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Effect of Foliar Application of Urea on Growth and Yield of Jute

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Abstract—*A field experiment was conducted at Jute Agriculture Experimental Station, Bangladesh Jute Research Institute, Jagir, Manikganj, Bangladesh in two consecutive years of 2016 and 2017 to find out the efficiency of basal, top and foliar application of urea for growth and yield of jute. There were different urea application treatments were like T_1= 50% basal + 50% top; T_2= 50% basal + 25% top + 25% top; T_3= No basal + 50% top + 50% top; T_4= 50% basal + 25% foliar + 25% top; T_5= 50% basal + 25% foliar + 25% foliar; T_6= No urea fertilizer and T_7= No basal + 25% foliar + 25% foliar + 25% foliar + 25% foliar. Yield contributing characters were significantly affected by different treatments. Result revealed that highest fibre and stick yield was recorded in T_2 (2.72 & 5.10 tha^{-1}, respectively) treatment and the lowest was recorded in T_6 (1.63 & 2.29 tha^{-1}, respectively) (control) treatment. Foliar urea produced the lowest plant height, base diameter, bark thickness, leaf area index, fibre and stick yield among all treatments except control.*

Keywords*: Top, basal and foliar urea, growth, yield, jute.*

1. INTRODUCTION

Nitrogenous fertilizer play a vital role in modern farm technology, however only 20-50% of the soil applied nitrogen is recovered by annual crops (Bajwa, 1992). The left over nitrogen is lost from the soil system through denitrification, volatilization and leaching. The partial and inefficient use of nitrogen results in lower crop harvests. Moreover, fertilizers are energy intensive to produce and are very expensive. The efforts are needed to minimize its losses and to enhance its economic use.

Foliar fertilization, that is nutrient supplementation through leaves, is an efficient technique of fertilization which enhances the availability of nutrients. Several researchers justified the idea that nutrients (like nitrogen) may be taken up through roots and leaves and may spray within the plant (Ahmed and Ahmed, 2005). The efficiency of nitrogen assimilation through foliar however depends upon several factors including varieties or genotypes. Basically jute is the kharif-1 (March-June) seasonal crop. Weather of this season is hot, humid and rainy (Mollah et al., 2017). Nitrogen fertilizer losses rapidly through denitrification, volatilization and leaching. From the above facts the experiment has been undertaken to observe the efficiency of basal, top and foliar application of urea for growth and yield of jute.

2. MATERIALS AND METHODS

A field experiment was conducted at the Jute Agriculture Experimental Station, BJRI, Jagir, Manikganj during the period from April to August, 2016 and 2017 to study the minimizing the urea fertilizer losses and getting more yield. The experimental field was medium high land belonging to Old Brahmaputra-Jamuna flood plain (AEZ-8) having silt loam soil with pH 6.5. The soil contained 1.6% organic matter, 0.08% total nitrogen, 7.65 ppm available P, 0.23 meq. K 100g^{-1}, and 12.87 ppm available S.

The experiment was consisted of one variety viz., O-72 and there were seven different urea application treatments viz., T_1= 50% basal + 50% top dress; T_2= 50% basal + 25% top + 25% top; T_3= No basal + 50% top + 50% top; T_4= 50% basal + 25% foliar + 25% top; T_5= 50% basal + 25% foliar + 25% foliar; T_6= No urea fertilizer (control) and T_7= No basal + 25% foliar + 25% foliar + 25% foliar + 25% foliar. The experimental field was prepared with three ploughing and cross ploughing followed by laddering. A randomized complete block design (RCBD) was used for this experiment with three replications. The unit plot size was 4m X 5m. Line to line and plant to plant spacing were 30 cm and 5 cm, respectively. The crop was sown on 15 April, 2016 and 10 April, 2017. The climatic condition was hot and humid with frequent rain during study period (Table 1). The crop was fertilized with triple super phosphate, muriate of potash and gypsum (50, 60 and 95 kg/ha, respectively) at final land preparation. Total 400g urea was applied on each plot through basal, top dress and foliar application method during crop cultivation period. In case of T_1 200g urea was applied in basal application during final land preparation and rest 200g urea was applied in top dress application method at 30 Days after sowing (DAS). In case of T_2 200g urea was applied during final land preparation through basal application method and rest 200g urea was applied in two equal split at 30 DAS and 45 DAS, respectively through top dressing method. In case of

