesting dates in 2008 season.

Variable	Seeding rate, kg/fed				Nitrogen level, kg/fed				Harvesting date		
	Sig.	4	5	6	Sig.	20	30	40	Sig.	120 days old	150 days old
Fiber yield/plant, g.	**	2.94 a	2.63 b	2.52 b	**	2.59 b	2.70 ab	2.80 a	**	2.61 b	2.79 a
Fiber yield/fed, kg	**	708.1 c	891.7 a	770.1 b	NS	785.4	796.6	787.9	**	772.6 b	807.4 a
Fiber percentage	**	7.22 b	7.67 a	7.00 b	*	7.44 a	7.29 ab	7.17 b	**	7.49 a	7.11 b
Fiber length, cm.	**	138.8 c	159.1 b	164.4 a	**	151.5 b	153.3 b	157.5 a	**	149.3 b	158.9 a
Fiber strength	**	15.53 b	16.42 a	15.43 b	NS	15.81	15.75	15.81	**	16.83 a	14.76 b
Fiber fineness	**	250.9 c	275.0 b	288.2 a	**	277.8 a	268.9 b	267.4 b	**	277.1 a	265.7 b

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**
Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

Table 12: Summary of the significant interaction effects among seeding rates(S), nitrogen levels (N) and harvesting dates (H) on fiber yield and quality of jute in 2007 and 2008 seasons.

Variables	Season	S x N		S x H		N x H		S x N x H	
		Highest value	Treatment	Highest value	Treatment	Highest value	Treatment	Highest value	Treatment
Fiber yield/plant, g.	2007	NS	-	3.22	$S_1 \times H_2$	2.98	$N_3 \times H_2$	NS	-
	2008	NS	-	NS	-	NS	-	NS	-
Fiber yield/fed, kg	2007	958.03	$S_2 \times N_2$	809.82	$S_3 \times H_2$	NS	-	NS	-
	2008	913.88	$S_2 \times N_2$	883.36	$S_2 \times H_1$	NS	-	NS	-
Fiber percentage	2007	NS	-	8.09	$S_2 \times H_1$	NS	-	NS	-
	2008	NS	-	8.07	$S_2 \times H_1$	NS	-	NS	-
Fiber length, cm.	2007	161.85	$S_3 \times N_3$	161.98	$S_3 \times H_1$	NS	-	NS	-
	2008	165.400	$S_3 \times N_3$	167.05	$S_3 \times H_2$	NS	-	NS	-
Fiber strength	2007	NS	-	17.38	$S_2 \times H_1$	NS	-	NS	-
	2008	NS	-	NS	-	NS	-	NS	-
Fiber fineness	2007	NS	-	301.87	$S_1 \times H_1$	NS	-	309.58	$S_1 \times N_1 \times H_1$
	2008	NS	-	NS	-	NS	-	304.30	$S_1 \times N_1 \times H_1$

S_1: 4 kg seeds/fed N_1: 20 kg N/fed H_1: 120 days after sowing
S_2: 5 kg seeds/fed N_2: 30 kg N/fed H_2: 150 days after sowing
S_3: 6 kg seeds/fed N_3: 40 kg N/fed

REFERENCES

Alamgir, M.A.; M.M. Islam; H. Mohammad; S.M. Moniruzzaman and A. Izaz (2008). Effect of population density and harvesting time on fiber yield, quality and economics of white jute varieties. International. Journal of Sustainable Agricultural Technology. 4(4): 71-75.

American Society for Testing and Materials (ASTM) (1976). Designations. D-2253-66 D-1442-67 D-3818-79, D 1578-67 and D-2255-64.

Bandyopadhyay. P.; A.K. Mitra and P.K. Jana (1991). Effect of seed rate and methods of sowing on yield attributes and yield of capsularis jute. Environment and Ecology. 9(4): 911-914.

Das, K.; B. Guha and D. Pathak (1996). Response of capsularis jute to potassium fertilization. Annals of Agric. Res. 17(2): 188-189.

Das, N.R. and S. Chowdhury (1997). Effect of tillage number and N levels on yields of rainfed jute. Advance in Agric. Res. India. 8: 119-123.

Duncan, D.B. (1955). Multiple range and multiple. F-test. Biometrics. 11: 1-42.

El-Gazzar, A.A. (2001a). Effect of NPK nutrients on growth, yield and quality of jute (*Corchorus capsularis* L.). Alex. Sci. Exch., 22(1): 1-13.

El-Gazzar, A.A. (2001b). Effect of planting pattern and seeding rate on growth, yield and quality of jute (*Corharus capsularis* L.). Alex. J. Agric. Res. 46(1): 31-44.

El-Shimy, G.H. and Amna, H.H. El-Sweify (2000). Studies on some genotypes of two species of jute. Egypt. J. Plant Breed. 4: 89-106.

