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Effects of Cutting Length and Position on the Seed Yield and Quality of Tossa Jute (*Corchorus olitorius* L.)

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Abstract

An experiment was conducted at the research field of Jute Research Regional Station of Bangladesh Jute Research Institute (BJRI) at Kishoreganj during August 2009 to January 2010 to assess the effect of cutting length and position of cutting on seed yield and quality of tossa jute (*Corchorus olitorius* L.). Three cutting lengths (15 cm, 20 cm and 25cm) and three cutting positions (1st top, 2nd top and 3rd top) were the treatments. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The highest seed yield (917 kg ha^{-1}) was obtained from 1st top x 15cm interaction and the lowest (811 kg ha^{-1}) was recorded in 3rd top x 25cm cutting length. The highest seed germination (89%), field emergence (87%) and accelerated ageing (73%) were recorded from 1st top x 15cm interaction and the lowest seed germination (83.00%), field emergence (81%) and accelerated ageing (72) were recorded in 3rd top x 25 cm cutting length. The upper position of cutting produced the highest yield and best quality seeds.

Keywords: Cutting length, cutting position, yield, quality, jute seed.

1. Introduction

Jute (*Corchorus* sp.) is the principal fiber crop of Bangladesh. It accounts for 6% of the foreign currency earnings from exports (Islam, 2009). Jute is predominantly grown for fiber rather than seed production. Despite so much importance of jute fibre, very little attention has been given on its research mainly on seed production practices. Moreover, the country faces an acute shortage of jute seeds every year. Bangladesh requires 4000-4500 MT of jute seeds annually, whereas production by Bangladesh Agricultural Development Corporation (BADC) is only 800-1000 MT. The farmers produce 400-600 MT. Rest of the demand is met up by importing mostly from India (Pulok *et al*., 2014). Conventionally, farmers sow jute seeds during March-April for fibre production and a part of it is kept at the corner of the land for seed production. Remnant part of fibre crop in its long stay in the field experiences natural calamities like hail storm, diseases and insect pest infestations, which results in a bad harvest in respect to both quality and quantity of seeds.

Jute is a photoperiod sensitive and short-day plant. It is evident from earlier report that jute plants induce flowers later or do not flower at all below 14 or above hours of photoperiod. It

hastens flower, no matter whenever planted, on or subjected to short days of around 12 hours (Husain, 1977). However, if it is planted in June or later, the plants exhibit stunted growth and profuse branching and induce flowers prematurely at the juvenile stage of crop due to short photoperiodic effect.

Vegetative propagation of jute plants is an improved technique in which about 20-25 cm plant tops are taken off from normal fibre plants at harvested and are planted in puddled field in the months from June and July. Sohel *et al*. (2002) reported good survival and increased seed yield of jute through top cutting method. Besides, plant tops at harvest of fibre crop contribute nothing to fiber yield rather can be used for growing a second crop for seed production.

Yield and quality of seeds varied on the basis of position of top cutting due to growth hormone produce at the top of the plant (Pandey and Sinha, 2006). Seed production of jute crop is a great problem now a day. Farmers are not interested to grow jute seeds crop in traditional ways. Besides, modern varieties of *C. olitorius* jute produce very poor seed yields in traditional method. Though the late jute seed production technology developed by BJRI becomes promising, the sowing of late jute seed crop is usually hampered due to heavy rainfall. To avoid this situation, planting of top cuttings in the wetland during July to September may be an alternative way for quality seed production in the late season. However, information on appropriate cutting positions and lengths for seed production of jute is scarcely available. The present study was, therefore, conducted to determine the effects of cutting length and position on the seed yield and quality of jute.

2. Materials and Methods

A field experiment was conducted at the Jute Research Regional Station, Kishoreganj, of Bangladesh during August/2009 to January/2010 to study the effect of cutting length and position on seed yield and quality of tossa jute. The soil was sandy loam to loam in texture which belongs to the Old Brahmaputra floodplain soils (AEZ 9). The type of land was high and soil pH was 6.4. The diurnal ranges of air temperature during the experimentation periods were 23.8^{o}C to 35.0^{o}C and 10.4^{o}C to 28.0^{o}C, respectively. Three types of cutting lengths e.g., 15cm, 20cm, 25cm and three types of top cutting position e. g., top (1st top), middle (2nd top), bottom (3rd top) position were used as plant materials in this experiment. The experiment was laid-out in a randomized complete block design (RCBD) with three replications.

