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# Study on morphology and yield attributes of white jute (*Corchorus capsularis* L.)

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***ABSTRACT***

*White jute (Corchorus capsularis) is one of the best sources of higher quality fibre than the fibre of C. olitorius. The experiment was conducted at Jute Agriculture Experimental Station, Jagir, Manikganj to study the morphology and yield contributing attributes of white jute. Three white jute genotypes, namely dwarf red, CVL-1, and BJC-2142 were sown on 30th March, 2022 to evaluate the morphological characters and yield contributing characters. This experiment revealed that the morphological characters like plant height, base diameter, top diameter, leaf number and bark thickness of white jute BJC-2142 were statistically superior to other two white jute varieties. Leaf area of BJC-2142 was lower than other two varieties. It was also found that BJC-2142 required more days for flowering than other two varieties. Yield contributing attributes likely green plant weight with leaf and without leaf, dry weight of fibre and stick of BJC-2142 were higher than white jute CVL-1 and dwarf red.*

***Key Words:*** *White Jute, Morphology and Yield attributes.*

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## I. Introduction

Jute, which belongs to the family Malvaceae, is the world's second-largest natural fiber crop, just after cotton (Islam et al., 2013). Once upon a time, it was known as golden fiber due to its silky shiny nature and high market value. Jute fiber is facing a global challenge due to the availability and low cost of polythene products. Nowadays, people are aware of the destructive, hazardous nature of polythene products. For that, the world is thinking again about the benefits and diversified uses of natural fibers like jute, kenaf, cotton, flax, and so on. Bangladesh's and Indian Subcontinental's soil and climate are



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suitable for jute and kenaf production. Jute contains more than 100 species. Two species are suitable for commercial cultivation in this region (Islam et al., 2017). White jute agriculture once covered approximately 90% of the land area, but it only accounts for 9% of total jute cultivation areas (Saha, 2011).

The world production is concentrated in India and Bangladesh, where the crop grows well in the Ganges and Brahmaputra floodplains and delta regions. Jute (*Corchorus spp*.) is grown in our country as a fiber crop in Kharif-1 season and plays a vital role in our national economy. Jute contributes about 4% GDP to the national economy and earns about 5% of the foreign exchange in Bangladesh (Islam and Ali, 2017). Jute fibers are composed primarily of the plant materials cellulose (major component of plant fiber) and lignin (major component of wood fiber). It is a versatile and eco-friendly biodegradable natural fiber widely grown in the summer season in Asia (Miah et al., 2020). A hectare of jute plants consumes about 15 tons of carbon dioxide and releases 11 tons of oxygen (FAO, 2023). White jute is an annual herbaceous plant with a distinctive morphology. The plant typically reaches 2 to 4 meters, characterized by a straight cylindrical stem.

Jute is well known for its bast fiber. Jute yield is considered for its fiber production. Fiber yield and quality depend on many morphological attributes i. e., plant height, base diameter, mid diameter, top diameter, node number, bark thickness etc. Dark jute (*Corchorus olitorius* L.) is more cylindrical than white jute (*Corchorus capsularis* L.) and for that, at the time of retting, white jute retted different portions at different times. It reduces the yield and quality of white jute fiber. For this reason, morphological parameters are crucial in jute cultivation. Considering the above facts, this experiment was designed to find out morphological attributes of white jute genotypes.

