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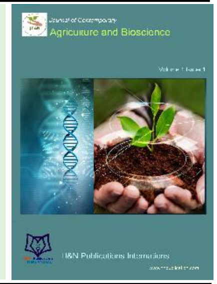

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Influence of Sowing Date on Yellow Vein Mosaic Virus (YVMV) Infestation in Kenaf (Hibiscus cannabinus L.) Varieties

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A b s t r a c t

Yellow vein mosaic virus (YVMV), transmitted by whiteflies (*Bemisia tabaci*), is a major limiting factor in kenaf (*Hibiscus cannabinus* L.) production, causing significant fiber yield losses. The experiment was carried out at the Jute Research Substation, Monirampur, Jashore, to evaluate the effect of different sowing dates on YVMV incidence and fiber yield of two kenaf varieties (A= HC-95 and B= BJRI Kenaf-4). Three sowing dates (1st April, 15th April and 1st May) were tested in a factorial randomized complete block design with three replications. YVMV incidence, area under disease progress curve (AUDPC), and fiber yield were recorded. Early sowing (1st April) recorded the highest YVMV incidence (28.0% in Variety A and 25.0% in Variety B) and the lowest fiber yield (2.2–2.3 t/ha), whereas mid-April sowing (15th April) minimized disease incidence (15–18%) and maximized fiber yield (2.5–2.6 t/ha). Variety B showed slightly lower disease incidence and higher yield than Variety A. A negative correlation (r ≈ -0.68) was observed between YVMV incidence and fiber yield. The study indicates that mid-April sowing combined with tolerant varieties can effectively reduce YVMV impact and improve kenaf fiber productivity.

Keywords: Kenaf, Yellow vein mosaic virus, *Bemisia tabaci*, sowing date and fiber yield.

Introduction

Kenaf (*Hibiscus cannabinus* L.) is an annual bast fiber crop belonging to the family Malvaceae. It is primarily cultivated for its long and strong fibers, which are used in rope, textiles, pulp, paper, and as an environmentally friendly alternative to synthetic fibers in composites (Vayabari, 2023). The crop has also gained importance in recent decades for its role in carbon sequestration, soil fertility improvement, and as a renewable raw material for bioplastics and construction materials. Owing to its adaptability to tropical and subtropical climates, short growth cycle (3–5 months), and high biomass yield, kenaf has been identified as a potential solution for sustainable fiber production in Asia, Africa, and Latin America (Webber & Bledsoe, 2002). Despite its potential, kenaf cultivation faces major challenges from insect pests and viral diseases, with yellow vein mosaic virus (YVMV) being the most devastating. YVMV, transmitted by whiteflies (*Bemisia tabaci*), causes vein clearing, leaf yellowing, stunted growth and severe fiber yield reductions. YVMV has been reported in India, Bangladesh, Nigeria, and several other fiber-growing regions, causing severe yield losses (Varma & Malathi, 2003).

The severity of YVMV epidemics often depends on environmental conditions, sowing time, and varietal resistance. Adjusting sowing dates has been reported to help crops escape peak vector populations and reduce viral disease incidence. Cultural practices such as adjusting sowing dates have been widely reported to reduce viral disease incidence in crops such as pulses, cotton, and mesta (Singh *et al.,* 2022).

The interaction between sowing date and varietal resistance is particularly important. Although, integrated evaluation of sowing dates across multiple varieties is essential to provide robust recommendations for kenaf growers. Therefore, this study was designed to investigate the effect of sowing dates on YVMV incidence and severity in different kenaf varieties, and to assess the consequent impact on fiber yield.

Materials and Methods

Experimental Site

The field experiment was conducted during the fiber growing season of 2023 at the Jute Research Substation, Monirampur, Jashore, Bangladesh and is characterized by a subtropical climate with hot, humid summers. Soils of the experimental field are silty loam with a neutral pH and moderate organic matter content.

Experimental Design and Treatment

The trial was laid out in a randomized complete block design (RCBD) with three replications. Treatments consisted of three sowing dates were 1st April, 15th April and 1st May, combined with two varieties: A= HC-95 and B= BJRI Kenaf-4. Each plot measured 3 m × 2 m, with rows spaced 30 cm apart and plants thinned to 10 cm within rows to maintain the recommended plant density.

