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Effect of weeding and different doses of nitrogen on growth and yield of jute

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ABSTRACT

A field experiment was conducted in the experimental field of Jute Research Regional Station, Faridpur, Dhaka, Bangladesh during the period from April to August, 2016 to study the effect of weeding and different doses of nitrogen on growth and yield of jute. The experiment considered two factors. Factor A: Weeding (3) i.e. Non Weeding Plot (W_1); Weeding Plot (1 Time) (W_2) and Weeding Plot (2 Time) (W_3) and Factor B: Nitrogen doses (4 levels) i.e. Control (N_0); N_1 (60kg/ha); N_2 (90kg/ha) and N_3 (120 kg/ha). The experiment was laid out in a randomized complete block design (RCBD) with three replications. Data were collected in respect of plant growth characters and yield. The weeding (2 times) had significant influence on plant height (3.84m), number of internodes per plant (76.90), basal diameter (19.29mm), green weight with leaf (3.75kg) and without leaves (3.44kg), fibre yield (5.05 t/ha) and stick yield (13.35 t/ha). In case of the effect of N fertilizer, 120 kg N ha^{-1} showed the greater effect among the whole characters studied such as plant height (4.32m), number of internodes per plant (86.00), basal diameter (22.66mm), green weight with leaf (4.16kg/plant) ,without leaves (3.83kg/10plant), fiber yield (5.77 t ha^{-1}) and stick yield (13.40 t ha^{-1}). In case of the effect of interaction, showed the greater effect among the whole characters studied such as plant height (4.32m), number of internodes per plant (90.07), basal diameter (22.67mm), green weight with leaf (4.16 kg/10plant),green weight without leaves (3.83 kg/10plant), fiber yield (5.77 t ha^{-1}) and stick yield (13.86 t ha^{-1}). The results of the present experiment showed that the W_3 was the best among the weedings. On the other hand, 120 kg N ha^{-1} was proved to be better than any other lower and higher levels of nitrogen. Therefore, it can be proved that jute can produce the highest fibre yield from a combination of weeding (W_3) with 120 kg N ha^{-1} in field.

Introduction

Jute is an important cash and fibre crop which belongs to the family Tiliaceae and genus *Corchorus*. Jute is an important natural fibre crop in Bangladesh. In trade and industry, jute and mesta crop together known as raw jute as their uses are almost same. Raw jute plays an important role in the country's economy. Raw jute was originally considered as a source of raw material for packaging industries only. But it has now emerged as a versatile raw material for diverse applications, such as, textile industries, paper industries, building and automotive industries, use as soil saver, use as decorative and furnishing materials, etc. Raw jute being biodegradable and annually renewable source, it is considered as an environment friendly crop and it helps in the maintenance of the environment and ecological balance. Jute as a natural fibre has some definite inherent advantages. Its silky lusture, high tensile strength, low exhaustibility, considerable heat resistance and long staple length are the qualities that cannot be matched by synthetic fibre. Further attraction of Jute lies in its easy availability, inexhaustible quantity at a comparatively cheaper rate. Moreover, it can easily be blended with other natural and man-made fibres. Jute cultivation is mainly concentrated in the eastern and north eastern India while that of Mesta cultivation is spread almost throughout the country.

Cultural practices are important management factors that affect the yield of a crop. The hot and humid climate coupled with intermittent rainfall during the jute-growing season, however, encourages weed growth resulting in severe crop-weed competition (Saraswat, 1999); yield losses may be up to 75 to 80% (Sahoo and Saraswat, 1988). Weeding is one of the most important cultural practices for the crop plants to take nutrients, moisture, light, space and sometimes controlling many diseases, organisms and insect pest (Alam *et al.,* 2010). But, the most effective and economic cultural practices for weed control in jute crops are not clearly known by our farmers. In Bangladesh, weeds are generally controlled by raking and niri (hand weeding) and weeding and thinning operations involve about 50% or more of the labour cost (Alam, 2003). Grasses constitute the dominant weed flora in jute fields and its management using pre-emergence herbicides is possible (Sarkar *et al.,* 2005), provided the farmers get sufficient time for land preparation and herbicide application before sowing.

Nitrogen increases the vegetative growth and delayed maturity of plants. The increase in the growth characters such as plant height, base diameter, green weight with and without leaves per plant may be ascribed to the functional role of N in the plant body. Efficient N uptake and assimilation are essential for optimum growth and yield of jute. N

uptake and its assimilation in crops are governed by various agronomic factors. N and K are the two important factors contributing nutrients uptake and fibre yield.

