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AN INTERACTING STUDY BETWEEN PLANTING TIME AND DISEASE INCIDENCES IN DIFFERENT VARIETIES OF TOSSA JUTE

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ABSTRACT

Diseases are a major constraint for Tossa jute (*Corchorus olitorius*) production, and management strategies require a clear understanding of epidemiological factors. An experiment was conducted at the Genome Research Centre, Bangladesh Jute Research Institute, Dhaka, from February to June 2025, to evaluate the effects of sowing date and variety on disease severity and plant survival. The study was laid out in a two-factor Randomized Complete Block Design, assessing four sowing dates (20-February, 05-March, 20-March, 05-April) and four varieties (BJRI Tossa pat 8, O-795, BJRI Tossa pat 9, JRO-524). Data were collected on the severity of die back, stem rot, wilt, and seedling blight, along with total plant population. The results indicated that sowing date, variety, and their interaction significantly influenced disease incidence. Early sowing (20-February) led to the highest severity of wilt (5.27), while late sowing (05-April) corresponded with the highest incidence of seedling blight (14.96). Among varieties, O-795 exhibited superior plant stands and resistance to die back but was most susceptible to wilt. The interaction effect proved most critical; the wilt susceptibility of O-795 was drastically reduced when sowing was delayed to late March. The combination of sowing O-795 on 20-March emerged as the optimal strategy, yielding a high plant count (146.00), the absolute lowest incidence of die back (1.00), and low severity of other diseases.

Key words: Jute, *Corchorus olitorius*, die back, wilt.

Introduction

The timing of planting plays a pivotal role in the epidemiology of jute diseases. Sowing dates determine the prevailing environmental conditions-such as temperature, humidity, and rainfall-that the crop will experience during its various growth stages. These climatic factors, in turn, heavily influence the lifecycle and virulence of pathogens. For instance, early sowing in March may expose young, vulnerable seedlings to conditions that are highly conducive for the development and spread of fungal diseases like stem rot and anthracnose. Conversely, later sowing dates might help the crop escape peak infection periods for certain diseases but could expose it to other biotic or abiotic stresses. Therefore, optimizing the sowing window is a crucial management strategy to mitigate disease pressure. Tossa jute (*Corchorus olitorius*), a prominent cultivated species, is susceptible to a range of pathogenic attacks, leading to substantial economic losses. The severity of these diseases is not uniform; it is intricately linked to several agronomic and genetic factors. The genetic makeup of the tossa jute variety is a key determinant of its susceptibility to diseases. Significant variations in resistance levels have been observed among different cultivars. Some varieties possess inherent genetic traits that make them more resilient to specific pathogens, such as root-knot nematodes or the fungi responsible for black band disease. The development and cultivation of these disease-resistant varieties are cornerstones of an integrated disease management approach. By selecting a variety that is well-adapted to the local disease spectrum and environmental conditions, farmers can substantially reduce the incidence and severity of infections, thereby safeguard their crop and ensure a more stable and profitable harvest. Understanding the interplay between sowing dates and varietal resistance is thus fundamental to developing effective and sustainable strategies for managing diseases in tossa jute. The date of sowing directly influences the environmental conditions-such as temperature, rainfall, and humidity-that prevail during the crop's lifecycle, thereby affecting both the host's susceptibility

and the pathogen's ability to infect and spread. Simultaneously, the inherent genetic makeup of different jute varieties determines their level of resistance or tolerance to specific diseases. The aim is to determine if a specific combination of sowing date and variety can provide superior disease control than either practice could alone, ultimately identifying an integrated strategy to minimize disease severity and maximize plant survival in tossa jute cultivation.

Materials and Methods

The field experiment was conducted at the Genome Research Centre (GRC) of the Bangladesh Jute Research Institute (BJRI) in Dhaka from February to June, 2025. The study was structured as a two-factor Randomized Complete Block Design (RCBD) with three replications to evaluate the effects of four sowing dates (20-February, 05-March, 20-March, and 05-April) and four tossa jute varieties (BJRI released varieties i.e., BJRI Tossa pat 9, BJRI Tossa pat 8, O-795, and Indian popular tossa jute variety i.e., JRO-524). The experimental field was prepared by ploughing and cross-ploughing, followed by harrowing to achieve a fine tilth. Fertilizers were applied at the recommended dose for tossa jute in the region. Seeds were sown in lines with a spacing of 30 cm between rows. After germination, seedlings were thinned to maintain a plant-to-plant distance of approximately 7-10 cm. Standard intercultural operations, including weeding and irrigation, were performed as needed throughout the growing season to ensure optimal crop growth. No fungicides were applied, to allow for the natural development of diseases. Data were collected on total plant population and the severity of die back, stem rot, wilt, and seedling blight. Diseases severity was calculated by manually counting of seedling blight, die back, stem rot and wilt infected plants per unit area. The collected data were compiled and statistically analyzed using the MSTAT-C software package. An Analysis of Variance (ANOVA) was performed to determine the significance of the effects of sowing date, variety, and their interaction on the recorded parameters. The differences between treatment means were compared using the Least Significant Difference (LSD) test at a 5% level of probability ($p \leq 0.05$) (Gomez and Gomez, 1984).

Results and Discussion

This study investigated the influence of sowing date, variety, and their interaction on plant population and the severity of several key diseases in tossa jute. The results clearly indicate that both factors significantly impact disease incidence, but the most crucial insights are found in their synergistic interaction, which is essential for developing effective crop management strategies.

