


Evaluation of Fibre Yield and Quality of Two Advanced Breeding Lines of White Jute as Influenced by Sowing Dates

Mubasshir Ahmed^{1*}, Umme Hafsa Timmi², Md. Taibur Rahman Tushar³, Md. Wahidul Islam⁴, Md. Mostansir Billah⁵, Md. Shamim-Al-Mamun⁴, Kamiliya Kader⁴, Ronzon Chandra Das⁴, Md. Shakhaowat Hossain⁶

¹Agronomy Division, Bangladesh Jute Research Institute, Dhaka, Bangladesh

²Fibre Quality Improvement Division, Bangladesh Jute Research Institute, Dhaka, Bangladesh

³Textile Engineering Division, Bangladesh Jute Research Institute, Dhaka, Bangladesh

⁴Genetic Resources and Seed Division, Bangladesh Jute Research Institute, Dhaka, Bangladesh

⁵Jute Seed Production and Research Centre, Dinajpur, Bangladesh

⁶Jute Farming System Division, Bangladesh Jute Research Institute, Dhaka, Bangladesh

Email: *hadi.sau@gmail.com

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Abstract

Agriculture faces numerous challenges due to climate change. Both the yield and quality of fibre are affected by appropriate sowing dates. A field experiment was conducted as a factorial experiment for evaluating two advanced breeding lines of white jute under three sowing dates (20th March, 30th March and 10th April) at Jute Agriculture Experimental Station (JAES), Manikganj, Bangladesh. Two advanced breeding lines of white jute (BJC-5002 and C-2262) and CVL-1 (control) were used as planting materials. The results indicated that the interaction effect of the sowing date (30th March) and advanced breeding line (C-2262) improved plant growth including germination percentage, vigour index, plant height, base diameter, fibre yield and stick yield. At the same time, significant differences appeared in fibre quality including fibre strength, brightness, whiteness, and fineness due to the interaction effect of sowing dates (30th March) and advanced breeding line (C-2262). The cutting percentage was higher with the combination of the advanced breeding line BJC-5002 and the sowing date of March 20th. Overall, the results demonstrated that sowing in the latter part of March significantly increased fibre yield and enhanced the quality of white jute fibre.

Keywords

White Jute, Sowing Dates, Fibre Yield, Fibre Quality, Advanced Breeding Line

1. Introduction

White jute (*Corchorus capsularis*) is a vital fibre crop widely grown in tropical and subtropical areas due to its high economic worth and variety of uses in packaging and textiles [1]. The use of jute fibres as composite material reinforcement has recently increased due to growing environmental concerns. Factors such as rising fuel prices, the depletion of fossil fuels, and global warming are major issues driving researchers to focus on green composites [2]. Due to its eco-friendly nature, jute is now considered not just a key textile fibre for packaging, but also for creating a wide range of diversified and high-value products. These include upholstery, furnishing textiles, and even wearable fabrics. Jute is increasingly used as a raw material for producing dyed and printed textiles, offering significant improvements in color vibrancy, dye uniformity, and color fastness in jute fabrics [3]. Different agronomic procedures affect jute fibre yield and quality; one important component is the sowing date. Achieving the best sowing time is essential to increasing the quantity and quality of fibre produced [4]. Advanced breeding lines of white jute present promising potential for increased yield and improved fibre characteristics. In recent years, climatic variability has been causing notable fluctuations in jute production, potentially impacting its long-term yields. Historical weather data from the past century reveals a significant rise in ambient temperature and considerable variations in monsoon rainfall in the lower Indo-Gangetic Plain (IGP) region, where jute is cultivated. An annual average surface air temperature, increase of 1.04°C has been recorded [5]. Seasonal rainfall variation is expected to rise in the coming decades. Temperature and rainfall are the most influential climatic factors for jute plant growth. Jute, primarily cultivated as a rain-fed crop, needs about 500 mm of water for optimal growth and development. Over the past 40 years, rainfall deficits have ranged between 40% - 50% from the 12th week (mid-March) to the 15th week which directly influences the sowing time of jute and allied fibre crops [6]. The fibre yield of Tossa jute can increase by up to 9% - 11% when sown at the appropriate time, as jute is a rain-fed crop highly dependent on environmental factors [7]. Sowing time directly affects the plant population, base diameter, fibre yield and stick yield [8]. The timing of sowing plays a critical role in the cultivation of jute and related fibre crops, significantly impacting crop development and fibre yield, particularly for advanced breeding lines before their release as varieties [9]. The sowing time influences both the internal and external characteristics of jute fibre. To be suitable for different products, jute fibres must possess specific qualities. Analysis of the mechanical, thermal, and physicochemical properties of jute fibres at various sowing intervals reveals that fibres harvested at the 105-day mark show a high level of thermal stability [10]. Sowing jute in late March takes advantage of the approaching pre-monsoon period, which offers optimal environmental conditions for its cultivation. During this time, temperatures are conducive to accelerated plant growth and enhanced fibre development. Furthermore, soil moisture levels are typically sufficient, fostering the production of long, robust fibres ideal for textile and industrial uses

[11]. The physical characteristics of jute fibre encompass its diameter, length, coarseness, hardness, low extensibility, limited flexibility, fibre cohesion, and the capacity to create fine, flexible yarns suitable for a range of products. Enhancing the potential of jute for textile and other uses largely depends on improving fibre quality. This improvement can be accomplished through advanced processing methods (mechanical, chemical, microbial/enzymatic), optimizing agricultural practices (like adjusting sowing dates), utilizing effective retting or treating techniques, and developing new varieties [12]. Jute (*Corchorus capsularis*) planted in the first week of April and treated with a microbial consortium for accelerated retting yielded better quality fibre and higher fibre recovery than conventional retting methods without the microbial treatment. Late sowing enhances fibre fineness, whiteness, brightness, fibre strength and cutting percentage [13]. Several physical properties such as bundle strength, brightness, whiteness, fineness, density, and defects are considered important. Among these, strength and brightness hold greater significance. Additionally, brightness and whiteness, along with color, are particularly important for specific products [14]. However, the quality of jute fibre depends on appropriate sowing dates, which vary based on regional climatic conditions [15].