Materials and methods

The experiment was conducted at the Jute Research Regional Station, Faridpur during the period from April to August, 2016 with a view to investigating the weeding and level of nitrogen on the fibre yield of jute. The weeding and treatments included in the experiment were i) three weeding viz. W_1 (Non weeding plot), W_2 (1 Time weeding plot) and W_3 (2 Time weeding plot) and ii) four nitrogen levels viz. 0 kg N ha^{-1}, 60 kg N ha^{-1}, 90 kg N ha^{-1}, and 120 kg N ha^{-1}.The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 3 m × 2 m and the distance between block and the unit plot were 50 cm and 1 m, respectively. The seeds of jute (O-9897) (*Corchorus capsularis*) were used as the planting material in the experiment. Seeds were collected from the Jute Research Regional Station, Faridpur. Seeds were tested for germination before sowing and it was found 90% germination. The experimental land was first opened on 10 April, 2016 with a power tiller. Thereafter, the land was ploughed and cross–ploughed to obtain good tilth. Laddering was done in order to break the soil clods into small pieces followed by each ploughing. All the weeds and stubble were removed from the field. The calculated entire amount of all fertilizers was applied during final plot preparation. The applied fertilizers were mixed properly with the soil in the plot. The whole amount of TSP, MoP, and Gypsum were applied as basal dose at the time of final land preparation. Urea was used as per treatment. The collected seeds from Jute Research Regional Station, Faridpur were sown on 18 April, 2016 in rows 30 cm apart. Seeds will be sown continuously in rows at a rate of 8 kg/ha while healthy and uniform sizes two to three seeds are sown in each hill in the experiment plot of the Jute Research Regional Station, Faridpur. Necessary intercultural operations were done as and when necessary. The crop was harvested on the 22 August, 2016 when 80% of the plants showed the sign of maturity. After shedding of leaves, the bundles were steeped plot-wise in pond water for 15-20 days for retting and fiber was extracted. At harvesting time, ten plants were selected at random from each plot and tagged in the field to note plant height (m),number of internode per plant, plant diameter (mm), green weight with leaf (kg), green weight without leaf (kg),fibre yield (t ha^{-1}),stick yield (t ha^{-1}).

Results and Discussion

Effect of weeding

Plant height

Among the weeding, the W_3 (2 times weeding) had taller (3.84 m) than that of the weeding W_1 (3.82 m) and W_2 (3.65 m) in the present study (Fig. 1). The weeding W_3 had taller than that of W_2 and W_1 which might be due to the variation in adaptability with the studied regional climatic factors, soil nutrients and other regional properties of the studied area. Variation in plant height might be due to the difference in their genetic make-up (Sarker *et al.* 2012).

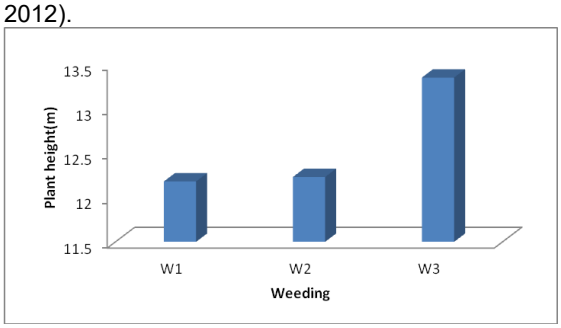

Fig. 1 Effect of weeding on plant height of jute

Number of internodes per plant

Weeding W_3 (2 time weeding) produced highest numbers of internodes (76.90) per plant, which was statistically similar to W_1 (76.68) and W_2 (76.18) (Fig 2).

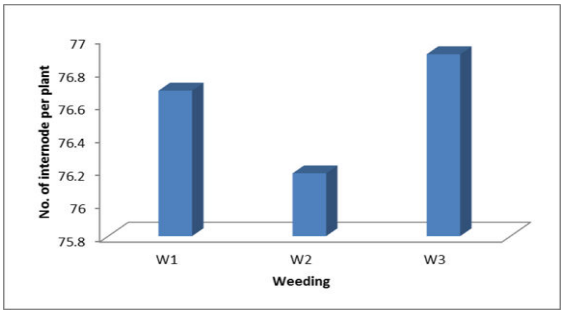

Fig. 2 Effect of weeding on number of internodes per plant of jute

Basal diameter

Fig. 4.5 also revealed that the basal diameter was obtained highest (19.29 mm) from W_3 followed by W_2 (19.18 mm) while W_1 showed the lowest basal diameter (18.92 mm) of jute in this study. Among the weedings,W_3 showed highest basal diameter as compared to W_2 and W_1(Fig 3).

