



Jute seed production as influenced by dates of sowing and topping in red and laterite zone of West Bengal

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Abstract: An experiment was carried out during the *tekharif* season of two consecutive years 2014 and 2015 at Regional Research Sub-station, Raghunathpur, Bidhan Chandra Krishi Viswavidyalaya, Purulia, West Bengal with the view to maximise the jute seed yield by manipulating certain non-monetary techniques like dates of sowing and topping associated with crop production. The *Capsularis* variety Bidhan pat-3 was sown in three different dates (1st-25th June, 2nd-15th July and 3rd-5th August) with 3 topping (clipping of apical portion) practices at 30, 45 and 60 days after sowing (DAS) as separate treatment with no topping as control. These different agronomic practices significantly (at 5 % probability level) influenced the performance of the crop in various aspects. The 1st date of sowing showed its supremacy in terms of expression of the crop in the field in all the aspects achieving a seed yield of 709.50 kg ha⁻¹ and 737.85 kg ha⁻¹ during first and second year respectively, whereas, the last date of sowing showed its inferiority obtaining a seed yield of 590.10 kg ha⁻¹ and 647.13 kg ha⁻¹ all through the first and second year respectively. 1st date of sowing also recorded higher net return (Rs. 33721.50 ha⁻¹ & Rs. 35989.50 ha⁻¹ during first and second year) and benefit: cost ratio (1.46 and 1.56 in first and second year) over the other two date of sowing. However, maximum seed yield was achieved when the crop was topped on 45 DAS (728.80 kg ha⁻¹ and 773.57 kg ha⁻¹ during first and second year) irrespective of the date of sowing.

Keywords: Date of sowing, Economics, Jute, Seed yield, Topping

INTRODUCTION

Jute is one of the most important commercial bast fibre crops which occupy a key place in the Indian economy. In West Bengal, it is the most important fibre crop occupying an area of 519 thousand ha with a production of 8075 thousand bales (Anonymous, 2016). In west bengal, it is mainly grown for fibre production in the alluvial tract. Besides, the leaves and soft stems are also consumed as vegetables as they supply energy, minerals, vitamins and many more (Antia *et al.*, 2006).

Now a day, the jute has been facing a strong competition from the synthetic materials prevailing in the market. Therefore, there is a felt need to augment the jute production considerably to make its cultivation profitable to the farmers. One of the most vital keys to success in our endeavour for higher fibre production, improved quality seed is an important input. It has been reported that quality seeds of an improved variety can itself provide 20 percent additional yield of the crop (Hossain *et al.*, 1994) over that obtained from the use of local seed. But, these quality seeds are generally unavailable to the jute growers of the West Bengal. The farmers usually met their requirement by the N.S.C where the seeds are grown under its supervision

in the states like Bihar, Andhra Pradesh and Maharashtra which in turn increases the cultivation cost significantly. On this contrary, in West Bengal areas like Bankura, Purulia, Midnapore, parts of Birbhum and Burdwan can be used for the seed production of jute as the prevailing agro-climatic conditions are congenial for this purpose.

Jute seed production can be increased significantly by adopting improved agronomic techniques. Among the improved agronomic techniques, Optimum sowing time is an important factor as the jute requires a well-distributed monsoon rains during the vegetative period and a rain free period during ripening to harvesting and processing for its seed production. When the crop is sown at its optimum time, there is a synchronisation of the growth phases of the crop with the optimum environmental condition which ultimately leads to better expression of the crop in terms of growth and yield (Salmasiet *al.*, 2006). Another important factor is topping (clipping of apical buds). When the apical buds are clipped off, the auxiliary buds develop lateral branches which in turn increases the seed yield by producing more number of pods. However, the practice of topping has been proved effective in increasing the yield levels of white jute (Das *et al.*, 2014). Keeping all these factors in mind a field

experiment was conducted during the *kharif* season of 2014 and 2015 at the Regional Research Sub-station, Raghunathpur, Bidhan Chandra Krishi Viswavidyalaya with the objective to study and assess the optimum date of sowing for higher seed production with the possibilities of increasing seed yield by topping.

MATERIALS AND METHODS

Experimental site: The field experiment was conducted at Regional Research Sub-station, Raghunathpur, Bidhan Chandra Krishi Viswavidyalaya, Purulia, West Bengal in two consecutive years of 2014 and 2015. The study area belongs to humid and tropical climate characterised by a wet monsoon season (June to September) and a dry post monsoon season. The experimental site was situated at 23.55°N latitude and 86.67°E longitude with the altitude of 155 metres above the mean sea level (MSL).

Experimental soil: The soil of the experimental field was sandy clay loam in texture (sand, silt and clay content is 56.2, 20.3 and 23.5% respectively as determined by the International Pipette Method; Piper, 1966) having good water holding capacity. Fertility status of the experimental soil was medium having pH of 6.4 with 0.56% organic carbon, 0.059% total nitrogen, 18.50 kg ha⁻¹ available phosphorus and 176.33 kg ha⁻¹ available potassium.