The experimental plots were fertilized with urea, triple super phosphate (TSP), muriate of potash (MoP) and gypsum @ 200-50-60-95 kg ha^{-1}, respectively. All fertilizers except urea were applied during final land preparation. Urea was top dressed in three equal splits at 15, 30 and 45 days after sowing (DAS). Weeding was done by hand at 25 and 45 days after sowing (DAS). The crop was infested by mealy bug and white fly at the vegetative stage and those were effectively controlled by spraying Ripcord 10 EC @ 2mlL^{-1} of water for three times at an interval of 10 days. No irrigation was applied while excess water was drained out as and when necessary. The crop was harvested at maturity (when 80% pods became brown). Plant survivalism^{-2}, plant height, primary branches plant^{-1}, secondary branches plant^{-1} and capsules plant^{-1}, seeds capsule^{-1}, capsule length, capsule diameter, seed yield, stick yield, germination, field emergence and accelerating percent were recorded. The crop was harvested on 7-8 January in 2010 (180 DAT). After harvest the crop was dried for three days and then threshed by beating with a stick. Seeds were then cleaned and dried for another five days in the sun to bring seed moisture content to below 10%.

2.1. Germination test

Germination test was conducted following wait tissue paper method. One hundred seeds in four replications were placed on the moist tissue paper (Bashundhara kitchen towel) in petridish

(11 cm diameter). The petridishes were kept in the germinator at 30 ±1°C. Daily counting of the germinating seedlings were done up to 8 days of seed setting. The number of normal seedlings was counted at 8 DAS and the germination percentage of seed was measured as:

$$\text{Germination (\%)} = \frac{\text{Number of normal seedling}}{\text{Number of seed sown}} \times 100$$

2.2. Accelerated ageing (AA) test

Accelerated ageing seed was done by taking 15 g seeds in accelerated ageing chamber and exposing the seeds to 41^0C temperature and 100% RH for 72 hours. For conducting the AA test, seeds were weighed and placed on a screen tray (10.0× 3.5 × 3.0 cm) which was inserted into an inner chamber (plastic box: 10.0 × 6.0 × 4.0 cm) containing 50 ml of water. The boxes were covered with lids and kept airtight. The inner chamber was placed into an accelerated ageing (outer) chamber. During the ageing period the seeds absorb moisture from the humid environment within the inner chamber and were stressed by high temperature and RH. After accelerated ageing, germination test of seeds was done using modified paper folding method (ISTA, 1999).

2.3. Field emergence (FE)

Field emergence was calculated according to Mollah (2014) using the following formula:

$$\text{Field emergence (\%)} = \frac{\text{Number of normal seedling}}{\text{Number of seed sown}} \times 100$$

2.4. Statistical analysis

Data were analyzed by using the Analysis of Variance Technique and differences among the treatment means were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984) following a statistical computer package (MSTATC).

3. Results and Discussion

3.1. Cutting length on survivalist

Cutting length had significant effect on plant survivalist of jute seed production (Table 1). The highest plant survivalist (14.5) was recorded in 25cm cutting length. It may be due to more node contain in this cutting. The lowest plant survivalist (12.7) was recorded in 20 cm cutting length. Cutting position also has significant effect on plant survivalist of jute seed production (Table 2). The highest plant survivalist (14.4) was recorded in 2nd top it may be due to more auxin produce in the upper part of cutting and 1st top may be vulnerable (Pandey and Sinha, 2006). The lowest plant population (12.8) was recorded in 3rd top. From cutting length and position interaction effect it was evident that ~~on~~ the highest plant population (15.4) was found in 3rd top x 25 cm followed by 2nd top x 20 cm (15.3). The lowest plant population (10.0) was found in 3rd top x 20 cm interaction (Table 5). Similar result was reported by BJRI (2005-06) and Zigene and Kassahun (2016).

3.2. Cutting length on plant height

Plant height is an important yield contributing character. Cutting length and position had significant effect on plant height. The highest plant height (1.33 m) was recorded at 25 cm cutting length and the lowest one (1.26 m) was in 20 cm cutting length followed by 1.29 m at 15 cm cutting length (Table 1). The highest plant height (1.35 m) was recorded in 1st top and the lowest plant height (1.26 m) was recorded in 2nd and 3rd top (Table 2). Interaction effect of cutting length and position shows that the highest plant height (1.38 m) was found in 1st top x 15 cm followed by 1st top x 25 cm. The lowest plant height (1.19 m) was found in 3rd top x 20 cm interaction (Table 5). Similar result was reported by BJRI (2005-06) and Zigene and Kassahun (2016).