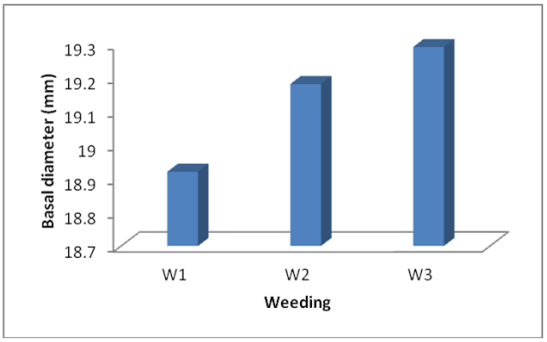

Fig. 3 Effect of weeding on basal diameter of jute at harvest.

Green weight with leaves

Weeding effect had also significant influenced on green weight with leaves where W_2 produced the highest (3.75 Kg) followed by W_3 (3.72Kg) while W_1 recorded the lowest green weight of leaves (Fig 4).

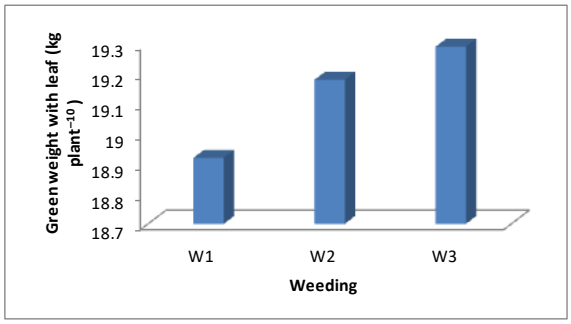

Fig. 4 Effect of weeding on green weight with leaves of jute

Green weight without leaves

The highest weight of green plant without leaves (3.44 kg) was found from the weeding W_2 followed by W_3 (3.39 Kg). As a result, W_1 recorded the lowest green weight without leaves (3.34 Kg) (Fig 5).

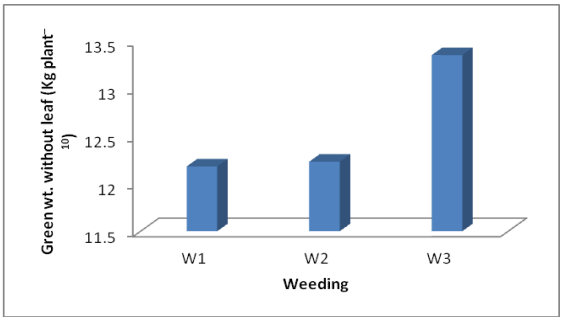

Fig. 5 Effect of weeding on green weight without leaves of jute

Fibre yield (t ha^{-1})

The fibre yield (t ha^{-1}) was significantly affected by weeding. The highest fibre yield (5.05 t ha^{-1}) was obtained in W_3 and the lowest on was obtained in W_1 (4.33 t ha^{-1}). Weeding W_2 was intermediate regarding fibre yield (4.74 t ha^{-1}) (Fig 6).

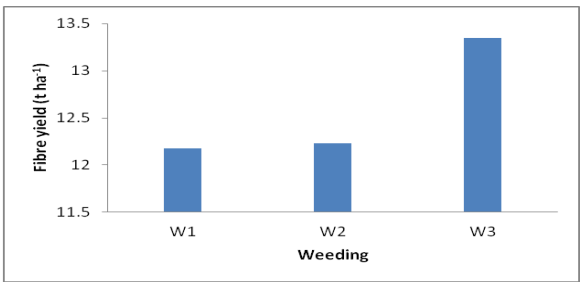

Fig. 6 Effect of weeding on fibre yield of jute

Stick yield (t ha^{-1})

The stick yield was significantly affected by weeding. The highest (13.35 t ha^{-1}) stick yield was obtained from W_3 and the lowest from W_1 (12.18t ha^{-1}) which was statistically similar to W_2 (12.22 t ha^{-1}) (Fig 7).