T_3 400g urea was applied in two equal split at 30DAS and 45DAS, respectively through top dressing method. In case of T_4 200g urea was applied during final land preparation through basal application method, 100g urea was applied at 30DAS through foliar spray @ 2% w/v and rest 100g urea was applied at 45DAS through top dressing method. In case of T_5 200g urea was applied during final land preparation through basal application method, rest 200g urea was applied in two equal split at 30 DAS and 45 DAS, respectively through foliar spray @ 2% w/v. In case of T_6 no urea was applied during crop cultivation and in T_7 total 400g urea was applied in four equal split (30, 45, 60 and 75DAS, respectively) @ 2% w/v by foliar application. Foliar application was done at full sunny day on stem as well as dorsal and ventral portion of leaf. All intercultural operation operations were done as and when necessary. The crop was harvested at 120 days after sowing and data were collected accordingly.

Recorded data were analyzed by using the Analysis of Variance Technique and difference among the treatment means were adjudged by Duncan's Multiple Range Test (DMRT) followed by statistical computer package program MSTAT-C (Gomez and Gomez, 1984).

Table 1: Meteorological data recorded at the experimental site during the study period (2016 & 2017)

Month	Air temperature				Rainfall (mm)	
	Maximum		Minimum			
	2016	2017	2016	2017	2016	2017
April	32.5°	32°	25°	24°	160	172
May	32°	33°	25.5°	26°	128	113
June	32.5°	32°	26°	26°	189	257
July	31.5°	31°	25°	26°	465	423
August	31°	32°	26°	27°	315	291

3. RESULTS AND DISCUSSION

Plant population

Plant population of all treatments was statistically similar. Highest plant population was recorded in T_1 (23.5) treatment which was statistically identical with other treatments (Table 2).

Plant height

Plant height is an important vegetative factor affecting fibre yield. Foliar application of urea exerted significant effect on plant height over control. The tallest plant was recorded (3.07 m) in T_2 treatment which was statistically identical with (2.98m) in T_3 treatment and (2.91m) in T_5 treatment. The shortest plant was recorded (2.60m) in T_6 (control) treatment which was lowest than all other treatments. Moderate plant height was found in T_1, T_7, and T_4 treatments, respectively (Table 2). Result reveled that plant growth was more in top dress and basal urea application method compared to foliar application method of urea. Similar result was reported by [4, 8].

Base diameter

Base diameter of all treatments was statistically similar. Highest base diameter was recorded in T_3 (14.29mm) treatment which was statistically identical with other treatments (Table 2).

Bark thickness

Bark thickness of all treatments was statistically similar. Highest bark thickness was recorded in T_2 (2.96mm) treatment which was statistically identical with other treatments (Table 2).

Table 2: Comparison among different nitrogen treatments on growth and yield of jute (cont.)

Tr.	Plant population at harvest (m^{-2})			Plant height (m)			Base diameter (mm)			Bark thickness (mm)		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
T1	23a	24a	23.50a	2.89bc	2.83ab	2.86b	14.30a	13.77a	14.04a	2.76bc	2.68b	2.72a
T2	22a	22ab	22.00ab	3.14a	2.99a	3.07a	14.71a	13.52a	14.12a	2.89a	3.02a	2.96a
T3	22a	22ab	22.00ab	3.00b	2.96a	2.98ab	15.18a	13.39a	14.29a	2.85ab	2.91ab	2.88a
T4	23a	22ab	22.50ab	2.86c	2.73b	2.80b	14.16a	13.05a	13.61a	2.68c	2.65b	2.67a
T5	23a	21ab	22.00ab	2.92bc	2.89ab	2.91ab	13.53a	13.52a	13.53a	2.70c	2.61b	2.66a
T6	21a	23a	22.00ab	2.83c	2.36c	2.60c	13.60a	11.88b	12.74a	2.55d	2.66b	2.61a
T7	22a	22ab	22.00ab	2.85c	2.82ab	2.84b	13.82a	13.46a	13.64a	2.65cd	2.61b	2.63a
LSD	2.69	2.19	1.58	0.13	0.17	0.19	1.76	0.81	1.81	0.11	0.31	0.46
CV	6.83	5.75	4.06	2.50	3.44	3.80	6.96	3.46	7.40	2.46	6.44	9.56