3.3. Primary branch per plant

Primary branch in a jute plant is an important seed yield contributing character. Cutting length and position had significant effect on primary

branch per plant. The highest number of primary branch per plant (1.90) was recorded at 25 cm cutting followed by (1.80) in 20 cm cutting and the lowest one (1.60) was at 15 cm cutting (Table 1). Similarly the number of primary branch was the highest (1.93) in 3rd top, followed by (1.83) in 2nd top and the lowest one (1.53) was recorded in 1st top (Table 2). Interaction of cutting length and cutting position shows that the highest number of primary branch (2.3) was found in 3rd top x 25 cm cutting and the lowest (1.5) was found in 1st top x 15 cm, 1st top x 25 cm and 3rd top x 15 cm cutting (Table 5). Similar result was reported by Zigene and Kassahun (2016).

3.4. Secondary branch per plant

Number of secondary branch per plant was varied with cutting length and position.. The number of secondary branch per plant was the highest (3.47) in 20 cm cutting, followed by 3.38 cm in 15 cm cutting and the lowest one (3.25) was in 25 cm cutting (Table 1). The highest secondary branch (3.80) was recorded in 2nd top and the lowest secondary branch (3.06) was recorded in 1st top followed by 3.23 in 3rd top (Table 2). From cutting length and position interaction effect on the highest secondary branch (4.1) was found in 2nd top x 20 cm and the lowest secondary branch (2.8) was found in 1st top x 25 cm (Table 5).

3.5. Number of capsule per plant

Number of capsule per plant is an important seed yield contributing character in jute. Cutting length and position had significant effect on capsule number per plant. The highest number of capsule per plant (38) was recorded in 25 cm cutting and the lowest one (33) was in 20 cm cutting length (Table 1). For cutting position the highest number of capsule per plant (37) was recorded in 1st top and the lowest one (35) was recorded in 2nd top (Table 2). Interaction effect of cutting length and position revealed that the highest capsule per plant (41) in 1st top x 25 cm, followed by 2nd x 25 cm and the lowest one (33) was obtained in 3rd top x 15 cm (Table 5).

3.6. Capsule length and diameter

Capsule length and diameter are important seed yield contributing characters of jute. Cutting length and position had significant effect on capsule length and diameter. The highest capsule length (6.27 cm) and diameter (5.33 mm) was recorded in 15 cm cutting and the lowest capsule length (6.03 cm) and diameter (5.19 mm) was in 20 cm cutting (Table 1). The highest capsule length (6.20 cm) and diameter (5.32 mm) was recorded in 2nd top and the lowest capsule length (6.03 cm) and diameter (5.19 mm) was recorded in 3rd top (Table 2). Interaction of cutting length and position he shows the highest capsule length (6.33 cm) and diameter (5.39 mm) in 2nd top x 20 cm and the lowest capsule length (5.64 cm) and diameter (5.09 mm) was found in 3rd top x 20 cm (Table 5).

3.7. Number of seed per capsule

The highest number of seed per capsule (153) was recorded in 15 cm cutting and the lowest seed per capsule (145) was in 20 cm cutting length (Table 1). The highest number of seed per capsule (154) was recorded in 2nd top and the lowest number of seed per capsule (145) was recorded in 3rd top (Table 2). From cutting length and position interaction effect on the highest number of seed per capsule (156) was found in 2nd top x 20 cm followed by 155 in 3rd x 15 cm, 154 in 2nd x 15 cm and the lowest number of seed per capsule (137) was found in 3rd top x 20 cm (Table 5). Similar result was reported by BJRI (2005-06).

3.8. Seed and stick yield

Seed and stick yields are the ultimate goal of jute seed production. Cutting length and position has significant effect on seed yield and stick yield. The highest seed yield (798 kg/ha) and stick yield (3387 kg/ha) was recorded in 25 cm cutting length and the lowest seed yield (744 kg/ha) and stick yield (2848 kg/ha) was in 20 cm cutting length (Table 1). The highest seed yield (827 kg/ha) and stick yield (3338 kg/ha) was recorded in 1st top and the lowest seed yield (727 kg/ha) and stick yield (2901 kg/ha) was recorded in 3rd top (Table 2).