## II. Materials and Methods

The experiment was conducted at Jute Agriculture Experimental Station (JAES), Bangladesh Jute Research Institute, Jagir, Manikganj from 30 March to 30 July, 2022. The experimental field was located at 1262 m above sea level, latitude 23° 54' 8" N and longitude 90° 0' 39" E. The soils are well drained. The center experiences an annual average rainfall is 2376 mm and an average daily temperature range is 21–28$^0$C. The research was done on land belonging to the AEZ-8 containing slightly acidic soil (pH 6.5) following the Randomized Complete Block Design (RCBD) with three replications. Three jute genotypes viz. Dwarf red ($V_1$), CVL-1($V_2$) and BJC-2142 ($V_3$) were used as experimental materials. Dwarf red was collected from Gene Bank of Bangladesh Jute Research Institute, Dhaka and CVL-1 and BJC-2142 from Jute Agricultural Experimental Station, Bangladesh Jute Research Institute, Jagir, Manikganj. All genotypes are from *Corchorus capsularis* species. Land was prepared by ploughing and cross ploughing with laddering and was fertilized using 145kg of urea, 26 kg of triple super phosphate, 32 kg of muriate of potash, 42 kg gypsum and 11kg zinc sulphate per hectare. Half of urea and other fertilizers were used during the final land preparation. The unit plot size was 3m x 4m and seeds were sown in line. The crops were sown on 30 March, 2022. All intercultural operations were done as and when necessary. Crops were harvested 60 days after sowing. Just after harvesting plant height (cm), base diameter (mm), top diameter (mm), bark thickness (mm), leaf number and leaf area (cm$^2$), green weight with leaf (kg), green weight without leaf (kg). Dry fiber weight (kg) dry stick weight was calculated after jute retting, washing and drying. Flowering data was collected at the time of average flowering of the plot. Data were subjected to ANOVA using MSTAT-C (Gomez and Gomez, 1984). Treatment means were separated with LSD (Least significant difference).

## III. Results and Discussion

### Plant height

White Jute varieties showed significant variation with respect to plant height (Table 01). Plant height of a crop is determined by plant vigour, cultural methods, growing environment, and varietal traits. Because all the variations in the current experiment were cultivated in the same environment and cultural methods, the variation in plant height among the types may be attributed to varietal performance differences (Awal et al., 2007). All the varieties showed a gradual increase in plant height till 110 DAP. Plant height ranged between 182.20 cm to 206.60 cm. It was observed that the highest



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plant height was recorded in V3 (BJC-2142) and the lowest plant height was recorded in V1 (Dwarf red). The plant height due to different environmental conditions ranked in BJC-2142>CVL-1>Dwarf red. The significant variation in plant height among the white jute varieties is consistent with findings from previous studies that attribute such differences to varietal genetic makeup. Studies by Pervin and Haque et al. (2012) also noted that plant height in jute can range significantly among different varieties, even under uniform growing conditions, suggesting that genetic factors primarily drive these variations.

**Base diameter**

In this study, statistical analysis data revealed no significant difference caused by the effect of distinct morphological features on base diameter (Table 01). Base diameter is also vital for fibre output in jute variants; a bigger base diameter generates a thicker fibre, ensuring increased fibre production. Morphological criteria such as base diameter revealed that all types performed optimally at the harvest stage. Among the white jute types, BJC-2142 had the largest base diameter (16.570 cm), followed by CVL-1 and Dwarf red variants. The non-significant variation in base diameter aligns with findings by Islam et al. (2004), who reported that base diameter often shows minimal variation when environmental and cultural practices are uniform.

**Table 01. Effect of different morphological characters of white jute varieties**

| Variety | Plant height (cm) | Base diameter (mm) | Top diameter (mm) | Leaf number | Bark thickness (mm) | Leaf area ($cm^2$) |
|---|---|---|---|---|---|---|
| $V_1$ | 182.20 c | 12.490 a | 4.3000 b | 25.800 c | 1.2500 c | 58.557 b |
| $V_2$ | 188.50 b | 14.970 a | 4.8800 a | 32.200 b | 1.5700 b | 60.093 a |
| $V_3$ | 206.60 a | 16.570 a | 5.1300 a | 36.600 a | 1.8900 a | 57.020 c |
| CV | 0.29 | 13.86 | 4.35 | 2.06 | 2.78 | 0.82 |
| LSD | 1.2622 | 4.6107 | 0.4703 | 1.475 | 0.0988 | 1.0901 |
| SE | 0.4546 | 1.6607 | 0.1694 | 0.5312 | 0.0356 | 0.3926 |
| Level of Sig. | ** | NS | * | ** | ** | ** |

