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# Management of Jute Leaf Mosaic Through Vector Control and Cultural Practices

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**Abstract:** A field study was conducted to study some cultural treatments to find out an effective method, alternative to spraying of insecticide, for controlling vector to manage jute leaf mosaic disease. Five treatments viz. $T_1$ (Malathion 57 E.C), $T_2$ (field sanitation with rouging), $T_3$ (Hanging of polythene strips), $T_4$ (extra dose of nitrogen) and $T_5$ (control) were assigned randomly having four replications. $T_2$ and $T_4$ showed best performance on all the parameters including leaf mosaic of jute. However, the highest yield of raw jute 3091.5 kg $ha^{-1}$ and stick 5709.6 $ha^{-1}$ was obtained from $T_4$ and the second highest 2541.6 kg $ha^{-1}$ of raw jute and 5039.1 kg $ha^{-1}$ of stick were obtained in $T_2$. A combination of collection and use of seeds from healthy plants, one insecticidal spray around 30 days after emergence (DAE), combined with field sanitation with rouging several times in the growth period and application of an extra booster dose of nitrogen at around 45 DAE may be prescribed to farmers of Mymensingh region of Bangladesh.

**Key words:** Jute, leaf mosaic, vector, control, seed production

## Introduction

Jute (*Corchorus capsularis* L. and *C. olitorius* L.) is one of the most important fibre and cash crops of Bangladesh. In Bangladesh, about 1008 thousands acres of land is cultivated and 711 thousands Metric tons of jute fibre are produced annually (BBS, 2000). From agricultural point of view jute is still the golden fibre of Bangladesh. As it is still the third important commodity for export, earning good amount of foreign exchange approximately 15,988 million Taka per year (BBS, 2000). Jute's fibre is famous for making fabrics like hessians, sacking, gunny bags, carpets, mat, rope and many other fibre-products. The young green leaves of jute contain minerals and protein, which are edible and popular as vegetables. Jute sticks are directly used as rural house building materials and fuel.

Jute plants suffer from more than 12 different diseases. Leaf mosaic is one of the major diseases. It is a seed and vector borne disease. Leaf mosaic infected plants have lower percentage of cellulose, lignin, and pectin, thus the fibre strength become weak (Biswas *et al.*, 1989). The jute leaf mosaic pathogen can spread very easily from one place to another through infected seeds and the vector, named White fly (*Bemisia tabaci)* causing epidemic and thus resulting enormous loss in crop production in the subsequent seasons. The disease has been reported to be transmitted through grafts, seed and pollen (Ghosh and Basak, 1951). White fly transmission of the disease has been reported by Verma and Capoor (1966); Ahmed (1978) and Ahmed *et al.* (1980). Severe infestation of White fly may result in defoliation of jute plant and it causes reduction of yield through secretion of wax and honeydew which significantly reduces the photosynthetic area of the plant (Alam, 1998).

However, There is a lot of confusion about the exact identity of the causal agent of jute leaf mosaic or chlorosis of jute. Many workers believe that the causal agent is a virus (Ghosh and Basak, 1951; 1961; Mitra et al, 1984). Side by side, there are claims that the causal agent could be mycoplasma or rickettsea (Rabindran *et al*, 1988; Biswas, 1982; Biswas, *et al*; 1992). As the mosaic disease deteriorates the yield and quality of jute fiber and stick, it is necessary to adopt appropriate measure to manage the disease. It is unquestionable that proper disease control measure can substantially improve the quality of jute and significantly increase yield. There is no specific variety resistant to mosaic disease available in Bangladesh. Chemotherapy is not so effective. More over, chemical control of vectors creates environmental pollution. Cultural practices such as field sanitation with rouging, hanging of polythene strips over the plot and proper dose fertilizer application can be used for reducing the incidence and severity of leaf mosaic disease of jute. Now a day, control of plant disease by employing integrated disease management program (IDM) has been drawn special attention to the researcher all over the world. Integrated Disease Management (IDM) needs information on different aspects to integrate for management of jute leaf mosaic disease. On the above mentioned perspective, the present research work has been undertaken to find out an effective management method alternative to spraying of insecticide to control vector and performance of the cultural methods on yield.