Table 2: Comparison among different nitrogen treatments on growth and yield of jute

Treatment	Leaf area index (LAI)			Fibre yield (tha^{-1})			Stick yield (tha^{-1})		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
T1	42.65a	44.21a	43.43a	2.27b	3.12a	2.70a	5.03d	4.40ab	4.72a
T2	43.82a	43.44a	43.63a	2.48a	2.96ab	2.72a	5.76b	4.44ab	5.10a
T3	41.89a	43.92a	42.91a	2.26b	2.97ab	2.62a	5.10c	4.68a	4.89a
T4	42.88a	40.82b	41.85ab	2.34ab	2.76bc	2.55a	4.83e	4.60a	4.72a

T5	41.15a	36.04c	38.60bc	2.41ab	2.57c	2.49a	5.87a	4.01b	4.94a
T6	34.51c	30.59e	32.55d	1.62d	1.63e	1.63c	3.12g	1.45d	2.29b
T7	38.22b	32.97d	35.60cd	1.98c	2.05d	2.02b	3.97f	2.10c	3.04b
LSD	**2.49**	**2.31**	**3.42**	**0.17**	**0.25**	**0.33**	**0.06**	**0.47**	**0.76**
CV	**3.43**	**3.35**	**4.83**	**4.21**	**5.43**	**7.73**	**0.79**	**7.16**	**10.07**

Leaf area index (LAI)

Foliar application of urea exerted significant effect on leaf area index (LAI) over control. The highest LAI was recorded (43.63) in T_2 treatment which was statistically identical with (43.43) in T_1 treatment and (42.91) in T_3 treatment followed by (41.85) in T_4 treatment. The lowest LAI was recorded (32.55) in T_6 (control) treatment followed by (35.60) in T_7 treatment. Moderate LAI was found (38.60) in T_5 treatment (Table 2). Among all treatments except control the lowest LAI was recorded in T_7 treatment where total amount of urea was applied in foliar application method and the highest LAI was recorded in T_2 treatment where total amount of urea was applied in basal application and top dressing method in two equal split.

Fibre yield

Foliar application of urea exerted significant effect on fibre yield of jute over control. The highest fibre yield was recorded (2.72 tha^{-1}) in T_2 treatment which was statistically identical with (2.70 tha^{-1}) in T_1, (2.62 tha^{-1}) in T_3, (2.55 tha^{-1}) in $T_4$and (2.49 tha^{-1}) in T_5 treatments, respectively. The lowest fibre yield was recorded (1.63 tha^{-1}) in T_6 (control) treatment which was lowest than all other treatments. Fibre yield (2.02 tha^{-1}) in T_7 treatment remains in middle position (Table 2). Result reveled that fibre yield was more in top dress and basal urea application method compared to foliar application method of urea. Similar result was reported by [6, 2, 7, 8, and 4].

Stick yield

Foliar application of urea exerted significant effect on stick yield of jute over control. The highest stick yield was recorded (5.10 tha^{-1}) in T_2 treatment which was statistically identical with (4.94 tha^{-1}) in T_5, (4.89 tha^{-1}) in T_3 and (4.72 tha^{-1}) in T_1 & T_4 treatments, respectively. The lowest stick yield was recorded (2.29 tha^{-1}) in T_6 (control) treatment which was statistically identical with (3.04 tha^{-1}) in T_7 lowest than all other treatments (Table 2). It was observed that more stick yield found basal and top dressing application treatment compared to foliar application treatment. Among all treatments except control the lowest stick yield was recorded in T_7 treatment where total amount of urea was applied in foliar application method and the highest stick yield was recorded in T_2 treatment where total amount of urea was applied in basal application and top dressing method in two equal split.

4. CONCLUSION

From the results and discussion it can be concluded by urea fertilizer has significant effect on growth and yield of jute and foliar application method of urea is not suitable at all for O-72 jute variety cultivation. Basal and top dressing of urea in two equal split is the best method for O-72 jute variety cultivation. Foliar application of urea can be used as combination with basal and top dressing of urea. By getting the results of other cultivable jute varieties on their foliar urea use efficiency, we can make a concrete decision on this topic only.

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