Experimental design and treatments: The experiment was laid out in Factorial Randomized Block Design. There were 12 treatment combinations comprising 3 dates of sowing (1st- 25th June, 2nd-15th July and 3rd-5th August) and 4 topping practices {1st-without topping, 2nd- topping at 30 days after sowing (DAS), 3rd- topping at 45 DAS and 4th-topping at 60 DAS) which were replicated thrice. The individual plot size was 5m × 4m.

Crop management: The jute variety Bidhan pat 3 was sown in three different dates with the seed rate of 6 kg ha⁻¹ and spacing 30cm × 10cm. The fertiliser dose of 60:30:30 kg N, P₂O₅ and K₂O ha⁻¹ was used for the crop. 50% N along with the full dose of P₂O₅ and K₂O were applied as basal at the time of final land preparation and the rest amount of nitrogen was applied at 30 days after sowing (DAS). In order to induce auxiliary branches clipping of the apical portion (topping) was carried out at 30 DAS, 45 DAS and 60 DAS on separate plots. After topping 2% urea solution was sprayed to remove the stress (only on topped plots). During the first year, the crop was affected by the insect jute semilooper considerably and to control that Fipronil 5 SC @ 1 ml/litre of water was applied at 35 DAS (for 1st and 2nd sowing). In the first year, the crop was harvested on 08/11/2014 (1st sowing), 15/11/2014 (2nd sowing) and 27/11/ 2014 (3rd sowing) taking a total duration of 136, 122 and 113 days respectively. During the second year, the crop was harvested on 11/11/2015 (1st sowing), 20/11/2015 (2nd sowing) and 29/11/2015

(3rd sowing) taking a total duration of 139, 127 and 115 days respectively.

Plant sampling: For measuring the seed yield of jute, the entire produce from the net plot area (from demarcated portion, leaving the border area) was harvested and weighed after thorough drying under the sun. Seed yield from that area was converted to yield unit⁻¹ area (kg ha⁻¹). All the growth parameter (plant height, basal diameter) and yield parameter (pods plant⁻¹, seeds pod⁻¹) were measured by randomly taking 10 plants from each plot and finally averaged into a single value.

Statistical analysis: The critical difference (CD) for estimated treatment contrasts was worked out using standard statistical procedures as outlined in Gomez and Gomez (1984). The difference between treatment means were compared with CD value at 5% level of probability and the treatments with higher effect over others were identified.

RESULTS AND DISCUSSION

Effect of date of sowing and topping on the growth parameter of jute:

Plant height data of two consecutive years presented in Table 1. In the first year of experimentation, the treatment ascendancy with respect to plant height was observed with the first date of sowing recording a values of 36.46 cm at 30 DAS, 101.76 cm at 45 DAS and 168.85 cm at 60 DAS; while, the last date of sowing showed its lowness (plant height of 30.34 cm at 30 DAS, 76.46 cm at 45 DAS and 118.49 cm at 60 DAS). Similar trend was also found in the next year of study in which the first date of sowing outdated all other sowing date with respect to plant height. Best performance in advocating plant height for seed production of jute crop sown on 1st June has also been established by Kumar *et al.* (2013) and Singh *et al.* (2013). Topping done on different dates also influenced plant height of the crop significantly at 5 % probability level at different growth stages except at 30 DAS. The treatment supremacy regarding plant height at 45 and 60 DAS during both the years was observed under the no topping practices. The plants that were grown without topping achieved the maximum plant height (values being 99.08 and 103.79 cm at 45 DAS in the first and second year respectively and 158.73 and 151.60 cm at 60 DAS in both the successive years respectively) and were statistically superior over the others that got some topping at their different growth stages. However, the plants that were topped at 30 DAS recorded lowest plant height. This may be due to the fact that at initial stages the growth of the crop was not hampered up to 30 days as no topping practices were employed before that. But after that when the plants were topped off, it got a physical shock which reduced the growth considerably and became an important factor behind the difference of plant height at different topping

Table 1. Effect of date of sowing and topping on growth attributes of the jute variety Bidhan pat 3