Understanding the optimal sowing period for these breeding lines is essential for optimizing jute cultivation practices. Information on the physic-mechanical characteristics of these two advanced breeding lines is not available. In the textile industry, high-tenacity and diameter fibres are preferred. This can create yarns with a high strength. So far, no work has been done on the physical properties of these two advanced breeding lines BJC-5002 and C-2262. Almost no work has been done to determine the relationship between sowing date and fibre quality. The present study was, undertaken to study different physic-mechanical properties of BJC-5002 and C-2262 and suitable sowing dates for higher fibre yield and at the same time better quality fibre for reinforcement, diversification, and blending.

2. Materials and Methods

2.1. Experimental Site

A field experiment was conducted for two consecutive growing seasons at the Jute Agriculture Experimental Station, Manikganj, Bangladesh (23°54'08" N latitude and 90°00'39" E longitude), during March-July 2024 and March-July 2025. The average data from both years were analyzed. The study area was in the Agro-Ecological Zone 8 (AEZ-8), Permeable silt loam to silty clay loam soil was seen on the hills and in the basins, which are neutral to slightly acidic in response [16]. The soil pH of the research area was 6.2, and the organic matter content was low, indicating it was slightly acidic in response.

2.2. Weather Pattern of the Experimental Site

In March, weather conditions were relatively dry, with only 1.16 mm of rainfall, a maximum temperature of 30.9°C, and minimum humidity of 47%, indicating lim-

ited soil moisture suitable for land preparation and early sowing.

In April, rainfall slightly increased to 4.46 mm, and temperatures rose moderately (32.1°C max., 22.5°C min.), accompanied by higher humidity levels, which helped early crop establishment.

From May to July, rainfall and humidity increased sharply, marking the transition to the monsoon period. During these months, consistent high humidity (above 90%) and warm temperatures (31°C - 32°C) provided favourable conditions for vigorous jute growth.

Months	Rainfall (mm)	Max. temperature (°C)	Min. temperature (°C)	Max. humidity (%)	Min. humidity (%)
March	1.16	30.90	18.83	90	47
April	4.46	32.10	22.46	91	59
May	10.41	31.90	23.87	93	67
Jun	13.33	31.60	25.72	95	75
July	14.12	31.25	26.00	95	77

Source: <http://www.bmd.gov.bd>.

2.3. Plant Materials

Two advanced breeding lines of white jute (BJC-5002 and C-2262) developed by Bangladesh Jute Research Institute were used as plant material for this experiment and a high-yielding white jute variety CVL-1 developed by the breeding division of Bangladesh Jute Research Institute in 1977, was used as a control.

2.4. Design and Treatments

The experiment was conducted using a 3 × 3 factorial Randomized Complete Block Design (RCBD) with three replications. The two factors studied were jute lines (BJC-5002, C-2262, CVL-1) and sowing dates (20 March, 30 March, 10 April). Within each block, the combinations of line and sowing date were randomly assigned to plots to minimise experimental error and ensure unbiased estimation of treatment effects. The unit plot size was 4.0 m × 2.5 m. Space between plot to plot and around the field was 1m and between replications 1.5m. Seeds were sown on three different dates like 20 March, 30 March and 10 April regarded as treatment. Seeds were sown in lines 30 cm apart. Other cultural and intercultural practices were followed as per BJRI's recommendation. Plants were harvested 120 days after sowing.

2.5. Physiological Parameter of Seed

2.5.1. Germination Percentage

The germination process of white jute (*Corchorus capsularis*) seeds was monitored daily over seven days. On the final day (day 7), the number of successfully germinated seeds was recorded. The germination percentage was then determined using the formula in Equation (1):

$$\text{Germination percentage} = \left(\frac{\text{number of germinated seeds}}{\text{total number of seeds}} \right) \times 100. \quad (1)$$

2.5.2. Seed Vigor Index (SVI)

The lengths of the roots and shoots of individual seedlings were measured in centimetres using a ruler. On the seventh day, the seedling vigor index (SVI) for each seedling was calculated by multiplying its length by the previously determined germination percentage.

2.6. Major Parameters for Yield and Yield Contributing Attributes Studied

2.6.1. Plant Height

The most important parameter for fibre yield. The plant was cut just on top of the root from where the stem was touched to the air. A measuring tape was used to measure the height of the stalk. The unit of the plant height was in meters (m). 10 randomly selected plants were measured for plant height and then the average value was taken.

2.6.2. Base Diameter

10 randomly selected plants were used to measure the base diameter. A slide caliper was used to measure the base diameter. The measurement was taken three times from three portions of the base of the plant and then the average result was taken. The unit for base diameter was in millimetre (mm).

2.6.3. Fibre Yield

All the plants of each plot were cut and left on the soil for 2 - 3 days for dropping of leaves and after dropping the leaves, 3 - 4 bundles of plants were made of 25 plants to each bundle. Then it was taken to an open source of running water for retting. After 15 - 18 days when retting was done, the bark (Fibre) of the plant was removed from the wooden part and dried in the sun. After drying we weighted it to an electric balance. Then we converted the fibre yield tons per hectare.

2.6.4. Stick Yield

After retting fibre was taken out from the wooden part (Stick) and the stick also dried in the sun. When it dried completely after 5 - 7 days sundry then it was weighted to an electric balance. Stick yield was also converted to tons per hectare.

