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Seed yield and economics of white jute as influenced by different dates of sowing, spacing and topping schedule in Terai region of West Bengal

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ABSTRACT

A field experiment was conducted at the farm of Uttar Banga Krishi Viswavidyalaya to optimize the suitable date of sowing, spacing and topping schedule in case of seed production of white jute. Jute cultivar JRC 321 was sown on 25 July, 9 August and 24 August 2011 with 45 x 10 cm, 45 x 15 cm and 60 x 15 cm spacing and topping was done at 30 and 45 days after sowing (DAS). Experiment was laid out in split-split-plot design with three replications. Date of sowing was assigned to the main plots, spacing to the sub-plots and topping to the sub-sub-plots. In terms of growth parameters 9 August sown crop performed the best. Results showed that among all the three dates of sowing 9 August sown crop recorded maximum seed and stick yield of 5.45 and 51.40 q/ha respectively as well as net return (Rs 20732/ha) and B:C ratio (1.76). Spacing influenced all growth parameters significantly except number of primary branches per plant. There was significantly higher seed yield (4.42 q/ha) obtained with 45 x 15 cm spacing but stick yield gradually decreased with the increase in spacing. Highest net return (Rs 9608/ha) and B:C ratio (1.35) was also achieved in this treatment. Topping at 45 DAS exhibited superior performance with regard to all the yield parameters and gave 12.05 per cent higher seed yield over topping at 30 DAS and highest net return (Rs 9764/ha) and B:C ratio (1.36).

Keywords: Date of sowing; seed yield; spacing; topping; economics

INTRODUCTION

Jute (*Corchorus* spp) is the most important natural fibre crop next to cotton grown in the humid tropical climate mainly under rainfed condition predominantly by marginal and small farmers of Indo-Bangladesh subcontinent. Seed is a vital agricultural input and gives highest return relative to its cost. In India requirement of

certified, foundation and breeder seed of jute is 5000, 62.5 and 0.8 ton respectively (Kumar et al 2010). There is an imbalance between total seed requirement for fibre production and total seed production in fibre producing states. At present jute seed crop particularly of *C olitorius* varieties are grown mainly in Andhra Pradesh, Maharashtra and Gujarat. Non-availability of quality jute seed to the farmers at a lower price and at proper time is one of the major constraints faced by jute farmers. To minimize the hindrances towards getting higher jute fibre production with uniform productivity across the growing zones the issues those are to be readily addressed include standardization of quality jute seed production technology. Date of sowing is one of the factors affecting seed yield of different crops. Spacing influences growth rate and crop yield as a result of inter-plant competition for different inputs needed for growth and development (Tripathi et al 2013). Thus investigation on spacing becomes mandatory for understanding the mechanism of yield enhancement. Apical topping breaks the apical dominance and induces development of lateral branches thereby increasing the site for pod/capsule development. The practice of topping has been proved effective in increasing the yield levels of different crops (Sajjan et al 2002, Singh et al 2011). Information on seed production of jute is very little and it is urgent need to produce jute seed in fibre producing states. Therefore the present study was undertaken to determine possibility of jute (*Corchorus capsularis*) seed production and to optimize proper sowing time, spacing and topping schedule in Terai region of West Bengal.

MATERIAL and METHODS

The experimental site was located in the farm of Uttar Banga Krishi Viswavidyalaya, Cooch Behar, West Bengal (situated at $26^0$19'86" N latitude and $89^0$23'53" E longitude and at an elevation of 43 meters amsl). The soil was sandy loam, having pH 5.39, medium in organic C (0.58%), low in available N (175.62 kg/ha) and medium in available P (14.56 kg/ha) and available K (204.51 kg/ha). The rainy season starts from 1st week of May and continues up to last week of September having intermittent drizzling and occasional heavy rainfall. The average rainfall per annum of this zone varies between 2100 to 3300 mm. The maximum rainfall ie about 80 per cent of the total is received from south-west monsoon during the rainy months of June to September. The temperature range of this area varies from minimum of 7.1-8.0°C to maximum of 24.8-32.2°C. The area as a whole is humid and warm except having a winter spell during December to February. The field experiment was conducted during July to December 2011. The three dates of sowing (D1- 25 July, D2- 9 August and D3- 24 August), three spacings (S1- 45 x 10 cm, S2- 45 x 15 cm and S3- 60 x 15 cm) and two topping schedules (T1- 30 DAS and

T2- 45 DAS) were laid out in split-split-plot design and replicated thrice. Date of sowing was assigned to the main plots, spacing to the sub-plots and topping to the sub-sub-plots having total 18 treatments. Fertilizer doses of 60, 30 and 30 kg/ha N, P_2O_5 and K_2O were applied respectively. N was applied in two equal split doses one as basal dose and another top dressed at 30 DAS when hand weeding was done.

