



Advanced Yield Trial of Early Seeding, Higher Yield and Low Temperature Tolerant Breeding Lines of White Jute

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Abstract

The experiment was carried out at four regional stations (Rangpur, Chandina, Faridpur and Kishoreganj) and JAES, Manikganj to develop breeding lines with better performance in respect of seeding time and growth. Significant differences were observed among the treatments for plant population, plant height, base diameter and fibre weight at Manikganj, plant height and fibre weight at Rangpur and Chandina station. Pooled mean over stations revealed that the tested strains C-2234 (4.37 t/ha), C-2236 (4.12 t/ha) and C-2281 (3.87 t/ha) out yielded both the check varieties BJRI Deshi Pat-5 (3.68 t/ha) and CC-45 (3.57 t/ha) in terms of fiber.

Keywords: Breeding Lines; Stress; Yield; Corchorus; White Jute

Introduction

Jute (*Corchorus* sp) is a natural long, soft, shiny vegetable fibre that can be spun into coarse, strong threads. It is produced from plants in the genus *Corchorus*, belonging to the family Tiliaceae. Jute is considered as the main cash crop of Bangladesh. It's influence on ecology and economy is so intimate that it's effects are significantly related to the agro-ecology and the socioeconomic life of the people [1]. The suitable climate for growing jute (warm and wet climate) is the monsoon season. Temperatures ranging 20 to 40°C and a relative humidity of 70 - 80% are favorable for successful cultivation. Jute requires a weekly rainfall of 5 - 8 cm with an extra amount during the sowing period. Due to its good spinning quality, it is a good textile fibre. It helps to make best quality industrial yarn, fabric, net and sacks. It is one of the most versatile natural fibres that has been used in raw materials for packaging, textiles, non-textile, construction and agricultural sectors. Bulking of yarn results in a reduced breaking tenacity and an increased breaking extensibility when blended as a ternary blend [2].

Jute grows abundantly in Bangladesh having best quality in comparison with that of India [3]. Bangladesh ranked second in respect of fibre production and jute alone contributes about 1.0% to GDP. In 2016 - 2017, about 8.39 million tons of jute fibre were produced from 10.89 million acre of land and covered about 2.80% of the total cropped area and accounted for about 5 - 6% export earnings [4]. Plant density is the function of spacing between the rows and plants. Under various spacing's the plants manifest remarkable capacity to exploit environments with varying competition stresses for moisture, light, nutrition and carbon dioxide and thus, the plant growth is affected accordingly. Plant density is an important yield contributing factor which can be manipulated in 2 jute to attain higher fibre production per unit area. The yield of many crops is known to be positively correlated with the number of plants per unit area in the field. If the plant population is lower or higher than the optimum, the final output is adversely affected. In order to obtain required plant density, one of the major yield components of jute is optimum seed rate, resulting in proper spacing

to maintain the uniformity of stand for better growth and development of plant. Hashim, *et al.* [5] reported that four plant densities (348, 261, 323 and 174 thousand acre⁻¹) were arranged in different planting patterns of 45, 60, 67.5 cm 90 sq cm plant⁻¹. Although there were no significant differences in yield between the treatments, higher densities of population produced higher yield. Among the sowing patterns 15 cm x 7.5 cm had the highest yield followed by 22.5 cm x 5 cm and 10 cm x 11.25 cm. However, 22.50 cm row width displayed better performance compared to other row widths. 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 [6]; yield losses may be up to 75 to 80% [7]. Weeding is one of the most important cultural practices for the crop plants to take nutrients, moistures, light, space and sometimes controlling many diseases, organisms and insect pest [8]. An effective weed management practice is necessary for higher crop production and better economic return [9]. But, most effective and economic cultural practices for weed control in jute crop are not clearly known to 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 [10]. Grasses constitute the dominant weed flora in jute fields and its management using pre-emergence herbicides is possible [11] provided the farmers get sufficient time for land preparation and herbicide application before sowing.

Development of short day and low temperature tolerant varieties having better yield of fibre and seed, grown in medium high and low land area is a prerequisite for intensive cultivation of white jute. Mean performance over stations revealed that the tested strains tested strains C-2234 (4.37 t/ha), C-2236 (4.12 t/ha) and C-2281 (3.87 t/ha) out yielded both the check varieties BJRI Deshi Pat-5 (3.68 t/ha) and CC-45 (3.57 t/ha) in terms of fiber in 2014. So, the trial will be carried out again at different locations by sowing them on 15th March 2015 for evaluation of their yield and adaptability. Objectives of this study was to develop breeding lines with better performance in respect of seeding time and growth.

Methodology

The experiment was carried out at four regional stations (Rangpur, Chandina, Faridpur and Kishoreganj) and JAES, Manikganj. Three breeding lines viz. C-2234, C-2236, C-2281 along with two check varieties BJRI Deshi Pat-5 and CC-45 were grown. Seeds were sown on 15th March 2014. This experiment was laid out in a

randomized complete block design with 3 replications having unit plot size of 4.5m x 3.0m = 13.5 sq. m. At the age of 120 days, the plants were harvested and data were recorded on plant population, plant height, base diameter, green weight with leaves, green weight without leaves, fibre weight and stick weight. Proper intercultural operations and standard agronomic practices were followed for uniform growth. The significance of differences between the means of the treatments was evaluated by one way analysis of variance followed by Duncan's Multiple Range Test at the significance level of 5% and least significance difference (LSD) test at 5% and 1% level of probability [12]. The statistical software Excel and MSTAT-C computer package program developed by Russel [13] were used for these analyses.