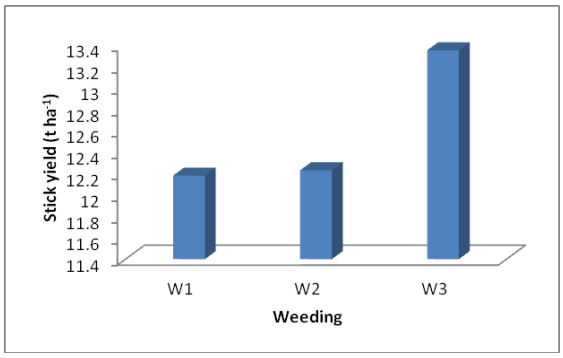

Fig. 7 Effect of weeding on stick yield of jute

Effect of nitrogen

Plant height

Among the different doses of N fertilizer, plant height increased significantly due to the increasing doses of fertilizer as well as the tallest plant (4.13 m) was recorded from the higher doses (120 kg ha^{-1}). On the other hand, without N obtained the shortest plant of jute (3.36 m) in this study (Fig. 8).

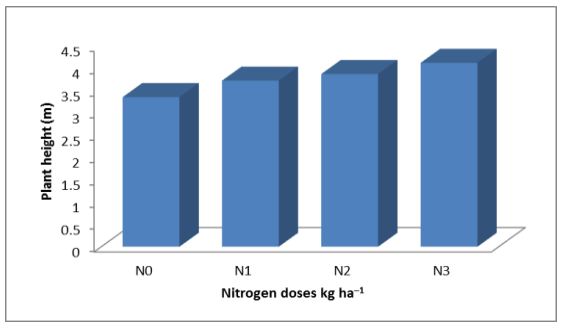

Fig. 8 Effect of nitrogen on plant height of jute at harvest

Number of internodes per plant

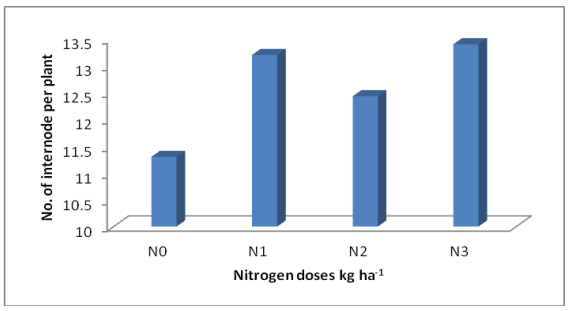

Fig.9 Effect of nitrogen on number of internodes per plant of jute

Nitrogen application influenced number of internodes per plant positively i.e. with the application of N fertilizer number of internodes per plant increased. The highest number of internodes per plant (86.00) was counted at 120 kg N ha^{-1}, (Fig. 9) and the lowest number of internodes (61.62) was found at N_0 (without N).

Basal diameter

From the variation in result it was found that the 120 kg N ha^{-1} had more significant for getting the highest basal diameter. Thereafter it decreased significantly and found lowest basal diameter (16.57 mm) in control or without N fertilizer (Fig. 10).

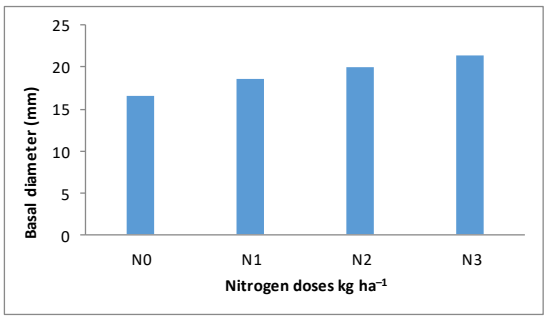

Fig. 10 Effect of nitrogen on basal diameter of jute

Green weight with leaves

Green weight with leaves ranged from 3.41 to 3.96 Kg $plant^{-10}$ due to the effect of N fertilizer where 120 kg N ha^{-1} produced significantly the highest while control treatment or without N recorded the lowest green weight with leaves. However, 90 and 60 kg N ha^{-1} recorded the second and third highest (3.81 and 3.68 Kg) green weight with leaves in this study.