Note: Variety 1= Dwarf red, Variety 2= CVL-1, Variety 3= BJC-2142

**Top diameter**

White Jute varieties showed significant variation concerning top diameter (Table 01). This study observed that the highest top diameter was recorded in BJC-2142 and the lowest top diameter was recorded in Dwarf red varieties due to different environmental conditions. Due to different environmental conditions, the top diameter ranked in the order of BJC-2142>CVL-1>Dwarf red. Our study's significant variation in top diameter is corroborated by similar research indicating that top diameter can significantly affect fiber yield. Singh et al. (2018) found that varieties with greater top diameters generally produced better-quality fibers, supporting our observation that BJC-2142 had the highest top diameter.

**Leaf number**

The white jute varieties significantly varied concerning leaf number (Table 01). This study observed that the highest number of leaf was recorded in BJC-2142 and the lowest number of leaf was recorded in Dwarf red varieties due to different morphological characteristics of white jute varieties. The leaf number due to different environmental conditions ranked in the order of BJC-2142>CVL-1>Dwarf red. The significant differences in leaf number among the varieties align with findings from Chowdhury and Hossain (2016), who noted that leaf number could vary greatly due to genetic differences. Their research also highlighted that a higher leaf number could enhance photosynthetic capacity, contributing to overall plant vigour, which supports our observation of BJC-2142 having the highest leaf number.

**Bark thickness**

Bark refers to all tissues outside the vascular cambium, including secondary phloem. Bark refers to various tissue types, including periderm and secondary phloem. It is a highly complicated structure composed of cells derived from lateral meristems. Bark thickness is one of the most critical parameters in fibre production. The study observed that white jute varieties significantly varied with respect to bark thickness (Table 01). It was observed that the highest bark thickness (1.89 mm) was



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observed in BJC-2142 and the lowest (1.25 mm) was recorded in Dwarf red. The variation in bark thickness observed in our study is supported by findings from Das et al. (2014), who reported that bark thickness is a crucial factor for fiber yield and can significantly differ among varieties. Their research, like ours, found that the variety with the thickest bark (BJC-2142) produced the best fiber quality.