Results

Analysis of variance revealed significant differences among the treatments for plant population, plant height, base diameter and fibre weight at Manikganj, plant height and fibre weight at Rangpur and Chandina station (Table 1).

Plant population (m/ha): Plant population were significantly different in different lines in different locations. It ranged from (0.541 - 0.214 m/ha). Highest plant population (0.367 m/ha) was observed from Manikganj in C-2236 line. Lowest plant population (0.214 m/ha) was observed from Rangpur in BJRI Deshi Pat-5.

Plant height (m): Plant height was highest (3.85m) in C-2281 line at Chandina, lowest (2.53m) in C-2236 line at Kishoreganj which were statistically different from other lines of different locations. Average plant height was 3.36m.

Base diameter (mm): Base diameters were significantly different in different lines in different locations. It was ranged from 25.69 to 17.36 mm. Highest base diameters (25.69 mm) was observed from Rangpur in C-2234 line while lowest base diameters (17.36 mm) was observed from Rangpur in BJRI Deshi Pat-5.

Green weight with leaves (t/ha): It was ranged from 97.33 - 21.13 t/ha. Green weight with leaves was highest (97.33 t/ha) in CC-45 line at Rangpur while lowest (21.13 t/ha) in C-2234 line at Kishoreganj which were statistically different from other lines of different locations.

Green weight without leaves (t/ha): Green weight without leaves were significantly different in different lines in different locations. It was ranged from 73.47 - 15.36 t/ha. Highest Green weight without leaves (73.47 t/ha) was observed from Chandina in C-2234

Stations	Varieties/lines	Plant population (m/ha)	Plant height (m)	Base diameter (mm)	Green weight with leaves (t/ha)	Green weight without leaves (t/ha)	Stick weight (t/ha)
Manikiganj	C-2234	0.346	3.13	23.47	64.44	50.52	8.34
	C-2236	0.367	3.32	22.52	58.58	44.513	8.56
	C-2281	0.365	3.45	20.58	52.63	41.51	8.73
	BJRI Deshi Pat-5	0.347	3.37	20.52	56.55	39.36	8.58
	CC-45	0.353	3.53	20.47	58.42	47.67	9.72
	LSD (5%)	0.016	0.303	0.24	NS	NS	NS
	LSD (1%)	0.021	0.363	0.233	NS	NS	NS
	CV%	13.31	5.36	9.31	14	19.23	12.43
Rangpur	C-2234	0.224	3.62	18.47	87.53	73.13	16.21
	C-2236	0.242	3.71	20.62	86.45	72.35	15.26
	C-2281	0.215	3.37	17.68	85.64	71.42	14.78
	BJRI Deshi Pat-5	0.214	3.35	17.36	70.46	59.26	12.63
	CC-45	0.241	3.42	17.51	97.33	66.35	14.59
	LSD (5%)	NS	0.285	NS	NS	NS	NS
	LSD (1%)	NS	0.372	NS	NS	NS	NS
	CV%	9.11	4.63	10.31	17.14	9.15	10.31
Chandina	C-2234	0.236	3.57	22.74	89.58	73.47	11.67
	C-2236	0.241	3.59	23.38	77.56	64.45	11.63
	C-2281	0.234	3.85	23.31	72.85	61.74	10.35
	BJRI Deshi Pat-5	0.237	3.63	21.37	82.48	70.36	11.89
	CC-45	0.256	3.95	22.63	67.64	56.36	9.86
	LSD (5%)	NS	0.263	NS	NS	NS	NS
	LSD (1%)	NS	0.357	NS	NS	NS	NS
	CV%	10.16	3.47	12.42	17.55	17.32	15.32
Faridpur	C-2234	0.437	3.53	18.37	88.42	70.38	10.56
	C-2236	0.512	3.42	18.63	87.72	67.75	11.45
	C-2281	0.541	3.31	18.41	84.32	72.24	11.47
	BJRI Deshi Pat-5	0.536	3.51	17.65	76.26	68.26	10.53
	CC-45	0.531	3.54	18.52	80.38	64.75	12.31
	LSD (5%)	NS	0.41	NS	NS	NS	NS
	LSD (1%)	NS	0.31	NS	NS	NS	NS
	CV%	12.65	6.41	7.95	12.33	12.44	14.12
Kishoreganj	C-2234	0.263	3.13	25.69	21.13	15.36	2.32
	C-2236	0.253	2.53	25.58	27.16	20.85	2.35
	C-2281	0.236	2.77	23.52	25.37	19.47	2.64
	BJRI Deshi Pat-5	0.263	2.68	22.74	26.58	19.43	2.42
	CC-45	0.287	2.73	20.46	24.64	19.67	2.61
	LSD (5%)	NS	NS	NS	NS	NS	NS
	LSD (1%)	NS	NS	NS	NS	NS	NS
	CV%	14.45	8.86	3.53	10.67	15.54	11.46

Table 1: Mean fibre yield and yield contributing characters of three short day tolerant lines of white jute.