## Materials and Methods

The experiment was conducted in field laboratory, Department of Plant Pathology, Bangladesh Agricultural University (BAU), Mymensingh during March 2002 to October, 2002. The jute seeds of var. D-154 (*Corchorus capsularis*) were collected from the Central Experimental Station, Bangladesh Jute Research Institute (BJRI), Manikganj, Bangladesh. Cowdung (5,000 kg), Urea (110 kg), TSP (25 kg) and MP (40 kg) were applied to the experimental field as per recommended by BJRI, 2002. The experiment was laid out in a Randomized Completely Block Design (RCBD) with four replications. Five treatments were $T_1$=Malathion 57 EC, $T_2$=Field sanitation with rouging, $T_3$=Hanging of Polythene strips, $T_4$= Extra dose of nitrogen and $T_5$=Control. Malathion (2 ml/L) was applied after 15 days interval from the Days after sowing (15, 30, 45 and 60 DAE). Field sanitation with rouging operation of symptom bearing seedlings was done after 15 days interval according to the scheduled treatment (15, 30, 45 and 60 DAE). Hanging of blue colored shining polythene strips were used over the assigned plots with bamboo poles and rope. Extra dose nitrogen (Urea) was applied in splits after each 15 days interval (at 15, 30, 45, 60 DAE) @ 50.6 kg $ha^{-1}$ as side dressing only to the assigned plots. The control plots were exposed to natural conditions without hindrance.

The incidence of mosaic were recorded three times at 30 DAE, 45 DAE and 60 DAE. The incidence of leaf mosaic was calculated as follows :

$$\%\text{Mosaic expressing plants} = \frac{\text{Number of infected plants in each plot}}{\text{Total number of plants in each plot}} \times 100$$

Number of white flies per plant at 15 days interval before the application of insecticides and rouging operation were measured with the help of a plastic Beljar. The visiting white fly insects were also counted. Ten healthy and 10 diseased plants were selected at random from each unit plot for the collection of data in following parameters Plant height (cm), Base diameter (cm), Green weight (g), Leaf weight (g), Fibre weight dry (g $plant^{-1}$), Bulk weight of dried capsules (g $plant^{-1}$), No. of capsules per plant, 1000 seed weight (g). The mean values were compared by Duncan's Multiple Range Test (DMRT) which was also done with the help of a computer.

## Results and Discussion

**Effect of treatments on white fly (*Bemisia tabaci*) population per plant:** Effect of treatments on white fly population per plant at different days (DAE) are presented in Table 1. At 30 DAE, white fly population was significantly influenced by the treatments. The highest white fly population per plant was recorded (4.00) in the control treatment ($T_5$) which was followed by Malathion 57 EC ($T_1$) with 3.75. The lowest white fly population was counted 2.50% in field sanitation with rouging ($T_2$), extra dose nitrogen ($T_4$) and Polythene strips ($T_3$) respectively. At 45 DAE, white fly population was also significantly influenced by the treatments. The low population of white fly was observed 1.75, 1.75 and 2.00 per plant in field sanitation with rouging ($T_2$), nitrogen ($T_4$) and Hanging of shining polythene strips ($T_3$) respectively while the highest white fly population was found (3.25) in control treatment ($T_5$) which was statistically similar to that of $T_1$ (3.0) Malathion treatment and significantly different from the other treatments. At 60 DAE also white fly population was significantly influenced by the treatments. The lowest white fly population was recorded (0.750) in $T_2$ (field sanitation with rouging), which was statistically significantly similar with extra dose nitrogen, $T_4$ (1.25), Malathion spray $T_1$ (1.250) and hanging polythene, $T_3$ (1.500), respectively. The highest white fly population was recorded (2.5) in control ($T_5$) plot. Which was not statistically significant among the other treatments. After 60 DAE, the white fly population was drastically reduced, irrespective of treatments, because of heavy rainfall. Such a situation is normal and reported earlier by other workers. Horowitz (1986) found significant drop of white fly population level at heavy rain condition . Similar findings were obtained by Salinas and Sumalde, (1994) observed that high temperature and rainfall appeared to have a disruptive effect on the population of the white fly.

**Effect of treatments on percent mosaic incidence at different days after emergence (DAE):** Effect of treatment on percent mosaic incidence at different days after emergence (DAE) are presented in Table 2. At 30 DAE, percent mosaic incidence was significantly influenced by the treatments. The lowest mosaic incidence was recorded (0.8328) in field sanitation with rouging ($T_2$). This was statistically similar to that of $T_4$ (nitrogen) and also of $T_1$ (Malathion) treatments where as the $T_5$ (control) treatment had given the highest (1.444) percent mosaic incidence. At 45 DAE, the lowest (0.772) percent mosaic incidence

Table 1: Effect of treatments on white fly (*Bemisia tabaci*) population per plant

| Treatments | 30 DAE | 45 DAE | 60 DAE |
|---|---|---|---|
| $T_1$ | 3.750a | 3.00a | 1.250b |
| $T_2$ | 2.500b | 1.750b | 0.750b |
| $T_3$ | 2.750b | 2.000d | 1.500b |
| $T_4$ | 2.500b | 1.750b | 1.250b |
| $T_5$ | 4.00a | 3.250a | 2.500a |