Treatments	Plant height (cm)						Basal diameter (cm)					
	30 DAS		60 DAS		90 DAS		30 DAS		60 DAS		90 DAS	
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
D ₁ (25 th June)	36.46	37.88	101.76	103.74	168.85	158.12	0.385	0.397	1.361	1.401	2.02	2.20
D ₂ (15 th July)	34.37	35.81	90.52	94.65	144.65	144.24	0.347	0.352	1.292	1.337	1.85	2.09
D ₃ (5 th August)	30.34	31.19	76.46	77.82	118.49	120.87	0.289	0.292	1.172	1.239	1.55	1.74
S. Em (±)	1.16	1.13	2.70	2.93	3.89	3.57	0.01	0.01	0.023	0.03	0.05	0.06
CD (P=0.05)	3.40	3.30	7.92	8.59	11.40	10.48	0.02	0.02	0.067	0.10	0.14	0.17
T ₁ (No topping)	34.70	35.07	99.08	103.79	158.73	151.60	0.329	0.351	1.239	1.307	1.74	1.90
T ₂ (Topping at 30 DAS)	32.44	33.16	78.66	81.75	130.57	129.56	0.353	0.344	1.322	1.366	1.91	2.16
T ₃ (Topping at 45 DAS)	33.59	36.37	87.52	86.42	139.23	139.32	0.343	0.355	1.288	1.335	1.82	2.03
T ₄ (Topping at 60 DAS)	34.15	35.23	93.06	96.29	147.46	143.81	0.337	0.339	1.252	1.295	1.76	1.95
S. Em (±)	1.34	1.30	3.12	3.38	4.49	4.13	0.01	0.01	0.027	0.04	0.05	0.07
CD (P=0.05)	NS	NS	9.14	9.91	13.17	12.10	NS	NS	NS	NS	NS	NS

Table 2. Effect of date of sowing and topping on yield attributes and yield of the jute variety Bidhan pat 3

Treatments	Branches plant ⁻¹			Pods plant ⁻¹			Seeds pod ⁻¹			Test weight (g)			Seed yield (kg ha ⁻¹)			Stalk yield (t ha ⁻¹)		
	2014	2015	2015	2014	2015	2015	2014	2015	2015	2014	2015	2014	2015	2014	2015	2014	2015	
	D ₁ (25 th June)	7.83	8.16	67.25	69.14	41.06	42.44	3.50	3.57	709.50	737.85	6.25	6.46					
D ₂ (15 th July)	6.18	6.44	58.66	63.96	38.48	39.85	3.44	3.48	656.38	696.10	5.62	5.80						
D ₃ (5 th August)	4.94	5.00	48.76	51.25	33.76	34.14	3.39	3.44	590.10	647.13	4.49	4.55						
S. Em (±)	0.15	0.14	1.39	1.72	1.44	1.67	0.06	0.07	9.67	9.06	0.12	0.10						
CD (P=0.05)	0.45	0.41	4.08	5.04	4.22	4.89	NS	NS	28.37	26.57	0.36	0.29						
T ₁ (No topping)	3.94	4.29	44.57	47.40	35.60	36.63	3.37	3.47	571.97	600.43	5.08	5.44						
T ₂ (Topping at 30 DAS)	7.51	7.48	63.45	66.83	38.53	39.59	3.47	3.50	674.90	726.77	5.26	5.03						
T ₃ (Topping at 45 DAS)	7.96	8.42	68.14	76.79	40.18	41.09	3.52	3.64	728.80	773.57	5.88	6.23						
T ₄ (Topping at 60 DAS)	5.84	5.93	56.73	54.78	36.76	37.92	3.41	3.38	632.30	674.00	5.59	5.71						
SE m(±)	0.18	0.16	1.61	1.99	1.66	1.93	0.07	0.08	11.17	10.46	0.14	0.12						
CD (P=0.05)	0.52	0.47	4.71	5.82	NS	NS	NS	NS	32.76	30.68	0.41	0.34						

Table 3. Effect of date of sowing and topping on economics of production of the jute variety Bidhan pat 3

Treatments	Total cost of cultivation (Rs ha ⁻¹)		Gross income (Rs ha ⁻¹)		Net income (Rs ha ⁻¹)		Benefit: cost ratio		Cost of production/ kg of seed (Rs kg ⁻¹)
	2014	2015	2014	2015	2014	2015	2014	2015	
Date of sowing									
D ₁ (25 th June)	23038.50	23589.00	56760.00	59028.00	33721.50	35989.50	1.46	1.56	32.68
D ₂ (15 th July)	23038.50	23589.00	52510.00	55688.00	29471.50	32649.50	1.36	1.41	35.34
D ₃ (5 th August)	23038.50	23589.00	47208.00	51770.00	24169.50	28731.50	1.04	1.24	40.44
Topping									
T ₁ (No topping)	21012.00	22078.00	45757.33	48034.67	24745.33	27022.67	1.18	1.28	37.83
T ₂ (Topping at 30DAS)	23714.00	24026.00	53992.00	58141.33	30278.00	34427.33	1.28	1.45	35.71
T ₃ (Topping at 45 DAS)	23714.00	24026.00	58304.00	61885.33	34590.00	38171.33	1.52	1.61	32.92
T ₄ (Topping at 60 DAS)	23714.00	24026.00	50584.00	53920.00	26870.00	30206.00	1.18	1.27	38.16

practices. This result corroborated the findings of Mollah *et al.* (2015) in kenaf crop.

