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Effect of Age and Spacing of Mother Plant Cuttings on Seed Yield

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ABSTRACT

Plant height was highly influenced by ages of cutting. The cuttings made and planted from 120 days of mother plants gave highest plant height (1.283 m) which was significantly higher than cuttings of 105 days (1.213 m) and 135 days (1.210 m) of plant age (Table 1). Spacing had no significant influence on plant height although higher spacing (15"x5") gave taller plants than lower spacing (18"x4") of 1.254 m and 1.216 m, respectively (Table 2). Plant height was also affected significantly due to interaction of cutting age and spacing. The highest plant height (1.283 m) was obtained from cuttings of 120 days of mother plants in both the spacing (15"x5" and 18"x4") whereas the lowest plant height (1.167 m) was found in 105 days of cutting with spacing 18"x4". Plant height decreased when cuttings planted from other than 120 days plants (Figure 1). These results indicate that effect of cutting age was more dominant than that of spacing on plant height.

KEYWORDS

Stem cutting; Spacing; Tossa jute; Seed yield.

1. Introduction

Bangladesh has an agro-based economy where agriculture accounts for about 15% to the country's GDP and employs around 41% of total labour forces [1]. Jute is a versatile, environment friendly, fibre crop and is one of the leading cash crops of Bangladesh. At the global context, Bangladesh is the second largest producer of jute and allied fibers (35%), India being the largest one (56%) followed by China (3%), Thailand (1%) and others (5%) [2]. Principally two species, Corchorus capsularis L. (white jute) and Corchorus olitorius L. (tossa jute) are cultivated in Bangladesh. In 1970s the ratio of white jute and tossa jute was 80t20. After development and acceptance of less-photosensitive tossa jute variety (O9897), the area under jute cultivation is dramatically converted from the domain of white to tossa jute. As a result, the present acreage in favor of tossa jute is 80-85% of total jute area [3-4]. In Bangladesh, nearly 0.75 million hectares of land is annually cultivated for 9.0 million bales of jute fibre [5]. To cultivate the said area, the farmers require 4500-5000 metric tons of jute seed annually out of which around 3000 metric tons are of tossa jute seed. A small portion of the required tossa jute seed is produced in Bangladesh and partly is coming from neighboring country India. But the major portion is supplied in local market through smuggling [6]. Such seeds in most cases are of poor quality. Beside this, in most of the years, flood cause damages to seed crops resulting in low yield of poor quality seed. Jute is normally grown for fibre and thus less attention is given to its seed production. The jute growers in Bangladesh

are not well 26 Mohammad Golam Mostofa et al.: Age of Cutting and Spacing Effects on Seed Yield of Tossa Jute (Corchorus olitorius L.)

aware of the production procedure of jute seed. They produce jute seed in traditional way which is low yielder, inferior quality and takes long time from March to December. Such long staying in the field, seed crop faces adverse climatic conditions and produce poor quality seeds. Not only that but also it hampers transplant aman rice and rabi (winter) crops [7]. So, appropriate technology to produce quality seed is a must, to increase the production of jute in Bangladesh. Late jute seed production technology viz. direct seeding method, top and stem cutting method; and seedling transplanting method can solve this problem. Off all the techniques, top and stem cutting method is best considering yield and quality aspects. With this technique seedling materials (stem and top cutting) are transplanted in July and seeds are harvested in December and the crops are subjected to favorable environmental stimuli [8-10].

However, optimum age of plants for cutting and spacing for planting yet not optimize for jute seed production under late condition. Therefore, the present investigation aims at developing spacing for cutting placement and to find out suitable plant age for cutting preparation and thereby to produce higher amount of quality tossa jute seed.