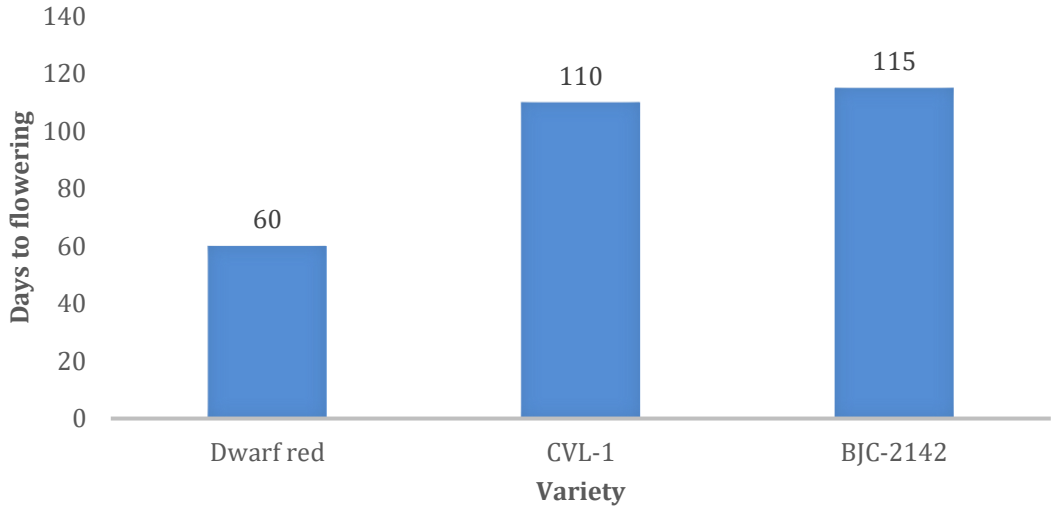


**Figure 01. Days to flowering of three selected varieties**

**Leaf area**

Leaf surface area is an important factor affecting plants' growth and survival. It relates to the amount of light a plant can capture and the amount of water and nutrients it can absorb. From the study, it was observed that leaf area also significantly varied. It was estimated that the highest leaf area was recorded in CVL-1 and the lowest in BJC-2142. Due to different environmental conditions, the leaf area was ranked in the order CVL-1 > Dwarf red>BJC-2142.

**Days to flowering**

Flowering time can be influenced by various environmental factors such as photoperiod, temperature, water availability, and soil nutrients (Cho et al., 2016). It was observed that white jute plants significantly varied concerning flowering time. It was also observed that flowering time was lengthy (115 days) in BJC-2142 and shortest (60 days) was recorded in Dwarf red due to different morphological characteristics (Figure. 01). The variation in flowering time observed in our study is consistent with research by Cho et al. (2016), who found that environmental factors such as photoperiod and temperature could influence flowering time significantly. Our findings that BJC-2142 has a longer flowering period align with their observations of genetic differences impacting flowering times.

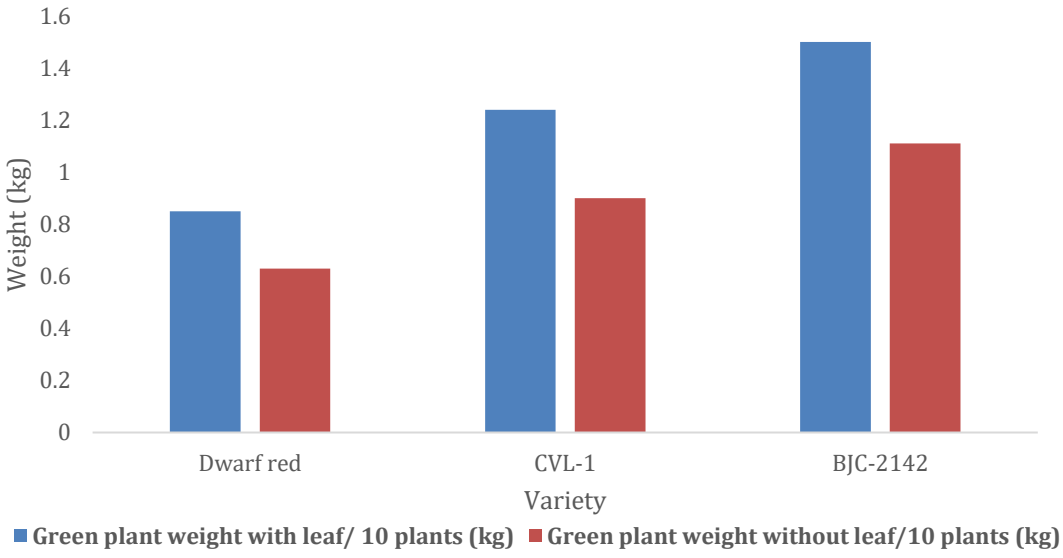


**Figure 02. Green plant weight of three selected varieties**



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**Green plant weight with leaf**

In this case, 10 plants were randomly selected from the field for green plant weight with leaf and it showed significant results (Figure 02). From the study, it was observed that the highest green plant weight (1.5kg) with leaf was found in BJC-2142 and the lowest (0.85 kg) was found in Dwarf red variety. The significant differences in green plant weight with leaf among the varieties support findings from Singh and Choudhury (2018), who observed that higher green plant weight is often associated with varieties with greater overall plant vigour and biomass accumulation, as seen with BJC-2142.