El-Sweify, Amna, H.H. and SH.M. Abd El-Rasoul (2002). Yield and quality of jute (*Corchorus capsularis*) as affected by nitrogen levels and cultivars under the calcareous soil. Egypt. J. Appl. Sci., 17(11): 561-578.

Faisal, R.I.I. (1989). Effect of weed control in maize. Ph.D. Thesis Fac. Agric. Al-Azhar Univ., Egypt.

Hoque, M.M. (1986). Effect on seed rate as line and broadcast sowing on jute yield (capsularis). On Farm Research Div. Proceedings of the Central Review Workshop. Joydebpur: 6-7.

Idris, M. (1989). Response of jute to row spacing and nitrogen levels. Indi. J. of Ecology. 16(2): 136-138.

Jayaraman, S. and N. Asokaraja (1995). Nitrogen levels and stages of harvest in production of olitorius jute. Madras. Agricultural Journal; 82(9/10): 557-559.

Mishra, G.C; A.K. Kar; L.N. Mahapatra; S.S. Mahapatra and L.K. Rath (1998). Effect of genotypes, sowing date and row spacing with and without clipping on seed yield and occurrence of pests and diseases in jute. Environment and Ecology. 16(3): 514-517.

Mishra, G.C.; S.C. Nayak; P.K. Panda and M.K. Mishra (1996). Response of white jute (*Corchorus capsularis*) varieties to graded levels of nitrogen. Environment and Ecology 14(2): 439-441.

Mishra, M. and B. Jena (1987). Effective of nitrogen levels and days to harvesting on the fibre yield of jute. Indi. J. of Agro. 32(4): 464-465.

Mishra, M. and A. Mishra (1997). Crop weed competition in jute (*Corchorus capsularis*) under various management practices. Indian Journal of Agronomy. 42(2): 381-385.

Moran, R. (1982). Formulae for determination of chlorophyllus pigments extracted with N, N-dimethyl formamide. Plant Physiol. 69: 1367-1381.

Nayak, S.C.; G.C. Mishra and P.K. Sarangi (1996). Response of tossa jute (*Corchorus olitorius*) varieties to increasing levels of nitrogen. Indian Journal of Agricultural Sciences. 66(11): 674-675.

Nayyar, M.M.; M.A. Iqbal and A.G. Kausar (1983). Effect of different seed rates on the yield of jute fibre. Journal of Agricultural Research. 21(1): 19-21.

Patel, S.R. and D.S. Thakur (2003). Effect of sowing dates and fertility levels on growth and fibre yield of jute (*Corchorus* species) varieties. Indian Journal of Agronomy. 48(2): 130-132.

Radwan, S.R.H. and A. Momtaz (1966). The technological properties of flax fibres and methods of estimating them. El-Felaha. J. 46(5): 466-476.

Sarkar, S.K.; R.K. Ghost; G. Sounda; S. Maitra; D.K. Roy and K. Ghost (1997). Effect of levels of nitrogen, potassium and soil moisture tension on growth. Nutrient uptake and water use efficiency of jute. J. of Interacademica, 1(3): 183-188.

Snedecor, G.W. and W.G. Cochran (1982). Statistical Methods. 7th edition. Iowa State. Univ. Press. Ames., Iowa, USA.: 325-330.

Watson, D.J. (1952). The physiological basis of variation in yield. Adv. Agron. 4: 101-145.

تأثير معدلات التقاوى ومستويات التسميد النيتروجينى ومواعيد الحصاد على النمو والمحصول وجودته لمحصول الجوت

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أجرى هذا البحث بالمزرعة البحثية لمحطة البحوث الزراعية بسخا خلال موسمى ٢٠٠٧ ، ٢٠٠٨ وذلك لدراسة تأثير ثلاثة معدلات تقاوى (٤ ، ٥ ، ٦كجم/فدان) وثلاثة مستويات من السماد النيتروجينى ٢٠ ، ٣٠ ، ٤٠كجم/فدان بالإضافة إلى ميعادى الحصاد بعد ١٢٠ ، ١٥٠ يوم من الزراعة على نمو ومحصول وجودة صنف الجوت U.P.C.94.

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:

- أدت الزراعة بمعدل تقاوى ٥كجم/فدان عند عمر ١٠٢ يوم من الزراعة إلى الحصول على أعلى متوسط للوزن الجاف/نبات ، طول النبات ، مساحة الأوراق/نبات بينما تم الحصول على أعلى القيم لدليل مساحة الأوراق عند الزراعة بمعدل ٦ كجم/فدان عند عمر ٧٢ يوم من الزراعة فى كلا الموسمين وأن الزراعة بمعدل تقاوى ٤ كجم/فدان أعطت أكبر متوسط لمعدل النمو المحصولى ومعدل النمو النسبى ومعدل التمثيل الصافى عند الفترة ٨٧-١٠٢ يوم من الزراعة. وكان أكبر محتوى من كلوروفيل أ ، ب وكذلك مجموعهما عند الزراعة بمعدل ٤ كجم/فدان الذى أعطى أعلى تقديرات فى عدد الكبسولات/نبات ، دليل البذرة ، محصول البذرة/نبات وكذلك محصول الألياف/نبات فى كلا الموسمين ، بينما كانت أكبر قيم المتوسطات فى طول المنطقة الثمرية ، المحصول الأخضر/نبات ، محصول الألياف/فدان ، %للألياف ، متانة الألياف نتيجة الزراعة بمعدل ٥ كجم/فدان ، فى حين كانت الزراعة بمعدل ٦ كجم/فدان هى الأفضل للحصول على أكبر تقديرات من الطول الفعال ، طول الألياف ، ونعومة الألياف فى كلا الموسمين.
- وجدت زيادة تدريجية فى صفة الوزن الجاف/نبات مع زيادة التسميد النيتروجينى من ٢٠ إلى ٤٠ كجم/فدان وكذلك بتقدم عمر النبات من ٥٧ إلى ١٠٢ يوم من الزراعة ، وكان أكبر القيم لصفات طول النبات ، مساحة الأوراق/نبات ، دليل مساحة الأوراق عند التسميد بمعدل ٣٠ كجم/فدان عند عمر ١٠٢ يوم من الزراعة هذا وكان أفضل معدل نمو محصولى وأكبر معدل تحول صافى قد تحقق بالتسميد بأى من المستويين ٣٠ أو ٤٠ كجم/فدان خلال الفترة ٥٧-٧٢ يوم من الزراعة فى كلا الموسمين بالإضافة إلى وجود زيادة تدريجية فى كل من كلوروفيل أ ، ب ومجموعهما وذلك بزيادة مستوى التسميد النيتروجينى من ٢٠ إلى ٤٠ كجم/فدان.
- أيضا وجدت زيادة تدريجية لكل من صفات المحصول الأخضر ومحصول البذور ومكوناتهما وكذلك محصول الألياف بزيادة التسميد النيتروجينى ولكن كان هناك نقص فى % للألياف ونعومة الألياف فى كل من الموسمين.
- أدى تأخر ميعاد الحصاد إلى ١٥٠ يوم من الزراعة إلى زيادة كل الصفات تحت الدراسة باستثناء % للألياف ، متانة الألياف ، نعومة الألياف حيث حدث بهم نقص فى هذا العمر وذلك بالمقارنة بالحصاد عند الميعاد الأول (١٢٠ يوم من الزراعة).
- من النتائج المتحصل عليها من هذه الدراسة وتحت ظروف منطقة إجراء البحث يمكن الحصول على أعلى إنتاج من محصول الألياف بالزراعة بمعدل ٥ كجم/فدان والتسميد بمعدل ٣٠-٤٠ كجم ن/فدان والحصاد عند ١٠ يوم من الزراعة

قام بتحكيم البحث

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Table 2: Means of dry matter accumulation, plant height (g), leaf area per plant (dm^2) and leaf area index of jute as affected by seeding rates and nitrogen levels at different stages in 2007 season.

Variable	Days after sowing	Seeding rate kg/fed				Nitrogen level kg/fed				Interaction
		Sig.	4	5	6	Sig.	20	30	40	
Dry weight/plant (g)	57	NS	4.616	5.145	4.983	NS	4.719	5.008	5.016	**
	72	*	7.597 b	8.175 a	7.480 b	NS	7.502	7.951	7.799	NS
	87	**	10.035 b	11.877 a	12.372 a	**	9.940 b	12.146 a	12.198 a	NS
	102	NS	14.521	16.342	15.255	**	14.012 b	15.903 ab	16.203 a	NS
Plant height (cm)	57	**	92.525 b	96.583 a	95.667 a	**	90.333 b	98.450 a	95.992 a	**
	72	NS	125.392	130.458	130.683	NS	126.175	131.192	129.167	NS
	87	NS	149.333	156.858	145.275	*	146.808 b	151.217ab	153.442 a	NS
	102	NS	165.725	167.800	166.475	**	161.917 b	169.842 a	168.242ab	NS
Leaf area/plant (dm^2)	57	NS	2.989	3.424	3.195	NS	3.044	3.463	3.101	*
	72	NS	4.136	4.562	4.300	NS	3.985	4.772	4.241	NS
	87	**	3.439 b	4.379 a	3.756 b	NS	3.584	4.022	3.968	NS
	102	**	2.423 b	2.868 a	2.735 ab	NS	2.537	2.884	2.606	NS
Leaf area index	57	**	7.951 b	11.647 a	13.148 a	NS	10.543	11.800	10.402	*
	72	**	10.999 b	15.515 a	16.666 a	NS	13.450	15.283	14.447	NS
	87	**	9.156 b	14.895 a	15.455 a	*	12.103 b	13.791 a	13.602 a	NS
	102	**	6.445 b	9.757 a	11.255 a	NS	8.787	9.887	8.782	NS

***, ** and NS indicate P < 0.05, P < 0.01 and not significant, respectively.**

Means within the same row for each factor followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.