2.7. Major Parameters Fibre Quality Contributing Attributes Studied

2.7.1. Fibre Strength

Ten random samples of 1 cm fibre were taken and tested for their strength using a Stelometer at the Department of Physics Laboratory of the Bangladesh Jute Research Institute. The strength was expressed in grams per Tex (gmtex^{-1}).

2.7.2. Fibre Brightness and Whiteness

Fibre brightness and whiteness were measured using a Photovolt Meter-577. A blue filter was used to measure brightness, while a green filter was used for whiteness. Twenty measurements were taken from different parts of the sample fibre, and the values were averaged and expressed as a percentage.

2.7.3. Fibre Fineness

Fibre fineness was measured using a CSIRO Sonic Fineness Tester. Ten measurements were taken and averaged, and the result was expressed in micrometres (μm).

2.7.4. Cutting Percentage

The hard portion of the bark that remains attached to the fibre at the base of the plant after retting is referred to as the “cutting.” Ten randomly selected plant fibres were taken, and the length of the cutting portion was measured using a measuring tape. The measurements were then expressed as a percentage.

2.8. Statistical Analysis

The statistical analysis of all the gathered data was performed with the help of a computer statistical package named “Design of Biological Research” in R software. The Least Significant Difference (LSD) and T-test were used to determine the mean differences between the treatments at the 0.05 level [17]. Graphs were created with the help of ggplot in R software.

3. Results

The combined analysis of variance presented in **Table 1** indicates that the interaction between advanced breeding lines and sowing dates had a significant effect on the seed vigor index. In addition to the seed vigor index, plant height was also significantly influenced by the interaction between these advanced lines and sowing dates (**Table 2**). Furthermore, fibre strength, brightness and cutting percentage were significantly affected by the interaction effect of advanced breeding lines and sowing dates (**Table 3**).

3.1. Effect of Advanced Breeding Lines on Fibre Yield and Yield Contributing Characteristics of White Jute

In **Figure 1**, the advanced breeding line C-2262 exhibited the highest values for germination percentage (90%), seed vigor index (1837.56), plant height (3.48 m), base diameter (18.95 mm), fibre yield ($3.32 \text{ t}\cdot\text{ha}^{-1}$), and stick yield ($6.64 \text{ t}\cdot\text{ha}^{-1}$). Regarding germination percentage, the second highest value (81.89%) was observed in BJC-5002, which was statistically similar to CVL-1 (**Figure 1(A)**). The advanced breeding line BJC-5002 recorded lower values for seed vigor index (1127.78), plant height (2.81 m), and stick yield ($5.11 \text{ t}\cdot\text{ha}^{-1}$) compared to the control, CVL-1 (**Figure 1(B)**, **Figure 1(C)**, and **Figure 1(F)**). No significant differences were found between BJC-5002 and CVL-1 in terms of base diameter and fibre yield (**Figure 1(D)** and **Figure 1(E)**).

3.2. Effect of Sowing Dates on Fibre Yield and Yield Contributing Characteristics of White Jute

The highest germination percentage (87.55%) was recorded on 30 March, which was statistically similar to April 10. The second highest germination percentage (84.67%) was observed on April 10, also statistically similar to 20 March (**Figure 2(A)**). March 30 also yielded the highest seed vigor index (1439.44), plant height (3.33 m), base diameter (18.97 mm), fibre yield (3.32 t·ha⁻¹), and stick yield (6.21 t·ha⁻¹) (**Figures 2(B)-(F)**). The lowest values for seed vigour index, plant height, fibre yield, and stick yield were recorded on 20 March. There were no significant differences in base diameter between March 10 and April 10.

3.3. Interaction Effect of Advanced Breeding Lines and Sowing Dates on Fiber Yield and Yield Contributing Characteristics of White Jute

The highest values for germination percentage (96%), seed vigor index (1938.33), plant height (3.60 m), base diameter (21.29 mm), fibre yield (3.50 t·ha⁻¹), and stick yield (7.00 t·ha⁻¹) were observed in the L₂:S₂ treatment combination (**Table 4**). In contrast, the lowest germination percentage (78%) was recorded in the V:S₁ treatment combination which was statistically Comparable to L₁:S₁, L₁:S₂, L₁:S₃, L₂:S₁, V:S₂ and V:S₃. The minimum seed vigor index was noted in the L₁:S₁ treatment combination which was statistically similar to L₁:S₂, L₁:S₃, V:S₁ and V:S₃. The shortest plant height (2.50 m) was recorded in the L₁:S₁ treatment combination which was statistically similar to V:S₁. For base diameter, the lowest value (16.18 mm) was from V:S₁ treatment combination which was statistically identical to L₁:S₁, L₁:S₃, L₂:S₁, L₂:S₃, V:S₂ and V:S₃. The lowest fibre yield (2.71 t·ha⁻¹) was found from V:S₁ treatment combination which was statistically similar to L₁:S₁. Lastly, the lowest stick yield (4.79 t·ha⁻¹) was from the L₁:S₁ treatment combination.

3.4. Effect of Advanced Breeding Lines on the Quality of Fibre of White Jute

The highest fibre strength (48.90 gmtex⁻¹), brightness (40.21%), and whiteness (51.99%) were observed in the C-2262 variety, while the highest fineness (33.94 µm) was found in the BJC-5002, and the highest cutting percentage (6.85%) was recorded in CVL-1 (**Figure 3**). Conversely, the lowest fibre strength (42.72 gmtex⁻¹), brightness (36.85%), and whiteness (47.96%) were observed in BJC-5002. The lowest fineness (32.45 µm) was recorded in CVL-1 and the lowest cutting percentage (4.79%) in C-2262.