Crop Management

Land preparation, sowing methods, and thinning were carried out following standard agronomic practices for Kenaf as recommended by the Bangladesh Jute Research Institute. Fertilizers were applied at recommended rates and incorporated before sowing. Intercultural operations such as weeding and gap filling were performed uniformly across all treatments to ensure proper crop establishment. No insecticides or acaricides were applied; pest and disease infestation was allowed to develop naturally in order to assess inherent pest pressure.

Data Collection

***Disease Observation*:** Plants were regularly monitored for yellow vein mosaic virus (YVMV) symptoms, transmitted by whiteflies (*Bemisia tabaci*), starting 15 days after germination and continuing at 15-day intervals until harvest. Typical symptoms included vein clearing, yellow mottling, and stunting.

Disease incidence (%) was calculated using the formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Disease incidence data were recorded from a randomly selected sample of 20 plants per plot.

To assess overall epidemic progress, the area under disease progress curve (AUDPC) was computed using the formula (Campbell & Madden, 1990):

$$\text{AUDPC} = \sum_{i=1}^{n-1} \frac{(y_i + y_{i+1})}{2} \times (t_{i+1} - t_i)$$

where y is the disease incidence (%) at the i-*th* observation, and t is the time (days after sowing).

Fiber Yield Measurement: At physiological maturity, plants from each plot were harvested, retted, and fibers extracted following standard retting techniques. Fiber yield per plot was recorded and converted into tons per hectare (t/ha).

Statistical Analysis

Data on disease incidence, AUDPC and fiber yield were subjected to analysis of variance (ANOVA) appropriate for a factorial RCBD design using standard statistical software. Treatment means were compared using Least Significant Difference (LSD) at 5% probability level. Correlation analysis was conducted to determine the relationship between YVMV incidence and fiber yield across sowing dates and varieties using standard statistical software.

Results

Effect of Sowing Dates and Varieties on YVMV Incidence

Yellow vein mosaic virus (YVMV) incidence was significantly influenced by both sowing date and variety (Figure 1). The highest incidence was recorded in 1st April sowings (28.0% in Variety A and 25.0% in Variety B). Disease incidence declined with delayed sowing, with 15th April sowings recording reduced infection levels (15.0% in Variety A and 18.0% in Variety B). The lowest incidence was observed in 1st May sowings, where Variety A showed only 10.0% incidence and Variety B 12.0%. Overall, Variety B exhibited slightly lower disease incidence than Variety A across sowing dates, indicating comparatively higher tolerance.

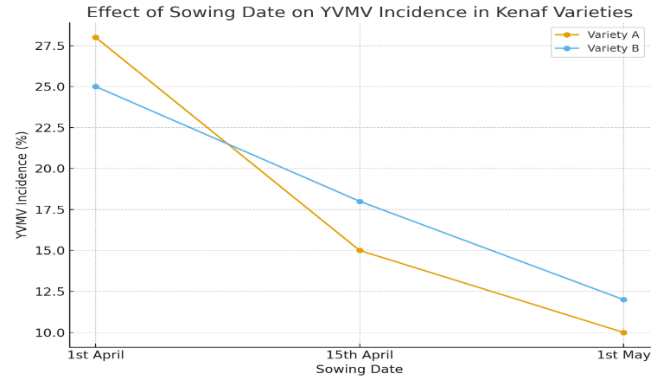

Figure 1: YVMV incidence (%) across sowing dates and varieties.

Effect of Sowing Dates and Varieties on Fiber Yield

Fiber yield was significantly influenced by sowing date ($p < 0.01$) and variety ($p < 0.05$). The maximum yield was recorded in 15th April sowings, where Variety A yielded 2.5 t/ha and Variety B 2.6 t/ha. Delaying sowing to 1st May slightly reduced yields (2.4 and 2.5 t/ha, respectively). The lowest yields occurred in 1st April sowings, coinciding with higher YVMV incidence (2.2 and 2.3 t/ha for Variety A and B, respectively) (Table 1). Variety B consistently outperformed Variety A across sowing dates, but the difference was modest

Table 1. Effect of sowing dates on fiber yield (t/ha) of kenaf varieties

Sowing Date	Variety A	Variety B	Mean
1st April	2.2	2.3	2.25
15th April	2.5	2.6	2.55
1st May	2.4	2.5	2.45
Mean	2.37	2.47	—

N.B.: LSD (5%): Sowing date = 1.22; Variety = 0.87; Interaction = Not Significant.