Table 2: Effect of treatments on percent mosaic incidence at different days after emergence

| Treatments | 30 DAE | 45 DAE | 60 DAE |
|---|---|---|---|
| $T_1$ | 1.055 b | 1.249 b | 1.555 b |
| $T_2$ | 0.8328 b | 0.7772 c | 0.7772 c |
| $T_3$ | 1.110 ab | 1.110 bc | 1.277 bc |
| $T_4$ | 0.9438 b | 1.110 bc | 1.194 bc |
| $T_5$ | 1.444 a | 1.944 a | 2.388 a |

In a column, figures having common letter (s) do not differ significantly at 5 % level by DMRT

$T_1$= Malathion 57 EC, $T_2$= Field sanitation with rouging, $T_3$= Hanging of polythene strips, $T_4$= Extra dose of nitrogen and $T_5$= Control

was observed in $T_2$ (field sanitation with rouging) treatment, where the highest (1.944) was recorded in $T_5$ (control). Percent mosaic incidence was significantly influenced by all the treatment compared to control. The percent mosaic incidence observed at $T_1$, $T_3$ and $T_4$ were 1.249, 1.110 and 1.110 respectively. These readings were statistically more of less similar. The disease incidence was also statistically similar, more or less in $T_2$, $T_3$ and $T_4$ treatments and the incidence were significantly lower than that of $T_1$ treatment at 45 DAE. At 60 DAE, the lowest (0.7772) percent mosaic incidence was found in $T_2$ (Field sanitation with rouging), which was statistically more or less similar (1.194) to that of $T_4$ and that of $T_3$ (1.277) treatments. The highest (2.388) percent mosaic incidence was recorded in $T_5$ (control) treatment, which was significantly different from all the other treatments. That is the treatments significantly reduced the disease incidence compared to control ($T_5$). The findings of the present study is an agreement with the findings of Mishra (1986). He reported that cultural control such as water management, soil pH, fertilizer use, weeding, thinning, rouging and removal of infected stubble reduced the mosaic disease incidence. Baskey (1983) observed that transparent and light blue plastics mulches decreased the number of mosaic infected plants by 70 and 77% respectively. Borah (1996) who reported that foliar application with cypermethrin, deltamethrin and dimethoate at 50 DAS proved quite effective in reducing the incidence of *B. tabaci* and thus also the virus infection.

Performance of treatments on plant height, base diameter, stick weight and fibre weight of jute Results of treatments on plant height, base diameter, stick weight and fibre weight of jute are presented in Table 3. Height of healthy and infected plants were significantly influenced by the treatments. The highest height (319.4 cm) of healthy plant was found in $T_4$ (nitrogen), Which was statistically similar (317.8 cm to that in $T_2$ (field sanitation with rouging). The lowest average plant height healthy plant was recorded as 228.2 cm in $T_5$ (Control). The highest plant height (259.6 cm) of infected plant was measured in $T_4$ (nitrogen) which was statistically similar (249.9 cm) to that of $T_2$ (field sanitation with rouging). The symptoms bearing plants in $T_5$ (control) treatment gave the lowest plant height of 171.9 cm . It has been found that the plants in the control plots were shorter and thinner, than those of plants under different treatments. The phenomenon was identical in symptom bearing diseased plants and healthy looking plants. It was clearly apparent that infection reduced the height as well as base diameter of the plants irrespective of treatment they have received. However, incase where extra nitrogen supplement was served, the plants suffered in terms of growth in a lesser percentage even in the plants which expressed symptoms of infection. The results of $T_2$ treatment data of diseased plants which received infection or expressed symptoms after 30 DAE, only as infected plants observed and counted at 30 DAE were rouged out. These data suggest that the infected plants, even though they have been infected later, possibly through vector activity, have substantially suffered in terms of growth.

Base diameter of healthy and infected plant was found to be significantly influenced by the treatments. The highest average base diameter of 24.50 cm was measured in healthy plants under in $T_4$ (nitrogen) treatment. This was significantly similar (23.25 cm) to the healthy plants, that of plots which received in $T_2$ (field sanitation with rouging) treatment. The next widest average base diameter was observed as 21.63 cm in $T_3$, which was closely (20.88 cm) followed by $T_1$ (Malathion) treatment. Eventually the lowest base diameter of 18.50 cm was observed in the plant in $T_5$ (control) plots. In the symptoms bearing diseased plants, the highest base diameter of 19.75 cm was recorded in $T_4$, which was significantly similar to that of $T_2$ (19.75). The lowest average base diameter of 13.75 cm was observed in the infected plant of the control ($T_5$) plots.