For data collection on growth (plant height, dry mater production/plant and branches/plant at harvest) and other yield attributing characters (capsules/plant, number of seeds/capsule and 1000-seed weight at harvest) five plants and ten capsules were picked at random from each plot. Harvesting was done on 29 November, 12 and 26 December for first, second and third dates of sowing respectively. The crop was threshed plot-wise and seed and stick yield obtained from net plot was converted into q/ha. While calculating gross return prevalent market price for sale of jute seed was taken as Rs 60.00/kg and price for sale of jute stick was considered as Rs 3.00/kg. Net return was calculated by deducting cost of cultivation from gross income and benefit/cost ratio was calculated by dividing total cost of cultivation (Rs/ha) to gross return (Rs/ha).

The data collected from the field were used for statistical analysis using split-split plot design. Analysis of variance for each parameter was performed using PROC GLM of Statistical Analysis System (SAS) software (Version 9.2). Mean separation of different treatments under different parameters was performed using Tukey's Studentized Range (HSD) test (P= 0.05).

RESULTS and DISCUSSION

Effect of date of sowing: The results reveal that planting dates influenced different growth parameters significantly (Table 1). D2 ie 9 August sown crop recorded highest plant height (172.93 cm), dry matter production (52.59 g/plant) as well as number of primary (10.99/plant) and secondary branches (12.12/plant). Regarding all the growth parameters last date of sowing ie 24 August (D3) performed significantly worst. These results are in line with the findings of Guha and Das (1997) who reported a significant variation for growth parameters of jute seed crop in different planting dates. Factually not only by the total rainfall but also the distribution of rainfall during the entire vegetative growth period is of paramount importance in case of jute fibre as well as jute seed production. Second date of sowing (9 August) gained much growth over D1 (25 July) probably due to the following reason. The high rainfall in the early stage of 25 July sown crop resulted in higher weed infestation and poor crop establishment which ultimately hampered the crop growth (Table 1). Treatment D3 (24 August) gave the worst results because total rainfall received during

entire growing period was only 403 mm (Table 2). On account of the receipt of a very meagre amount of rainfall (38.5 mm) during first 15 days 24 August sown crop suffered a lot in terms of growth which could not be compensated during the later stages of the crop. It is clear in Table 1 that 9 August sown crop achieved significantly higher number of capsules (113.43/plant), 1000-seed weight (3.82/g), seed yield (5.45 q/ha) and stick yield (51.40 q/ha). This phenomenon may be attributed to the sound and better crop stand attained by 9 August sown crop. In case of seed yield first two dates of sowing were statistically at par. For date of sowing significant differences for seed and stick yield were also reported by Guha and Das (1997) and Mishra and Nayak (1997) respectively. Roy and Mazumdar (1995) reported significant effect of date of sowing on 1000-seed weight. Highest gross return, net return (Rs 20732/ha) and B/C ratio (1.76) were manifested by D2 (Table 3) due to more seed and stick yield achieved in this treatment.

Effect of spacing: Spacing influenced all growth parameters significantly except number of primary branches per plant (Table 1). For plant height, dry matter production per plant and number of branches per plant both treatments S2 (45 x 15 cm) and S3 (60 x 15 cm) had no significant differences but spacing of 60 x 15 cm (S3) performed excellent in terms of dry matter production (42.76 g/plant), number of primary branches (10.12/plant) and number of secondary branches (9.30/ plant). Achievement of more vigour by an individual plant in case of wider spacing might explain the result as all the above mentioned growth parameters were taken, calculated and quantified for individual plant. Spacing had no significant effect on the yield components (Table 1). Madakadze et al (2007) also made similar observation for 1000-seed weight. Spacing of 45 x 15 cm gave the best result in terms of capsules (94.18/plant) and 1000-seed weight (3.75 g). As the number of capsules per plant and 1000-seed weight were maximum with 45 x 15 cm spacing seed yield (4.42 q/ha) was found maximum with this treatment being statistically at par with 60 x 15 cm spacing (4.34 q/ha). As a matter of fact though widest spacing (60 x 15 cm) performed excellent in terms of most of the growth and yield parameters yield might not increase up to the highest extent due to less plant population per unit area. Poorest performance of S1 (45 x 10 cm) might be attributed to its worst performance with regard to almost all the growth and yield parameters. S1 being the closest spacing recorded more stick yield (45.72 q/ha) probably due to more plant population per unit area (Mishra and Nayak 1997). Highest gross return and net return (Rs 9608/ha) were manifested by S2 ie 45 cm x 15 cm but S1 achieved same B/C ratio as that of S2 (Table 3) because much higher

Table 1. Effect of date of sowing, spacing and topping schedule on growth, yield attributes and yield of jute seed crop