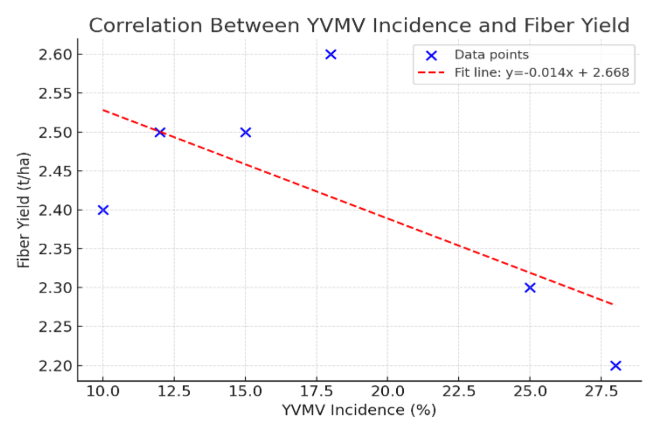

Figure 2. Relationship between YVMV incidence (%) and fiber yield (t/ha) in kenaf varieties across sowing dates.

Relationship between YVMV Incidence and Fiber Yield:

Correlation analysis revealed a moderate negative relationship ($r \approx -0.68$) between YVMV incidence and fiber yield across treatments

(Figure 2). Plots with higher YVMV incidence consistently exhibited lower fiber yield. This suggests that disease severity is a primary determinant of yield loss in kenaf under field conditions.

Overall, these results demonstrate that early sowing (1st April) increased YVMV incidence and reduced fiber yield. Mid-April sowing (15th April) resulted in lowest disease incidence and highest yield, representing the optimum sowing window. Variety B performed slightly better than Variety A, both in terms of lower YVMV incidence and higher fiber yield. YVMV incidence and fiber yield were negatively correlated, highlighting the impact of the disease on kenaf productivity.

Discussions

The present study demonstrated that sowing date significantly influenced the incidence of yellow vein mosaic virus (YVMV) and the fiber yield of kenaf varieties. Early sowing (1st April) resulted in the highest YVMV incidence and lowest fiber yield, while mid-April sowing (15th April) reduced disease incidence and maximized yield. These findings highlight the importance of adjusting sowing schedules as a practical management strategy against YVMV. The higher incidence of YVMV observed in early April sowings can be attributed to the synchronization of young, susceptible crop stages with peak whitefly (*Bemisia tabaci*) populations, the primary vector of begomoviruses. Similar trends have been reported in other crops affected by begomoviruses. In okra, early plantings were more vulnerable to okra yellow vein mosaic virus due to higher whitefly pressure during early growth stages (Sastry & Singh, 1974). Likewise, in cotton, early sowing favored cotton leaf curl virus epidemics under high vector density (Akhtar *et al.*, 2010). Delaying sowing to 15th April reduced YVMV incidence, likely due to reduced vector activity and inoculum pressure during crop establishment. However, further delay to 1st May showed only marginal improvement in disease suppression, suggesting that excessively late sowings may expose crops to other environmental stresses or shortened growing periods that affect yield potential.

The negative correlation ($r \approx -0.68$) between YVMV incidence and fiber yield underscores the direct impact of the disease on kenaf productivity. Higher incidence was associated with reduced photosynthetic activity, impaired carbohydrate translocation, and stunted growth, ultimately lowering fiber biomass. Similar yield losses due to YVMV have been reported in mesta (*H. sabdariffa* var. *altissima*) and kenaf under natural epiphytotics (Meena *et al*., 2019).

The findings suggest that adjusting sowing dates to mid-April is a low-cost and effective strategy to minimize YVMV pressure and enhance fiber yield in kenaf. This approach aligns with integrated pest and disease management principles, where cultural practices are synchronized with crop–vector–pathogen dynamics (Jeger *et al*., 1998). Furthermore, the identification of relatively tolerant varieties, such as Variety B in this study, highlights the potential for breeding and varietal selection as complementary strategies. Combining resistant varieties with optimum sowing dates could significantly reduce YVMV-induced losses without relying on chemical control of vectors.

Conclusion

Sowing date significantly affects YVMV incidence and fiber yield in kenaf. Mid-April sowing minimizes disease incidence and maximizes fiber yield. Variety B exhibits relatively higher tolerance and yield. A negative correlation exists between disease incidence and fiber yield. Integrated management through adjusted sowing dates and varietal selection is recommended for sustainable kenaf production.

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