3.5. Effect of Sowing Dates on the Quality of Fibre of White Jute

The highest fibre strength (49.76 gmtex⁻¹), brightness (40.30%), whiteness (52.08%), and fineness (33.87%) were recorded on 30 March, while the highest cutting percentage (8.28%) was observed on March 20 (**Figure 4**). In contrast, the

lowest fibre strength (43.09 gmtex^{-1}), brightness (36.62%), and whiteness (47.06%) were recorded on March 20, which was statistically comparable to April 10. The lowest fineness ($30.53 \mu\text{m}$) was also observed on March 20, with the lowest cutting percentage (4.29%) recorded on March 30.

3.6. Interaction Effect of Advanced Breeding Lines and Sowing Dates on the Quality of Fibre of White Jute

The maximum fibre strength (55.68 gmtex^{-1}), brightness (43.08%) and whiteness (55.08%) were found in the $L_2:S_2$ treatment combination, as presented in **Table 5**. The highest fineness ($35.03 \mu\text{m}$) was recorded in the $L_1:S_3$ treatment combination, while the $L_1:S_1$ treatment combination exhibited the highest cutting percentage (9.14%). In contrast, the lowest values for fibre strength (40.67 gmtex^{-1}), brightness (35.13%), and whiteness (45.13%) were found in the $L_1:S_1$ treatment combination. The lowest fibre strength was statistically comparable to $V:S_3$, the lowest brightness was statistically identical to $L:S_3$, $L_2:S_1$, $V:S_1$, and $V:S_3$ and the lowest whiteness was statistically similar to $L:S_3$, $L_2:S_1$, $V:S_1$, $V:S_2$ and $V:S_3$. The highest value for fibre fineness ($35.29 \mu\text{m}$) was observed in $V:S_2$ treatment combination which was statistically similar to $L:S_1$, $L_1:S_2$, $L_1:S_3$ and $V:S_3$, while the lowest fibre fineness ($28.29 \mu\text{m}$) was observed in $L_2:S_1$ treatment combination which was statistically comparable to $L_2:S_3$ and $V:S_1$. The highest cutting percentage (9.14%) occurred in the $L_1:S_1$ treatment combination which was statistically similar to $V:S_1$ while the lowest value (3.17%) was observed in the $L_2:S_2$ treatment combination which was statistically identical to $L_1:S_2$.

Table 1. The combined analysis of variance for the effect of advanced breeding lines and sowing dates on seed germination and seed vigor index.

Source of variation	df	Germination (%)			Seed vigor index		
		Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)
Replication	2	36.70	1.40	0.275	293	0.2866	0.754606
Advanced breeding lines (L)	2	221.37	8.46	0.003**	1438373	1404.5150	<2.2e-16***
Sowing dates (S)	2	107.70	4.12	0.036*	29884	29.1806	4.594e-06***
L:S	4	17.370	0.66	0.626	7983	7.7956	0.001**
Error	16	26.16			1024		

df: Degree of freedom.

Table 2. The combined analysis of variance for the effect of advanced breeding lines and sowing dates on plant height, base diameter, fibre yield and stick yield.

Source of variation	df	Plant height			Base diameter			Fibre yield			Stick yield		
		Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)
Replication	2	0.015	2.33	0.13	2.07	1.99	0.168	0.0038	0.507	0.6113	0.0139	0.5367	0.594
Advanced breeding lines (L)	2	1.02	155.83	3.233e-11***	11.09	10.71	0.0011**	0.3509	46.28	2.224e-07***	5.4266	209.52	3.347e-12***

Continued

Sowing dates (S)	2	0.71	108.37	4.986e-10***	12.18	11.76	0.0007***	0.4138	54.59	7.122e-08***	1.4355	55.42	6.408e-08***
L:S	4	0.08	12.98	6.724e-05***	2.003	1.93	0.153	0.0091	1.205	0.3466	0.0367	1.416	0.2734
Error	16	0.006			1.034			0.0075			0.0259		

df: Degree of freedom.

Table 3. The combined analysis of variance for the effect of advanced breeding lines and sowing dates on fibre strength, fibre brightness, fibre.

Source of variation	df	Fibre strength			Fibre brightness			Fibre whiteness			Fibre fineness			Cutting percentage		
		Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)	Mean Square	F-Value	Pr-(>F)
Replication	2	2.387	1.1417	0.3439	13.416	3.7442	0.04635	24.865	3.587	0.0516	3.6204	0.9153	0.42036	0.105	0.3337	0.72111
Advanced breeding lines (L)	2	87.222	41.717	4.494e-07***	25.944	7.2409	0.0057**	47.181	6.807	0.00725**	25.116	6.3501	0.00933**	10.176	32.3472	2.389e-1***
Sowing dates (S)	2	118.28	56.575	5.549e-08***	30.7393	8.5789	0.00293**	58.093	8.382	0.0032**	25.571	6.4651	0.00875**	38.464	122.2623	2.024e-1***
L:S	4	20.105	9.6161	0.0003***	9.2943	2.5939	0.0760*	16.003	2.309	0.1025	9.0819	2.2961	0.10397	1.420	4.5129	0.01245*
Error	16	2.09			3.5831			6.930			3.9554			0.315		

df: Degree of freedom.