Treatment	Plant height (cm)	Dry weight (g/plant)	Branches/ plant		Capsules/ plant	Seeds/ capsule	1000-seed weight (g)	Seed yield (q/ha)	Stick yield (q/ha)
			Primary	Secondary					
Date of sowing									
D1 (25.07.2011)	168.53 b	39.11 b	10.33 a	6.73 b	91.05 b	36.24 b	3.63 b	5.12 a	33.51 b
D2 (09.08.2011)	172.93 a	52.59 a	10.99 a	12.12 a	113.43 a	37.11 b	3.82 a	5.45 a	51.40 a
D3 (24.08.2011)	115.63 c	30.99 c	7.76 b	6.20 b	66.20 c	39.23 a	3.65 b	2.05 b	23.98 c
MSD (P= 0.05)	4.22	3.16	1.18	1.79	15.22	1.39	0.13	0.53	3.43
Spacing									
S1 (45 x 10 cm)	145.31 b	38.08 b	8.98 a	6.84 b	82.44 a	37.59 a	3.64 a	3.86 b	45.72 a
S2 (45 x 15 cm)	156.17 a	41.86 a	9.98 a	8.91 a	94.18 a	37.34 a	3.75 a	4.42 a	34.92 b
S3 (60 x 15 cm)	155.61 a	42.76 a	10.12 a	9.30 a	94.07 a	37.64 a	3.72 a	4.34 ab	28.26 c
MSD (P= 0.05)	4.22	3.16	NS	1.79	NS	NS	NS	0.53	3.43
Topping schedule									
T1 (30 DAS)	149.29 b	42.09 a	7.48 b	10.52 a	89.13 a	37.33 a	3.65 b	3.94 b	38.35 a
T2 (45 DAS)	155.44 a	39.71 b	11.91 a	6.19 b	91.33 a	37.72 a	3.75 a	4.48 a	34.24 b
MSD (P= 0.05)	2.84	2.13	0.79	1.20	NS	NS	0.09	0.36	2.31

Means in a column followed by same letter do not differ significantly at $P \leq 0.05$ (Tukey's Studentized Range (HSD) test),
MSD= Minimum significant difference

Table 2. Periodical rainfall during the period of growth for different planting dates

Time gap	Rainfall (mm) in the crop season after different dates of sowing		
	D1 (25 July)	D2 (9 August)	D3 (24 August)
Sowing to 15 DAS	324.0	222.0	38.5
16 to 30 DAS	222.0	38.5	329.0
31 to 45 DAS	38.5	329.0	20.5
46 to 60 DAS	329.0	20.5	10.0
61 to 75 DAS	20.5	10.0	00.0
76 to 90 DAS	10.0	00.0	1.0
91 to 105 DAS	00.0	1.0	3.5
106 DAS to harvest	1.0	3.5	0.5
Total	945.0	24.5	403.0
Duration (days)	128	125	124

Source: Integrated Agromet Advisory Services, UBKV, Cooch Behar, West Bengal

Table 3. Effect of date of sowing, spacing and topping schedule on economics for jute seed production

Treatment	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit/cost ratio
Date of sowing			
D1 (25.07.11)	40773	13385	1.49
D2 (09.08.11)	48120	20732	1.76
D3 (24.08.11)	19494	-7894	0.71
Spacing			
S1 (45 x 10 cm)	36876	9488	1.35
S2 (45 x 15 cm)	36996	9608	1.35
S3 (60 x 15 cm)	34518	7130	1.26
Topping schedule			
T1 (30 DAS)	35145	7757	1.28
T2 (45 DAS)	37152	9764	1.36

Cost of cultivation= Rs 27388.00/ha

stick yield in case of S1 in comparison to S2 compensated the low seed yield.

Effect of topping schedule: It was observed that different topping schedules had significant effects on the growth parameters (Table 1). Earlier topping ie topping at 30 DAS (T1) had harmful effect on plant height but rendered beneficial effect in terms of other growth parameters like dry matter production and number of secondary branches per plant. This could be because of the fact that in T1 early removal of apical portion of the plant checked the vertical growth from early growing stage. Naturally branching started earlier in case of earlier topping and the primary branches remained in vegetative stage for long time leading to the formation of more number of secondary branches. 1000-seed weight, seed yield as well as stick yield were significantly influenced by topping management practices but topping had no significant effect on the yield components like capsules per plant and seeds per capsule (Table 1). Topping at 45 DAS (T2) exhibited superior performance with regard to all the yield parameters. This might due to be topping at 30 DAS promoted much vegetative growth but better reproductive growth was obtained with topping at 45 DAS. Topping at 45 DAS gave 12.05 per cent higher seed yield of jute over topping at 30 DAS. On the contrary stick yield was significantly more when topping was done at 30 DAS. Attainment of higher vigour by the plants receiving the treatment with topping at 30 DAS might lead to such result. It was also noted that higher gross return, net return (Rs 9764/ha) and B/C ratio (1.36) were achieved by T2 (Table 3).

CONCLUSION

Taking up of jute seed (*C capsularis*) production may be a profitable proposition in the experimental region and jute farmers would definitely be benefited upon getting seed at proper time and at moderate price. Moreover direct seeding during last week of July to first week of August proved to be optimum with 45 x 15 cm spacing and crop should be topped at 45 DAS to reap better seed yield.

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