Table 1. Effect of cutting length on the seed yield and yield attributes of jute

Length of cutting (cm)	Plant survivalist /m^2 (no.)	Plant height (m)	Primary branches /plant (no.)	Secondary branches /plant (no.)	Capsule s/ Plant (no.)	Length of capsule (cm)	Dia. Of capsule (mm)	Seed/ capsule (no.)	Seed yield (kg/ha)	Stick yield (kg/ha)
15	13.3b	1.29b	1.60c	3.38b	36b	6.27a	5.33a	153a	785b	2918b
20	12.7c	1.26b	1.80b	3.47a	33c	6.03c	5.19b	145c	744c	2848c
25	14.5a	1.33a	1.90a	3.25c	38a	6.10b	5.20b	147b	798a	3387a
LSD(5%)	0.16	0.03	0.03	0.03	0.06	0.03	0.03	1.17	0.49	3.49
CV(%)	1.21	1.58	1.29	0.80	0.19	0.50	0.48	0.79	0.06	0.11

Table 2. Effect of cutting position on the seed yield and yield attributes of jute

Position of cutting	Plant survivalist/ m^2 (no.)	Plant height (m)	Primary branches /plant (no.)	Secondary branches /plant (no.)	Capsule s/ Plant (no.)	Length of capsule (cm)	Dia. Of capsule (mm)	Seed/ capsule (no.)	Seed yield (kg/ha)	Stick yield (kg/ha)
1^{st} top	13.3b	1.35a	1.53c	3.06c	37a	6.18a	5.22b	147b	827a	3338a
2^{nd} top	14.4a	1.26b	1.83b	3.80a	35b	6.20a	5.32a	154a	772b	2912b
3^{rd} top	12.8c	1.26b	1.93a	3.23b	35b	6.03b	5.19b	145c	727c	2901c
LSD(5%)	0.16	0.03	0.03	0.03	0.06	0.03	0.03	1.17	0.49	3.49
CV(%)	1.21	1.58	1.29	0.80	0.19	0.50	0.48	0.79	0.06	0.11

Table 3. Effect of cutting length on the seed quality of jute

Length of cutting (cm)	Germination (%)	Accelerated Ageing (%)	Field Emergence (%)
15	86.00a	72.00a	84.00a
20	86.00a	71.33a	84.00a
25	85.00a	72.00a	83.00a
LSD(5%)	2.23	1.67	1.66
CV(%)	3.10	2.77	2.36

Table 4. Effect of cutting position on the seed quality attributes of jute

Position of cutting	Germination (%)	A. Ageing (%)	Field Emergence (%)
1st top	87.67 a	72.00 a	85.67 a
2nd top	85.33 b	72.33 a	83.33 ab
3rd top	84.00 b	71.00 a	82.00 b
LSD(5%)	2.23	1.67	1.66
CV(%)	3.10	2.77	2.36

Table 5. Interaction effect of cutting position and length on the seed yield and yield attributes of jute

Treatment	Plant survivalist /m^2 (no.)	Plant height (m)	Primary branches /plant (no.)	Secondary branches /plant (no.)	Capsules / Plant (no.)	Length of capsule (cm)	Dia. of capsule (mm)	Seed/ capsule (no.)	Seed yield (kg/ha)	Stick yield (kg/ha)
1st topx15	13.9c	1.38a	1.5f	3.3e	37d	6.21b	5.40a	151b	917a	3638b
1st topx20	12.8e	1.30bc	1.6e	3.1g	33g	6.13c	5.09d	142d	805d	3194c
1st topx25	13.2d	1.37a	1.5f	2.8h	41a	6.19b	5.16c	147c	761e	3183d
2nd topx15	13.0de	1.23de	1.8d	3.7b	38c	6.31a	5.31b	154a	733f	2655f
2nd topx20	15.3a	1.28bcd	1.8d	4.1a	34e	6.33a	5.39a	156a	761e	2905e
2nd topx25	14.9b	1.28bcd	1.9c	3.6c	33f	5.95d	5.27b	151b	822b	3177d
3nd topx15	12.9e	1.25cd	1.5f	3.1g	33f	6.28a	5.29b	155a	705g	2461g
3nd topx20	10.0f	1.19e	2.0b	3.2f	33f	5.64e	5.09d	137e	666h	2444h
3nd topx25	15.4a	1.33ab	2.3a	3.4d	40.6b	6.17bc	5.18c	142d	811c	3800a
LSD (5%)	0.28	0.05	0.05	0.05	0.11	0.05	0.05	2.03	0.86	6.05
CV (%)	1.21	1.58	1.29	0.80	0.19	0.50	0.48	0.79	0.06	0.11