NS: Non-Significant.

line, while lowest (15.36 t/ha) in C-2234 line at Kishoreganj. Average green weight without leaves was 53.22 t/ha.

Stick weight (t/ha): Stick weight was ranged from 16.21 - 2.32 t/ha. The highest (16.21 t/ha) in C-2234 line at Rangpur, while lowest (2.32 t/ha) in C-2234 line at Kishoreganj which were statistically different from other lines of different locations.

Fiber weight (t/ha): Fiber weight were significantly different in different lines in different locations (Figure 1). Highest Fiber weight (5.76 t/ha) was observed from Rangpur in C-2234 line while lowest (0.84 t/ha) in C-2234 line at Kishoreganj. Average fiber weight was 3.92 t/ha.

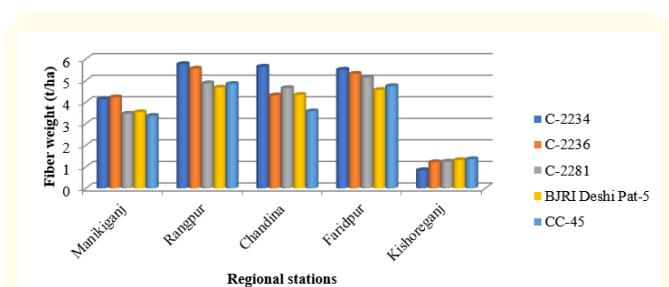


Figure 1: Fibre weight (t/ha) of different lines of white jute in different regional station.

Pooled mean over stations (Table 2) revealed that the tested strains C-2234 (4.14 t/ha) out yielded both the check varieties BJRI Deshi Pat-5 (3.50 t/ha) and CC-45 (3.50 t/ha).

Discussion

Plant population were significantly different in different lines in different locations. Highest plant population (0.367 m/ha) was observed from Manikganj in C-2236 line. Plant height was highest (3.85m) in C-2281 line at Chandina which was statistically different from other lines of different locations. In general, plant height is the most efficient morphological character which is directly related to greater fibre yield of Jute or Kenaf as well as the tallest plant maximizing the fibre yield of Jute or Kenaf. Similar findings were also obtained by Pervin, *et al.* [14] who observed that the analysis of variance significant differences among the genotypes for plant height.

Base diameters were significantly different in different lines in different locations. Highest base diameters (25.69 mm) was observed from Rangpur in C-2234 line. Significant varieties performance on base diameter were also obtained in jute [14-17]. Green weight with leaves was highest (97.33 t/ha) in CC-45 line at Rangpur which was statistically different from other lines of different locations. Green weight without leaves were significantly different in

Varieties/ strains	Parentage	Pedigree number	Plant population (m/ha)	Plant height (m)	Base diameter (mm)	Green wt. with leaves (t/ha)	Green wt. without leaves (t/ha)	Fibre weight (t/ha)	Stick weight (t/ha)
C-2234	JRC-212 x BZ-2	912-7-2234	0.301	3.40	21.75	70.22	56.57	4.37	9.82
C-2236	JRC-212x JutaRoxa	914-3-2236	0.323	3.31	22.15	67.49	53.98	4.12	9.85
C-2281	Hybrid C x BZ-1-3	9113-9-2281	0.318	3.35	20.70	64.16	53.28	3.87	9.59
BJRI Deshi Pat-5	-	-	0.319	3.31	19.93	62.47	51.33	3.68	9.21
CC-45	-	-	0.334	3.43	19.92	65.68	50.96	3.57	9.82

Table 2: Pooled mean of the advanced short day tolerance lines of white jute at different stations.

different lines in different locations. Highest Green weight without leaves (73.47 t/ha) was observed from Chandina in C-2234 line. Pervin and Haque [14], Islam [15] reported that the green weight data were statistically similar among the Jute varieties.

Stick weight was highest (16.21 t/ha) in C-2234 line at Rangpur which was statistically different from other lines of different loca-

tions. Fiber weight were different in different lines in different locations (Figure 1) which are not statistically significant. Highest Fiber weight was observed from Rangpur in C-2234 line. These were also found due to its genetic makeup and higher regional adaptability with the climatic condition and soil properties of the experimental field of the present study. Significant varieties performance on fibre

yield were also obtained by Sanjoy, *et al.* [18], Hassan, *et al.* [19], Mollah, *et al.* [20], Hossain, *et al.* [21] and Islam, *et al.* [22].

Conclusion

The result revealed that the tested strains C-2234 (4.37 t/ha), C-2236 (4.12 t/ha) and C-2281 (3.87 t/ha) out yielded both the check varieties BJRI Deshi Pat-5 (3.68 t/ha) and CC-45 (3.57 t/ha) in terms of fiber. This study should be continued for few year for further evaluation their yield and adaptability.

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