**Green plant weight without leaf**

10 plants were randomly selected from the research field for green plant weight without leaf and it was shown significant results (Figure 02). The study observed that the highest green plant weight without leaf (1.11kg) was found in BJC-2142 and the lowest (0.63 kg) was found in Dwarf red variety due to different morphological characters. The significant variation in green plant weight without leaf is in line with findings from Kumar et al. (2017), who reported that this metric could vary widely among different jute varieties, reflecting differences in stem biomass and structural characteristics.

**Dry fiber weight**

Dry fiber weight significantly varied and the maximum dry fiber weight per plant (5.57gm.) was recorded in BJC-2142 and the minimum dry fiber weight per plant (3.23gm) was recorded in Dwarf red variety due to various morphological characteristics (Figure 03). The significant differences in dry fiber weight among the varieties confirm the findings of Das et al. (2014), who emphasized that dry fiber weight is a critical measure of jute quality and yield potential. BJC-2142's superior performance in this area highlights its potential as a high-yield variety.

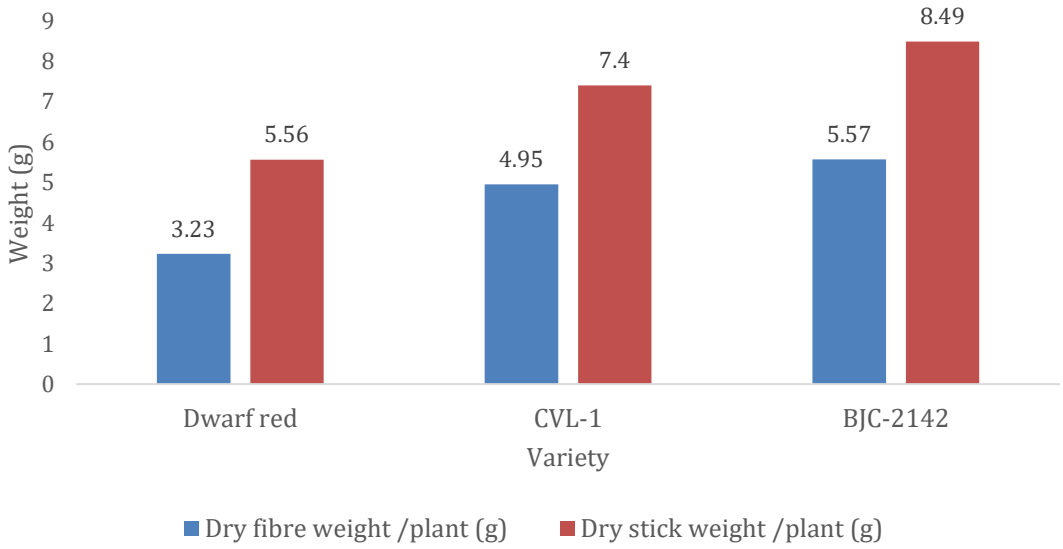


**Figure 03. Dry weight of fibre and stick of three selected varieties**

**Dry stick weight**

It was observed that dry stick weight significantly varied (Figure 03). Results showed maximum dry stick weight (8.49gm) per plant was recorded in BJC-2142 and the minimum (5.56 gm) per plant was recorded in Dwarf red variety due to different morphological characteristics. The significant variation in dry stick weight supports findings from Ahmed et al. (2017), who noted that dry stick weight could indicate overall plant robustness and biomass production.

## IV. Conclusion

In summary, the BJC-2142 variety exhibited superior performance in most morphological characters, including plant height, base diameter, top diameter, leaf number, bark thickness, green plant weight, dry fiber weight, and dry stick weight. These characteristics make BJC-2142 a promising variety for higher fiber yield. The CVL-1 variety also showed good performance in leaf area and other significant traits, making it a viable option. Dwarf red, although the shortest in plant height and lowest in several other metrics, may have niche applications based on specific agricultural needs.



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