Table 6. Interaction effect of cutting position and length on the seed quality of jute

Treatment	Germination (%)	Accelerated Ageing (%)	Field Emergence (%)
1st top x 15	89a	73a	87a
2nd top x 15	86abc	72a	84abcd
3nd top x 15	88ab	71a	86ab
1st top x 20	85abc	72a	83bcd
2nd top x 20	87abc	72a	85abc
3nd top x 20	84bc	73a	82cd
1st top x 25	84bc	71a	82cd
2nd top x 25	85abc	70a	83bcd
3nd top x 25	83c	72a	81d
LSD (5%)	3.87	2.89	2.88
CV (%)	3.10	2.77	2.36

From cutting length and position interaction effect on the highest seed yield (917 kg/ha)was found in 1st top x 15 cm and stick yield (3800 kg/ha) was found in 3rd top x 25 cm and the lowest seed yield (666 kg/ha) and stick yield (2444 kg/ha) was found in 3rd top x 20 cm (Table 5). Similar result was reported by BJRI (2005-06).

3.7 Germination

Germination percent, the most important quality parameter of jute seed was not affected significantly by cutting length but affected significantly by cutting position. The highest seed germination (87.67) was recorded in 1st top position, followed by 85.33 in 2nd top position and the lowest one was (84.00) recorded in 3rd top (Table 4). Interaction effect of cutting length and position shows that the highest germination percent was 89.00% in 1st top x 15 cm and the lowest one was 83.00 % in 3rd top x 25 cm.

3.8 Ageing

Seed ageing percent was not affected significantly by cutting length, cutting position and cutting length x cutting position interaction but affected significantly by cutting position (Table 3, 4, 6).

3.9 Field emergence

Field emergence percent was not influenced significantly by cutting length but affected significantly by cutting position. The highest field emergence (85.67) was recorded in 1st top position. The lowest germination (82.00) was recorded in 3rd top position (Table 4). Germination affected significantly on cutting length x position interaction. The highest field emergence percent (87.00) was recorded in 1st top x 15 cm interaction and the lowest (81.00) was recorded in 3rd top x 25 cm interaction (Table 6).

4. Conclusions

The highest yield and quality seeds were obtained from 1st top x 15 cm interaction and the lowest seed yield and quality was found from 3rd x 20 cm interaction. The upper position of cutting produced the highest yield and best quality seeds. It may be concluded that decreasing cutting position is the cause of reduced yield and quality of jute seed.

References

BJRI, 2005-06. Bangladesh Jute Research Institute. Annual Report, 144-145 pp.

Gomez KA., Gomez AA. 1984. Statistical procedures for Agricultural Research 2nd Edn. John Willy and Sons., New York. 97-111pp.

Husain M. 1977. Studies on the effect of short day length of flower induction of some selected cultivars of jute. *Bangladesh Journal of Jute Fibre Research*, 2 (1): 73-77.

Islam MM. 2009. In: Jute seed technology. 1st edition. Pub. By Md. Mahmudul Islam, 397, Middle Monipur, Mirpur, Dhaka-1216. College Gate Book Binding and Printing, Mohammadpur, Dhaka. 160 p.

ISTA. 1999. International Rules for Seed Testing, 2003. Zurich, Switzerland, ISTA.126-131 pp.

Mollah MAF. 2014. Yield and quality of kenaf seed as influenced by production and storage environment. PhD dissertation, Department of Seed Science and Technology. Bangladesh Agricultural University, Mymensingh. 56-60 pp.

Pandey SN., Sinha BK. 2006. Plant Physiology, 4th edition, Vikas Publishing House Pvt. Ltd., New Delhi, 447 p.

Pulok MAI., Hossain MM., Mazed HEMK., Mahabub ST., Sharmin S. 2014. Effect of storage containers on the seed quality attributes of deshi jute (*Corchorus capsularis* L.) *International Journal of Business, Social & Scientific Research*, 2(2): 100-103.

Sohel MA., Salim M., Hossain MA. 2002. Top cutting an improved technique in jute seed production. *Bangladesh Journal of Seed Science & Technology*. 6 (1&2): 103-107.

Zigene ZD., Kassahun BM. 2016. Effect of cutting size and position on propagation ability of Sage (*Salvia officinalis* L.). *International journal of Advanced Biological and Biomedical Research* 4(1): 68–76.