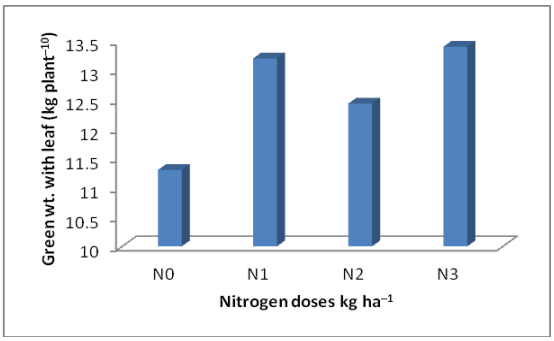

Fig. 11 Effect of nitrogen on green weight with leaves of jute

Green weight without leaves

Figure 12 indicated significant variation for green weight without leaves of jute due to the effect of N fertilizer while it was significantly ranged from 3.09 to 3.65 kg plant. Table 1 also indicated that the 120 kg N ha^{-1} applied plot took the highest green weight without leaves. On the other hand, without N applied plot showed the lowest green weight without leaves (3.09 kg) in this study.

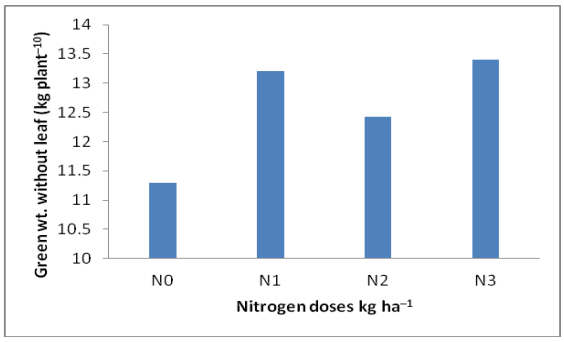

Fig. 12 Effect of nitrogen on green weight without leaves of jute

Fibre yield (t ha^{-1})

The fibre yield (t ha^{-1}) exhibited significant response to level of nitrogen. The highest fibre yield (5.34 t ha^{-1}) was obtained at 120 kg N ha^{-1}. On the other hand, lowest fibre yield was recorded from control treatment (3.65 t ha^{-1}) (Fig 13).

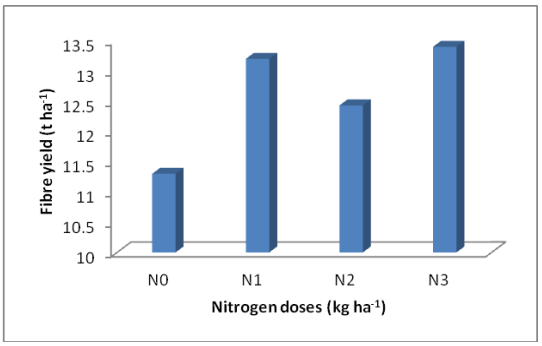

Fig. 13 Effect of nitrogen on fibre yield of jute Stick yield (t ha^{-1})

The stick yield was found significant response of nitrogen. The highest (13.40 t ha^{-1}) stick yield was recorded at 120 kg N ha^{-1}. Conversely, the lowest stick yield (11.30 t ha^{-1}) was noted from control (0 kg N ha^{-1}) (Fig-14).

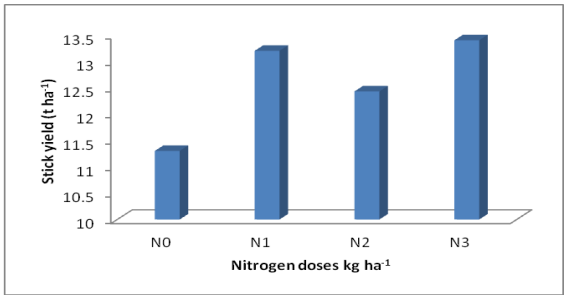

Fig. 14 Effect of nitrogen on stick yield of jute

Interaction effect

Plant height

Among the different treatments of interaction, 120 kg N ha^{-1} applied plot of W_3 produced the tallest plant (4.32 m) followed by both 120 kg N ha^{-1} applied plot of W_2 (4.15 m) and 90 kg N ha^{-1} treated plot of W_3 (4.02 m) where both are numerically identical. Similarly, without N applied plot of W_1 recorded the shortest plant (3.31 m) followed by without N applied plot of both W_2 (3.42 m) and W_3 (3.35 m) where both treatment were also numerically identical (Table 1).

Number of internodes per plant

Interaction effect of weeding and different levels of N on number of internodes per plant was found significant (Table 1). From Table 1 the highest number of internodes per plant (90.08) was recorded in W_3 at N_{120}. The lowest number of internodes per plant (60.40) was counted from the combination $W_1 \times N_0$ (without N).