4. Discussion

A promising advanced breeding line shows desirable traits such as disease resistance, yield, or quality than the comparable variety but it is not released commercially for cultivation [18]. In our study, we had two promising breeding lines of white jute that exhibited superior physiological traits compared to the control in most evaluations. Our research found that the breeding lines C-2262 and BJC-5002 exhibited a higher germination percentage than the control, likely due to their superior physiological traits. The advanced breeding line of white jute showed higher germination capacity than the control [15] [18]. The advanced breeding line C-2262 exhibited a higher seed vigor index, attributed to its inherent characteristics, whereas BJC-5002 demonstrated a lower seed vigor index compared to CVL-1. Similarly, the advanced breeding line BJC-5003 showed a higher seed vigor index in sandy clay loam soil [15]. In this study, plant height and base diameter were higher in C-2262 than in BJC-5002 and CVL-1. Plant height was more than 23% higher than BJC-5002 whereas base diameter was only 9% higher than BJC-5002. The advanced breeding line BJC-7370 demonstrated greater adaptability to the climatic conditions and soil of southern Bangladesh, including the salinity-affected areas under study, compared to other varieties [19]. Base diameter is a crucial trait for fibre yield in jute and kenaf varieties, as a larger base diameter typically results in thicker fibres, which in turn ensures higher fibre production [20]. Taller plants and greater base diameter produce higher fibre and stick

yield [21]. The results of this study showed higher fibre and stick yield in advanced line C-2262. White jute produced taller plant which led to better fibre and stick yield [22].

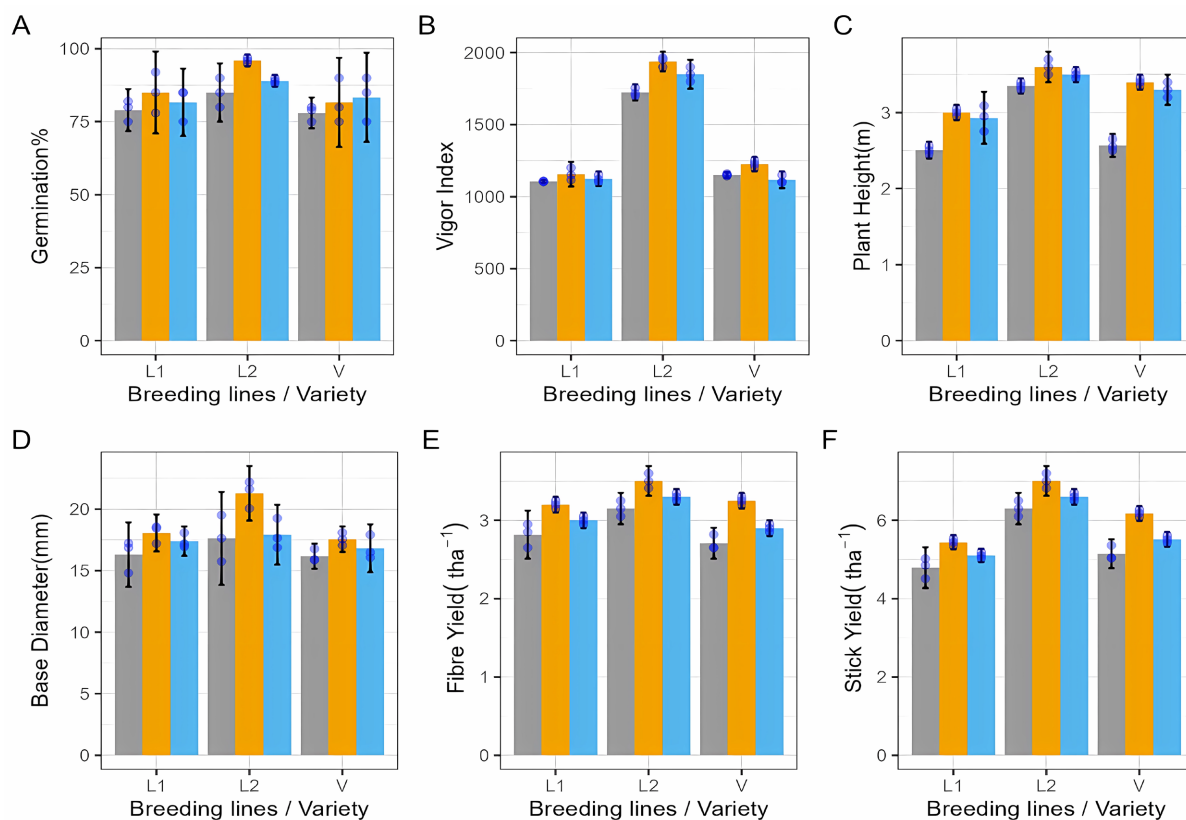
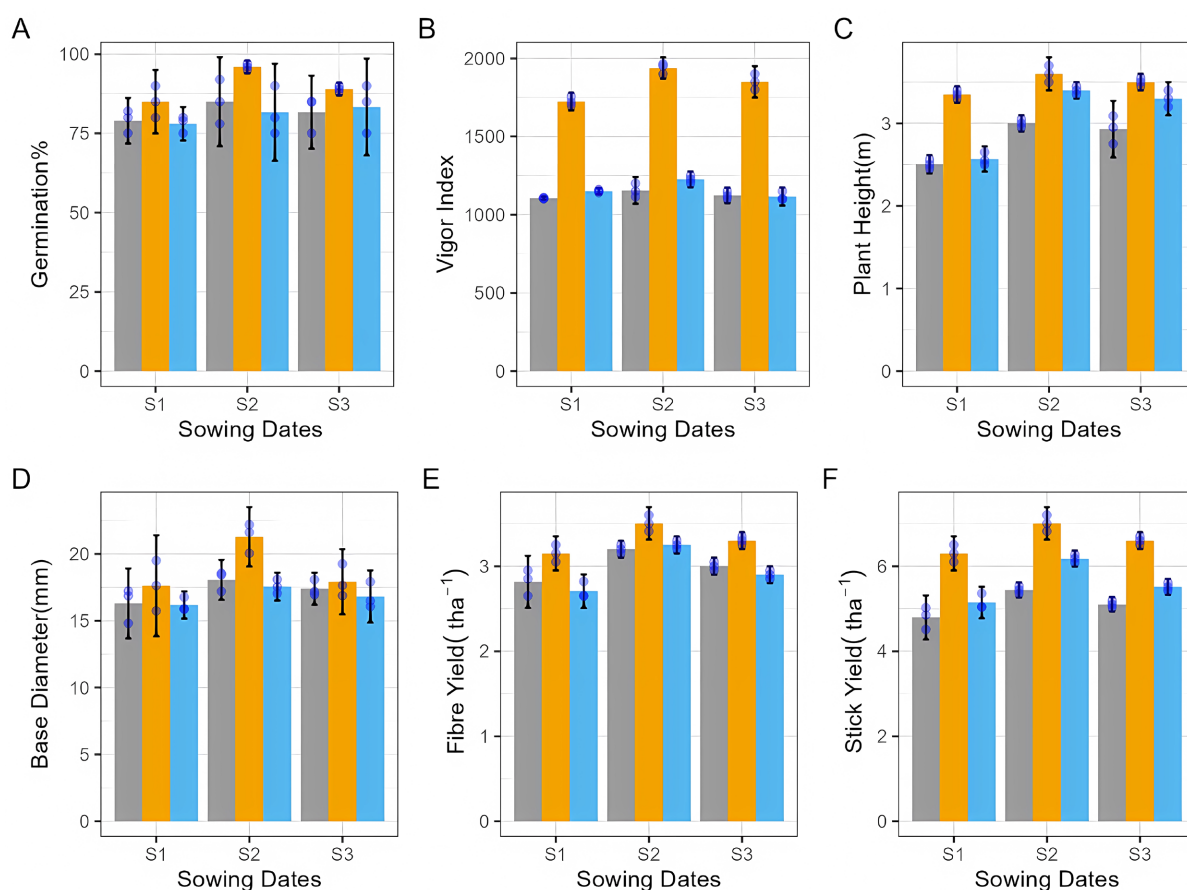