2. Materials and Methods

A two years study during 2017 and 2018 was conducted at the experiment field of Bangladesh Jute Research Institute sub-station, Monirampur. Stem cutting of tossa jute variety O-9897 was used as study material. The treatment of the experiment consisted of three ages of cutting (105, 120 and 135 days) and two spacing (15"x5" and 18"x4"). This gave a treatment combination of 6 (i.e. 3x2) and the study was a factorial experiment with two factors viz. age of cutting and spacing. The field layout was based on the Random Complete Block Design with three replications and the unit plot size was 180"x120". A total of 288 and 300 cuttings were planted per unit plot according to spacing. Cutting of all ages (105, 120 and 135 days) were planted in the same day (20th July) in both years and sowing of mother plants were adjusted accordingly. For the collection of top cutting, three separate beds each of one decimal were prepared for raising mother lants. The beds were first spaded; all weeds, stubbles and crop residues were removed and then leveled with the help of a ladder. The beds were uniformly fertilized with recommended doses (200-50-60-95-11 kg ha-1) of urea, TSP, MP, Gypsum and Zinc sulphate. After wards, jute seed was sown in the beds on three different dates viz. 5th March, 20th March and 5th April. All intercultural operations were done for crop good growth. The stem of healthy and disease free plants of around 1m from the tip were collected prior to flowering stage and bigger leaves were carefully removed. Then collected stems were slantically cut with sharp knife into pieces 20-25 cm in length with at least three buds. Each top and stem cutting was planted in soil with north-south direction to a depth of 5 cm at an angle about 450 maintaining required spacing (15"x5" and 18"x4"). Before planting, the land was well prepared and the fertilizers were applied @ 50 kg N, 36 kg P2O5, 12 kg K2O, 18 kg S and 4 kg Zn ha-1 in the form of urea, TSP, MP, Gypsum and Zinc sulphate. Urea was applied in two splits: half of urea and other fertilizers were applied as basal dose at the time of final land preparation. Each unit plot was weeded at 21 days after planting and simultaneously the rest of urea was top dress just after weeding. Plots were irrigated once at 45 days after planting. There was no disease and insect infestation in the experimental field. All necessary intercultural operations were done as and when needed. When about 80% fruits were turned in brown colour then the seed crops were harvested (last week of November) and ten sample plants in the middle rows (excluding border plants) were selected at random from each unit plot for recording data on plant height, number of branches per plant and number of fruits per plant. The harvested seed crops were sun dried for four days and the seeds were threshed by beating with bamboo sticks. The seeds were winnowed further four days to record plot-wise final seed yield data. All recorded data were analyzed statistically following the ANOVA technique and the means were separated using Least Significant Difference (LSD).

3. Results and Discussion

Plant height was highly influenced by ages of cutting. The cuttings made and planted from 120 days of mother plants gave highest plant height (1.283 m) which was significantly higher than cuttings of 105 days (1.213 m) and 135 days (1.210 m) of plant age (Table 1). Spacing had no significant influence on plant height although higher spacing (15"x5") gave taller plants than lower spacing (18"x4") of 1.254 m and 1.216 m, respectively (Table 2). Plant height was also affected significantly due to interaction of cutting age and spacing. The highest plant height (1.283 m) was obtained from cuttings of 120 days of mother plants in both the spacing (15"x5" and 18"x4") whereas the lowest plant height (1.167 m) was found in 105 days of cutting with spacing 18"x4". Plant height decreased when cuttings planted from other than 120 days plants (Figure 1). These results indicate that effect of cutting age was more dominant than that of spacing on plant height.

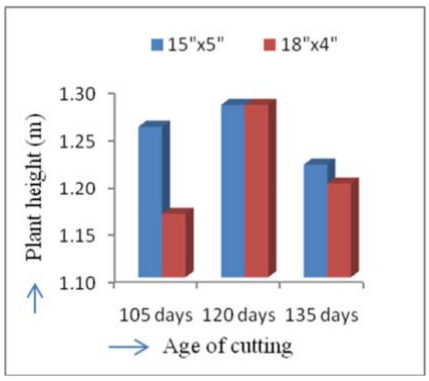

Figure 1. Interaction effect of cutting age and spacing on plant height.

Table 1. Effect of age of cutting on seed yield and yield components of tossa jute.