Effect of sowing date: As presented in Table 1, the date of sowing had a pronounced effect on disease epidemiology. Early sowing on 20-February led to the highest severity of wilt (5.2667) and high levels of die back (18.250). This suggests that the cooler, perhaps more humid conditions of the early season are highly conducive to these particular pathogens. Conversely, delaying sowing until 05-April resulted in the highest overall plant population (150.75) but also corresponded with the highest incidence of seedling blight (14.958). The 20-March sowing date appeared to offer a strategic advantage, showing the lowest severity for stem rot and wilt. This indicates a trade-off, where no single sowing date can control all diseases, and the optimal window depends on which pathogen poses the greatest local threat.

Effect of Variety: The genetic differences among the four jute varieties were a major determinant of disease susceptibility, as shown in Table 2. The O-795 variety demonstrated superior vigor with the highest total plant count (123.25) and showed outstanding resistance to die back (6.083). However, this genetic strength was offset by a significant weakness: O-795 was the most susceptible variety to wilt (4.2250). In contrast, BJRI Tossa pat 8 was extremely vulnerable to die back (21.000), making it a poor choice where that disease is endemic. BJRI Tossa pat 9 and JRO-524 were most susceptible to seedling blight. These findings highlight that varietal selection involves a critical assessment of inherent strengths and weaknesses, as no single variety possessed universal resistance.

Interaction effect of sowing date and variety: While the individual effects are informative, the interaction between sowing date and variety, detailed in Table 3, provides the most actionable insights for disease management. The data reveals that an optimal combination can amplify a variety's strengths while mitigating its weaknesses. The most compelling example is the O-795 variety. While it was highly susceptible to wilt in general (Table 2), Table 3 shows this susceptibility was most severe when sown early (7.3333 in combination 1x2). However, by delaying the sowing to 20-March (combination 3x2) or 05-April (combination 4x2), the wilt severity in O-795 was drastically reduced to among the lowest levels observed (2.7667 and 2.6333, respectively).

Table 1. Diseases severity of tossa jute at different sowing dates

Sowing date	Total plants	Die back	Stem rot	Wilt	Seedling blight
20-February	96.00c	18.250a	2.2917a	5.2667a	12.250b
05-March	67.75 d	6.500 b	2.0917a	4.5583b	12.500b
20-March	110.00b	17.750a	1.5250b	2.7083c	11.550b
05-April	150.75a	6.083 b	2.0083ab	2.7250c	14.958a
CV (%)	2.56	12.146	31.49	3.8146	12.42
LSD (0.05)	2.2681	1.5002	0.5197	0.4245	1.3273

Table 2. Diseases severity of tossa jute at different varieties

Variety	Total plants	Die back	Stem rot	Wilt	Seedling blight
BJRI Tossa pat 8	112.50b	21.00a	2.03ab	3.81ab	12.08b
Robi-2	123.25a	6.08d	1.60b	4.23a	11.76b
BJRI Tossa pat 9	86.00d	9.00c	1.87 b	3.46b	13.58a
JRO-524	102.75c	12.50b	2.41a	3.77b	13.84a
CV (%)	2.56	12.146	31.49	3.8146	12.42
LSD (0.05)	2.2681	1.5002	0.5197	0.4245	1.3273

Table 3. Sowing date X Variety interaction effect on diseases severity of tossa jute

Sowing date X Variety	Total plants	Die back	Stem rot	Wilt	Seedling blight
1x1	138d	26.00b	4.00a	5.00bc	12.33def
1x2	127e	20.00c	1.50cdef	7.33a	10.70ef
1x3	60k	14.00de	1.33def	3.33efg	16.00ab
1x4	59k	13.00def	2.33bcd	5.40b	9.97f
2x1	79i	16.00d	1.23ef	4.03de	10.00f
2x2	66j	2.00g	1.67cdef	4.17cde	12.00def
2x3	40l	4.00g	2.47bc	5.20b	13.00cde
2x4	86h	4.00g	3.00ab	4.83bcd	15.00abc
3x1	105f	31.00a	1.40def	3.60ef	10.00f
3x2	146c	1.00g	1.10f	2.77fg	10.33f
3x3	90h	16.00d	1.43cdef	2.67g	12.30def
3x4	99g	23.00bc	2.17bcde	1.80h	13.57bcd
4x1	128e	11.00ef	1.50cdef	2.60gh	16.00ab
4x2	154b	1.33g	2.17bcde	2.63gh	14.00bcd
4x3	154b	2.00g	2.23bcde	2.63gh	13.00cde
4x4	167.00 a	10.00f	2.13bcdef	3.03fg	16.83a
CV (%)	2.56	12.146	31.49	3.8146	12.42
LSD (0.05)	4.5361	3.0004	1.0394	0.8490	2.6546

Furthermore, the combination of sowing O-795 on 20-March (3x2) proved to be exceptionally effective, resulting in a high plant count (146.00), the absolute lowest incidence of die back (1.000), and very low levels of stem rot and wilt.

Conversely, the interaction can also lead to disastrous outcomes. The BJRI Tossa pat 8 variety's extreme susceptibility to die back was most pronounced when sown on 20-March (3x1), where it reached the study's peak severity of 31.000. Similarly, the lowest plant survival across the entire experiment was observed when BJRI Tossa pat 9 was sown on 05-March (2x3), with only 40 plants. The trend of late sowing increasing seedling blight was also confirmed, with the combination of sowing JRO-524 on 05-April (4x4) yielding the highest plant count (167.00) but also the highest seedling blight severity (16.833). Similar results were reported by Akter *et al*., 2009, Islam & Meah, 2012, Nasim *et al*., 2017 and Israt *et al*., 2024.

Conclusion

To control disease in Tossa jute, it's crucial to combine the right variety with the right sowing time. This study found that planting the O-795 variety in late March is the most effective strategy for maximizing plant survival and minimizing disease.

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