Figure 1. Effect of advanced breeding lines on fibre yield and yield contributing characteristics of white jute. Legends: L₁ = BJC-5002, L₂ = C-2262, C = CVL-1.

Sowing dates play a critical role in determining fibre yield and yield attributes of jute [23]. The last date of March showed better seed germination and seed vigor index. Due to favorable climatic conditions germination and crop establishment were higher when it was sown in the last part of March [24]. Plant height and base diameter were increased when it was sown on 30 March. Plant height and base diameter were faster when they reached the vegetative stage from May to June [25]. Fibre production's most important physiological characteristics are fibre yield and stick yield. In this study, higher fibre yield led to a higher stick yield sown on 30th March compared to 20th March and 10th April. Kenaf fibre yield was greatly increased with taller plants when it was sown in the early part of April [26].

Significant differences were observed in all the yield-contributing traits, including germination rate, seed vigor index, plant height, base diameter, fibre yield, and stick yield, across the various treatment combinations. The best performance for all parameters was recorded when the advanced breeding line C-2262 was planted on March 30th. Jute seed germination and seed vigor index are vital components of successful jute cultivation, particularly in breeding programs. Field conditions

in the latter part of March have been shown to significantly enhance both germination capacity and seed vigor index, which are crucial for the establishment and growth of advanced breeding lines [27]. In a field experiment, the advanced breeding line C-2262 exhibited greater plant height and broader base diameter, resulting in higher fibre and stick yields when sown on March 30th. Similarly, the advanced breeding line BJC-7370 demonstrated increased plant height, along with enhanced fibre and stick yields, when sown during the first week of April [19].



Legends: L₁ = BJC-5002, L₂ = C-2262, C = CVL-1.

Figure 2. Effect of sowing dates on fibre yield and yield contributing characteristics of white jute.

Table 4. Interaction effect of advanced breeding lines and sowing dates on fibre yield and yield contributing characteristics of white jute.