Ages of cutting	Plant height (m)	Number of branches plant^{-1}	Number of pods plant^{-1}	Seed yield (kg ha^{-1})
105 days	1.213	4.755	29.33	524.33
120 days	1.283	4.663	31.50	655.83
135 days	1.210	4.477	27.00	625.33
$LSD_{(0.05)}$	0.047	NS	2.091	45.595

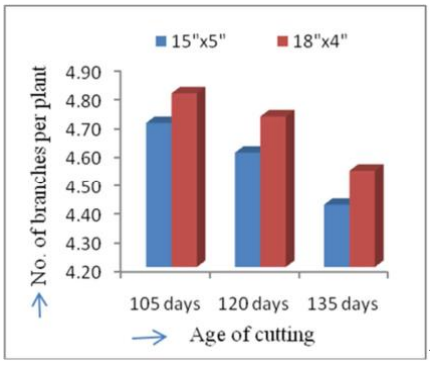

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Figure 2. Interaction effect of cutting age and spacing on branches per plan

Table 2. Effect of spacing on seed yield and yield components of tossa jute.

Planting spacing	Plant height (m)	Number of branches plant^{-1}	Number of pods plant^{-1}	Seed yield (kg ha^{-1})
15"x5"	1.254	4.573	28.11	575.11
18"x4"	1.216	4.690	30.45	628.55
$LSD_{(0.05)}$	NS	NS	1.715	37.232

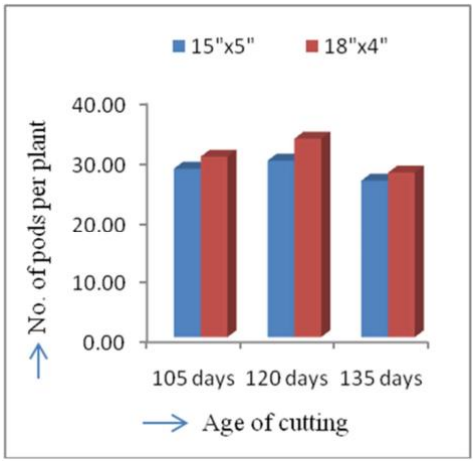

Figure 3. Interaction effect of cutting age and spacing on pods per plant.

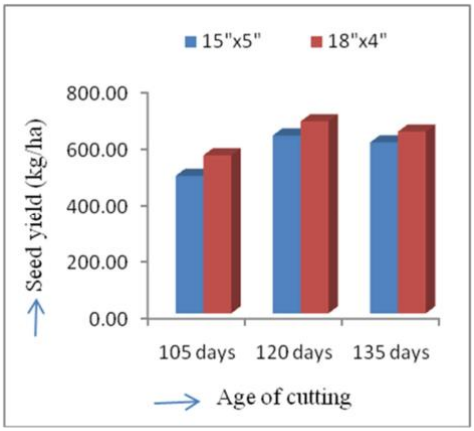

Figure 4. Interaction effect of cutting age and spacing on seed yield.

The branching of jute plant occurs normally through bifurcation of plant tip at the time of flower bud induction. It also occurs when plant top gets injured by cutting or infestation of insect pest at the early stage of the crop. The more branches than 15"x5" spacing (Table 2). Neither spacing nor age of cutting by spacing interaction significantly affects this trait (Figure 2).

Age of cutting significantly affected number of pods plant1 and the cutting planted from 120 days of mother plant gave the highest number of pods plant-1 (31.50). The number of pods plant-1 of other ages of cutting ranged from 27.00 to 29.33 (Table 1). As the crops with tender age cutting had higher number of branches, it might have higher number of pods plant-because number of pods plant-1 always gives very high and positive correlation values with the number of branches plant-1 [12-13]. There was significant difference in pods plant-1 due to spacing. Pods plant-1 was significantly higher in spacing 18"x4" (30.45) than in 15"x5" (28.11). The number of pods plant-1 was affected significantly due to interaction of age of cutting and spacing. The highest number of pods plant-1 (33.33) was found with the cutting of 120 days in 18"x4" spacing and the lowest pods plant-1 (26.33) was received with the cutting of 135 days in 15" x 5" spacing (Figure 3).