Basal diameter

120 kg N ha^{-1} applied plot of W_3 showed significantly the highest basal diameter (22.66 mm) but it was closely followed by 90 kg N ha^{-1} applied plot of W_2 (21.13 mm). On the other hand, 60 kg N ha^{-1} treated plot of W_1 observed the lowest basal diameter (16.40 mm) while it was statistically differed from other treatments (Table 1).

Green weight with leaves

Green weight with leaves had also statistically significant due to the effect of interactions of variety and N fertilizer whereas it was varied from 3.34 to 4.16 Kg (Table 1). From the above variation, it was found the highest value was obtained from the weeding W_3 treated by 120 kg N ha^{-1} and lowest value was found from the without N treated weeding W_1.

Green weight without leaves

Green weight without leaves also varied significantly from 2.98 to 3.83 kg due to the effect of interactions of jute variety and N fertilizer (Table 1). The highest green weight without leaves was recorded from the weeding W_3 when 120 kg ha^{-1} nitrogen fertilizer was applied and it was statistically differed from other treatments of the study. On the other hand, without N treated plant of W_1 recorded the lowest green weight without leaves.

Fibre yield (t ha^{-1})

The interaction of variety and level of nitrogen had a significant effect on fibre yield (t ha^{-1}). The highest fibre yield (5.77 t ha^{-1}) was recorded in W_3 with 120 kg N ha^{-1} and the lowest in W_1 with no nitrogen (3.18 t ha^{-1}) (Table 1).

Stick yield (t ha^{-1})

Significant variation was observed among the combinations of weeding and different levels of nitrogen. The highest (13.86 t ha^{-1}) stick yield was noted from the W_3 at 120 kg N ha^{-1}, whereas the lowest stick yield was found in W_1 with no nitrogen fertilizer (10.26 t ha^{-1}) (Table 1).

Table 1 Effect of interaction of weeding and different doses of N fertilizer on growth and yield characters of jute at harvest

Weeding	N fertilizer (kg ha^{-1})	Plant height (m)	Number of internode $plant^{-1}$	Basal diameter (mm)	Green weight with leaves (kg $plant^{-10}$)	Green weight without leaves (Kg $plant^{-10}$)	Fibre yield (t ha^{-1})	Stick yield (t ha^{-1})
W_1	0	3.31 g	60.40 g	16.40 f	3.34 h	2.98 f	3.18 f	10.26 f
	60	3.64 f	78.40 d	19.13 cd	3.73 de	3.38 cd	4.40 d	12.66 cd
	90	3.72 def	84.67 b	19.60 c	3.83 cd	3.50 bc	5.20 b	13.14 b
	120	3.92 cd	83.27 bc	20.53 b	3.82 cd	3.49 bc	4.80 c	13.63 ab
W_2	0	3.42 g	62.67 fg	16.53 f	3.40 gh	3.09 ef	3.76 e	10.80 e
	60	3.85 cd	74.67 e	18.13 e	3.64 ef	3.31 cd	5.22 b	13.60 ab
	90	3.89 cde	82.73 c	21.13 b	4.05 ab	3.72 a	4.91 bc	11.56 d
	120	4.15 ab	84.67 b	20.93 b	3.90 bc	3.63 ab	5.57 ab	12.86 bc
W_3	0	3.35 g	61.80 f	16.77 f	3.52 fg	3.21 de	4.00 de	12.96 bc
	60	3.70 ef	73.86 e	18.30 de	3.65 ef	3.32 cd	4.44 d	13.43 ab
	90	4.02 bc	81.86 cd	19.43 c	3.54 fg	3.22 de	5.23 b	12.76 c
	120	4.32 a	90.07 a	22.67 a	4.16 a	3.83 a	5.77 a	13.86 a
CV (%)		3.18	6.23	2.72	2.56	5.01	3.35	5.61
Level of significance		**	**	**	**	**	**	**

Conclusion

The results of the present experiment showed that the W_3 was better than the other two weeding. On the other hand, 120 kg N ha^{-1} proved to be better than any other lower and higher level of nitrogen. Therefore, it can be inferred that the results of this study that jute can produce the highest fibre yield from a combination of weeding W_3 with 120 kg N ha^{-}

[1] under conditions of the present experiment. Further studies are necessary to confirm the present findings.

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