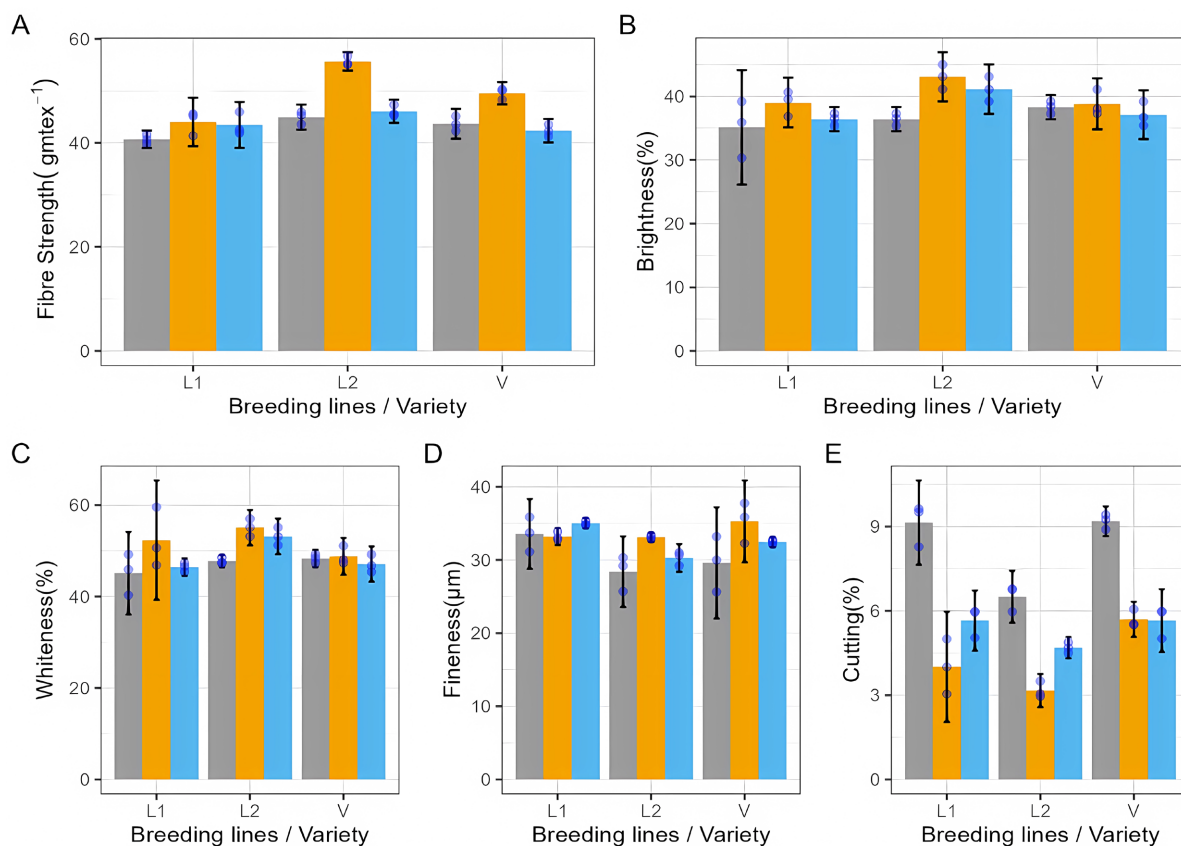
Treatments	Germination (%)	Vigor index	Plant height (m)	Base diameter (mm)	Fiber yield (t·ha ⁻¹)	Stick yield (t·ha ⁻¹)
L ₁ :S ₁	79.00 c	1105.00 e	2.50 e	16.30 bc	2.82 ef	4.79 f
L ₁ :S ₂	85.00 bc	1155.00 e	3.00 d	18.06 b	3.20 b	5.44 d
L ₁ :S ₃	81.67 bc	1123.33 e	2.93 d	17.40 bc	3.00 cd	5.10 e
L ₂ :S ₁	85.00 bc	1724.33 c	3.35 c	17.63 bc	3.15 bc	6.30 c
L ₂ :S ₂	96.00 a	1938.33 a	3.60 a	21.29 a	3.50 a	7.00 a
L ₂ :S ₃	89.00 ab	1850.00 b	3.50 ab	17.93 bc	3.30 b	6.60 b

Continued

V:S ₁	78.00 c	1150.00 e	2.57 e	16.18 c	2.71 f	5.15 e
V: S ₂	81.67 bc	1225.00 d	3.40 bc	17.56 bc	3.25 b	6.18 c
V:S ₃	83.33 bc	1116.67 e	3.30 c	16.83 bc	2.90 de	5.53 d
LSD (0.05%)	8.85	55.39	0.14	1.76	0.15	0.28
% CV	6.06	2.33	2.60	5.75	2.82	2.78

Values with different letters are significantly different at $P < 0.05$. Legends: L₁ = BJC-5002, L₂ = C-2262, V = CVL-1, S₁ = 20th March, S₂ = 30th March, S₃ = 10th April.

Our experiment found that advanced breeding line C-2262 showed greater fibre strength. Environmental factors play a crucial role in enhancing physiological conditions, which can contribute to increased fibre strength [28]. Although fibre brightness and whiteness were higher in the advanced breeding line C-2262, fibre fineness was superior in the advanced breeding line C-5003, while the cutting percentage was lower in C-2262. The advanced breeding line shows better physio-chemical characteristics which led to better brightness, whiteness and cutting percentage [29].