Concerning the effects of sowing date and topping practices on basal diameter of the plant, the data of two years of study as texted in Table 1 exhibited that basal diameter of the plant changed significantly with the different sowing date, while, there was no significant effect of topping practices found on basal diameter of the plant all through the growth stages. The crop sown on 25th June recorded maximum basal diameter all through the growth stage (Table-1) and the crop was sown on 5th August the minimum.

Effect of date of sowing and topping on yield attributes and yields of jute: A noteworthy effect of the date of sowing was evidenced in the case of yield attributes like no of pod plant⁻¹ and seed pod⁻¹ etc. (Table 2). The treatment supremacy regarding no. of pods plant⁻¹ (67.25 and 69.14 in 2014 and 2015 respectively) and no. of seed pod⁻¹ (41.06 and 42.44 in the successive years) were established with the first date of sowing which was statistically superior over the other sowing dates. However, the test weight was not varied significantly under different date of sowing. The better result under 1st date of sowing may be due to the greater interaction of the crop with the environmental factors such as temperature, humidity, rainfall etc. which in turn favoured the growth of the crop considerably. These higher values of all the yield attributes came together positively to escalate the crop yield (both grain and straw yield) in the first date of sowing making it superior over the other two date of sowing (Table 3). These findings are in agreement with those recorded by Rayhan *et al.* (2008) and Kumar *et al.* (2013) in jute sown on first week of June.

In both the experimental years the yield attributes like no of seed pod⁻¹, test weight were not influenced significantly with the different agronomic practices, even though, the no. of pod plant⁻¹ was significantly influenced. The highest no. of pod plant was recorded with the crop that were topped at 45 DAS; while the least no. of pods plant was recorded with the crop that were grown without any topping practices. However, the topping had a colossal effect on the seed yield and stalk yield of the crop. The best seed yield and stalk yield were documented under the crop topped at 45 DAS; while the least values of seed yield and stalk yield were found with the crop that was grown conventionally *i.e.* without any topping practices. The reason behind that the clipping off apical buds induces growth of new auxiliary branches and increases the other yield attributes like no. of pod plant⁻¹, no. of seed pod⁻¹ etc. which consequently results in an increase of seed yield to a sufficient extent. All these results are in concord with the findings recorded by Mollah *et al.* (2015) in kenaf crop and Das *et al.* (2014) in white jute (topping at 45 DAS) crop.

Effect of date of sowing and topping on the economics

of jute seed production: In crop cultivation, farmers are generally interested to produce more per unit of investment of inputs. So, an assessment of quantifying the net profit per unit investment involved in different treatment is necessary to see the overall picture. The cost of cultivation was same for all the three dates of sowing (Table 3). However, it was little more in the second year (Rs. 23589.00) than the first year (Rs. 23038.50). The treatment superiority with consideration to gross return, net return and benefit: cost ratio (1.46 and 1.56 in 2014 and 2015 respectively) were identified with the first date of sowing, while, the minimum values were achieved with the last date of sowing. This may be due to the fact that higher yield obtained due to better interaction of the crop with the environment in early sowing fetched more return, but, the cost of cultivation was same in all the three dates of sowing. Das *et al.* (2014), Kumar *et al.* (2013), Singh *et al.* (2013) also opined in the same way that the sowing on first week of June improved yield as well as economics.

Although the cost of cultivation was same for all the sowing dates, it varied with the different topping practices during both the years. The minimum cost of cultivation (Rs. 21012.00 and Rs. 22078.00 during 1st and 2nd year respectively) was observed under the no topping practices. The cost of cultivation was same and more for the other three topping practices as it includes the labour charges necessary for clipping off the apical portion (Table 3). However, the crop topped at 45 DAS achieved a maximum gross return, net return and benefit: cost ratio (1.52 and 1.61 in 2014 and 2015 respectively) due to the maximum yield realised under it followed by the topping of the crop at 30 DAS. These results are in endorsement with the opinions of Mishra *et al.* (1998) in tossajute and Das *et al.* (2014) in white jute where topping was done at 45 days old crop. They stated that though the employment of topping increased the cost of cultivation to some extent over the no topping practices but the significant yield augmentation due to the adoption of topping escalated the production to the sufficient extent, so, gross return, net return and ultimately the benefit: cost ratio became higher over conventional method of cultivation.

Conclusion

Therefore, from the above experiment, it can be concluded that higher jute seed yield can be obtained from the capsularis variety Bidhan pat-3 under rainfed condition in the red and laterite zone of West Bengal if the seeds are sown during the period of late June to mid-July along with topping at 45 DAS. The topping is advantageous over the conventional method of cultivation and delay in sowing

results in poor performance with respect to yield attributing characters and seed yield.

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