Seed yield was greatly influenced by ages of cutting. The cuttings planted from 120 days of mother plant produced 28 Mohammad Golam Mostofa et al.: Age of Cutting and Spacing Effects on Seed Yield of Tossa Jute (Corchorus olitorius L.) maximum seed yield of 655.83 kg ha-1 which was significantly higher than the cuttings planted from 105 days (524.33 kg ha-1). The cuttings made and planted from 120 days of mother plant had higher pods plant-1 which was responsible for producing higher seed yield (Table 1). Significantly higher seed yield was recorded from spacing 18"x4" compared to 15"x5" in this study (Table 2). The crops with distantly lined might have chances of producing higher yield because such type of plots (line to line distance

high) utilized better interception of sunlight, air, ground area and soil moisture and thus provided maximum seed yield ha-1. The seed yield was significantly affected due to the interaction of ages of cutting and spacing. The cuttings planted from 120 days of mother plant in 18"x4" spacing gave the highest seed yield of 680.67 kg ha-1. The seed yields were decreased with the cuttings planted from tender (105 days) or older (135 days) mother plants (Figure 4). The lowest seed yield of 560.67 kg ha-1 was found with the cutting planted from 105 days of mother plant in 18"x4" spacing. The similar trend of seed yields were also found in 15"x5" spacing. Top cutting method gave higher seed yield (971 kg ha-1) compared to that of conventional method (669 kg ha-1) which is supported by previous report [14]. It is also reported that the highest seed yield (645 kg ha-1) was recorded in top cutting method followed by line sowing and broadcasting method, respectively [15].

Correlation co-efficient between component characters of jute seed crop has been computed irrespective of ages of cutting and planting spacing. Plant height showed nonsignificant positive correlation (r=0.404) with seed yield of tossa jute which indicated that the seed yield increased with the increase of plant height (Table 3). Plant height although; do not contribute directly to seed yield but taller and healthy plants give increase number of pods plant-1 and eventually the seed yield. This suggests that the agronomic manipulation to develop healthy plant from cutting may improve seed yield. The number of branches plant-1 showed non-significant negative correlation (r= -0.283) with seed yield.

This result disagreed with the earlier report [12] who reported positive correlation of branches plant-1 to seed yield in jute. Number of pods plant-1 also showed non-significant positive correlation (r=0.374) with seed yield. It indicated that number of pods plant-1 in tossa jute whenever increased the seed yield would be increased as well unless it produces unfilled pods. So, proper management practices should be undertaken for increasing the number of pods plant-1 to have higher seed yield. This result complemented by the earlier reports [12-13]. Plant height and branches plant-1 showed non-significant positive correlation with pods plant-1 but plant height had negative correlation with branches plant-1 (Table 3). It indicated that pods plant-1 increased with the increase in plant height and branches plant-1 but number of branches decreased with the increase of plant height.

4. Conclusion

It can be concluded from this study that age of cuttings greatly influenced seed yield and yield components. The higher seed yield (655.83 kg ha-1) was obtained from the cutting of 120 days of mother plant compared to other ages. Seed yield was also affected by spacing. Interaction of cutting age and spacing resulted the highest seed yield (680.67 kg ha-1) when cuttings planted from 120 days of mother plant in 18"x4" spacing. Out of three yield components, plant height and pods plant-1 showed nonsignificant positive correlation with seed yield. Therefore, stem and top cuttings of jute crop for seed production must not be taken from too older or too younger plants, rather it should be ready from intermediate age (120 days) of plants and planted maintaining wider line to line distance with minimum cutting to cutting spacing so that intercultural operations may easier and the seed crop offers better chances of sufficient sunlight, air, ground area, soil moisture and thus provided maximum seed yield ha-1.

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