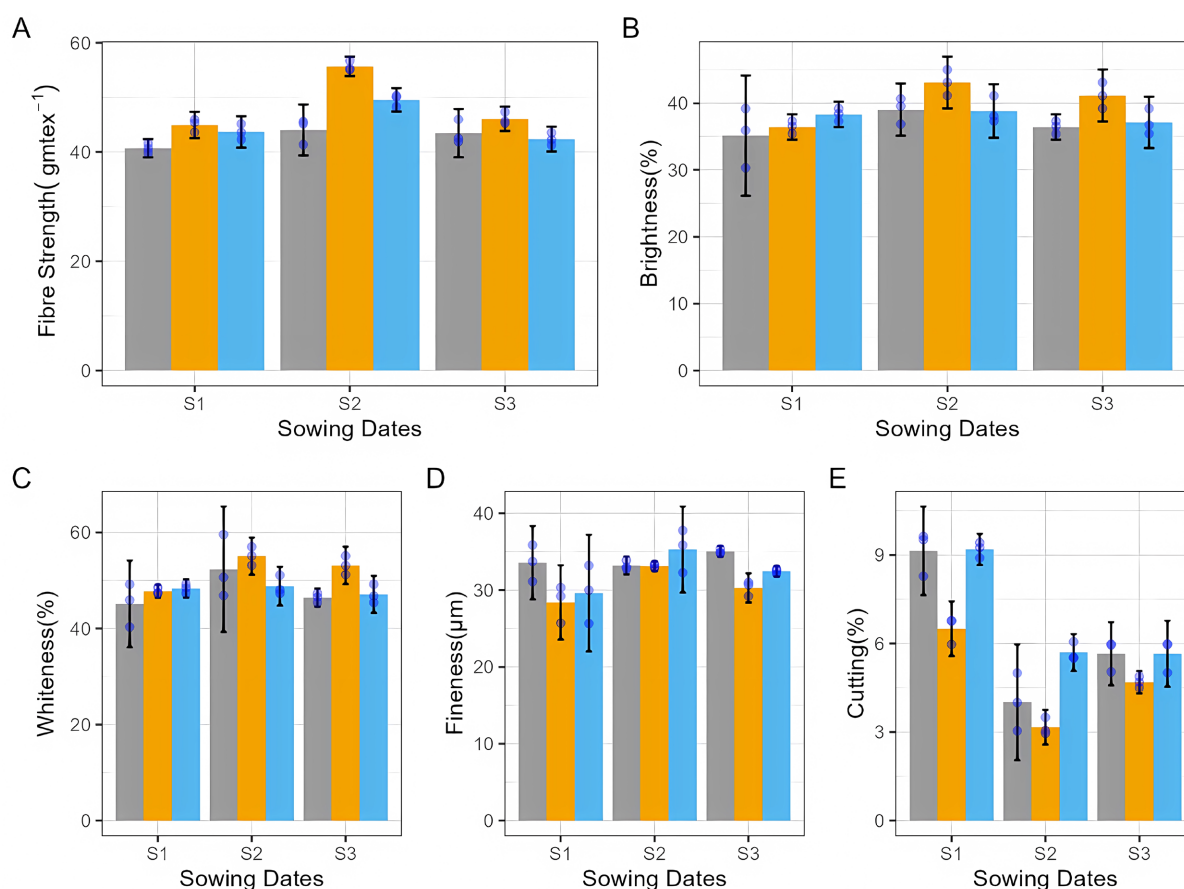


Legends: L₁ = BJC-5002, L₂ = C-2262, V = CVL-1.

Figure 3. Effect of advanced breeding lines on the quality of fibre of white jute.

The sowing date plays a crucial role in determining jute fibre quality. All the

quality parameters examined in this study were significantly influenced by sowing dates. Fibre strength, brightness, whiteness, fineness, and cutting percentage showed marked improvement when sown on March 30th, compared to the other two sowing dates evaluated in the experiment. Jute fibre strength was significantly reduced when sown in early March but improved with sowing in the latter part of March [30]. Delayed sowing improved fibre brightness, whiteness, and fineness, while simultaneously reducing the cutting percentage [31].



Legends: L₁ = BJC-5002, L₂ = C-2262, V = CVL-1.

Figure 4. Effect of sowing dates on the quality of fibre of white jute.

In this experiment, the advanced breeding line exhibited superior fibre strength, brightness, and whiteness when sown on March 30th. However, the variety CVL-1 showed better results on the same sowing date for fibre fineness. Proper sowing time greatly influenced the jute fibre strength in the case of white jute. Sowing during the second fortnight of March to the first fortnight of April enhances both jute fibre strength and fineness [32]. An increase in fibre brightness is also associated with a corresponding increase in fibre whiteness optimal sowing time can significantly influence the brightness and whiteness of jute fibre, more so than late or early sowing [33]. A lower cutting percentage means better fibre quality [34]. The advanced line C-2262 exhibited a lower cutting percentage when sown on

March 30, while early April sowing further reduced fibre cutting in jute [35].

Table 5. Interaction effect of advanced breeding lines and sowing dates on the quality of fibre of white jute.

Treatments	Fibre strength (gmtex ⁻¹)	Brightness (%)	Whiteness (%)	Fineness (µm)	Cutting (%)
L ₁ :S ₁	40.67 f	35.13 d	45.13 d	33.57 ab	9.14 a
L ₁ :S ₂	44.03 cde	39.02 bc	52.35 abc	33.21 ab	4.01 de
L ₁ :S ₃	43.45 de	36.41 cd	46.41 d	35.03 a	5.65 bc
L ₂ :S ₁	44.95 cd	36.41 cd	47.75 d	28.41 d	6.50 b
L ₂ :S ₂	55.68 a	43.08 a	55.08 a	33.11 ab	3.17 e
L ₂ :S ₃	46.07 c	41.14 ab	53.14 ab	30.29 bcd	4.69 cd
V: S ₁	43.67 cde	38.31 bcd	48.31 cd	29.61 cd	9.19 a
V: S ₂	49.57 b	38.82 bc	48.82 bcd	35.29 a	5.70 b
V: S ₃	42.34 ef	37.11 cd	47.11 d	32.45 abc	5.65 bc
LSD (0.05%)	2.50	3.28	4.56	3.44	0.97
% CV	3.17	4.93	5.34	6.15	9.39

Values with different letters are significantly different at $P < 0.05$. Legends: L₁ = BJC-5002, L₂ = C-2262, S₁ = 20th March, S₂ = 30th March, S₃ = 10th April.

5. Conclusion

Sowing dates are a crucial factor influencing jute fibre production, directly affecting both yield and fibre quality. The present study emphasizes that the optimal sowing period, ideally between the end of March and the first week of April, resulted in improved fibre yield and quality. The highest fibre yield (3.50 t·ha⁻¹) and stick yield (7 t·ha⁻¹) were achieved with the C-2262 variety when sown on March 30th. Additionally, the highest fibre strength (55.68 gtex⁻¹) and the lowest cutting percentage (3.17%) were recorded for C-2262 on the same sowing date. However, further trials are necessary to draw definitive conclusions or recommend specific sowing dates.

Author Contribution Statement

Mubasshir Ahmed, Md. Shamim-Al-Mamun, Ronzon Chandra Das: Conceived and designed the experiments; Analyzed and interpreted the data; Performed the experiments; Wrote the paper.

Md. Wahidul Islam, Md. Mostansir Billah: Performed the field experiments. Md. Taibur Rahman Tushar, Md. Shakhaowat Hossain, Umme Hafsa Timmi: Performed the laboratory test. Kamiliya Kader: Analyzed and interpreted the data.

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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