The highest stick weight of 42.23 g in healthy plant was found in $T_4$ (nitrogen ) which was statistically similar (34.92g) to that of $T_2$ (field sanitation with rouging). The next to best stick weight was observed as 30.51 g in $T_3$ (hanging polythene strips) which was closely followed by $T_1$(Malathion spray). The lowest stick weight was recorded as 23.83g in healthy plants of $T_5$ (control) treatments. The highest stick weight (21.21 g) of infected plant was recorded in $T_4$ (nitrogen), which was followed by field sanitation with rouging (21.07g). The lowest

Table 3: Performance of treatments on plant height and base diameter (growth and yield contributing characters) of jute

| | Plant height (cm) | | Base diameter (mm) | | Stick weight (g/plant) | | Fibre weight (g/plant) | |
|---|---|---|---|---|---|---|---|---|
| Treatments | Healthy | Diseased | Healthy | Diseased | Healthy | Diseased | Healthy | Diseased |
| $T_1$ | 282.4b | 202.1b | 20.88ab | 14.75bc | 28.81bc | 16.44b | 14.44bc | 8.233b |
| $T_2$ | 317.8a | 249.9a | 23.25a | 17.50ab | 34.92ab | 21.07a | 17.62ab | 10.62ab |
| $T_3$ | 282.3b | 209.9b | 21.63ab | 15.50bc | 30.51bc | 16.81ab | 15.23bc | 8.385b |
| $T_4$ | 319.4a | 259.6a | 24.50a | 19.75a | 42.23a | 21.21a | 21.09a | 13.26a |
| $T_5$ | 228.2c | 171.9c | 18.50b | 13.75c | 23.83c | 15.76b | 11.93c | 7.872b |

Table 4: Performance of treatments on seed production of jute against leaf mosaic infection

| | No. of capsules (No./plant) | | Bulk weight of capsules (g/plant) | | 1000 seed weight (g/plant) | |
|---|---|---|---|---|---|---|
| Treatments | Healthy | Diseased | Healthy | Diseased | Healthy | Diseased |
| $T_1$ | 76.13c | 32.95b | 14.46bc | 10.04b | 4.743ab | 3.888ab |
| $T_2$ | 103.8ab | 35.08b | 20.19a | 13.99a | 5.653a | 4.477a |
| $T_3$ | 90.70b | 32.38b | 16.40b | 12.59ab | 5.115ab | 4.243a |
| $T_4$ | 114.3a | 46.33a | 21.84a | 14.82a | 5.988a | 4.908a |
| $T_5$ | 50.30d | 30.02b | 11.39c | 4.693c | 3.753b | 2.950b |

In a column, figures having common letter (s) do not differ significantly at 5% level by DMRT.

$T_1$= Malathion 57 EC, $T_2$= Field sanitation with rouging, $T_3$= Hanging of polythene strips, $T_4$= Extra dose of nitrogen and $T_5$= Control

stick weight (15.76 g) of infected plant was measured in $T_5$ (control), which was followed by 16.44g in $T_1$ (Malathion) treatment. Among the treatment employed in this experiment, the application of extra dose of nitrogen alone, has significantly boosted up the yield parameters, even in the symptom bearing diseased plants, especially in terms of fibre weight, so much so that the average g/plant fibre weight of symptom bearing diseased plants was almost close to the average g/plant fibre weight obtained in healthy plants under Malathion or polythene strip (vector repellant) and was greater than the fibre yield obtained in the control healthy looking plants.

The highest fibre weight of healthy plants was measured as 21.09g in $T_4$ (nitrogen) which was followed (17.62g) by the $T_2$ (field sanitation with rouging). The highest fibre weight (13.26) of infected plant was measured in $T_4$ which was significantly similar 10.62 g to that of $T_2$. The lowest fibre weight of 7.872 g was obtained in $T_5$ (control), which was statistically similar to that of in $T_3$ (8.385g) and $T_1$ (8.233 g) respectively. However, extra dose nitrogen application treatment, could induce increment in stick yield corresponding to the fibre yield. Through, under this treatment, the increment in stick weight was more than double in healthy plants and almost double in the symptoms bearing diseased plants compared to control treatment.

**Performance of treatments on seed production of jute in case of leaf mosaic infection:** Results of treatments on seed production of jute are presented in Table 4. The number of capsules per plant in healthy and infected plants was significantly influenced by the treatments. The highest no. of capsules in healthy plants was recorded 114.3 in $T_4$ (nitrogen), and this was statistically similar (103.8) in $T_2$ (field sanitation with rouging). The control ($T_5$) treatment gave the least number (50.30) of capsules correspondingly in infected plants. The highest number of capsules (46.33) diseased plant was obtained in $T_4$ as against the lowest no. of capsules (30.02) in $T_5$ (control). The number of capsules produced per infected plant in $T_1$, $T_2$ and $T_3$ were 32.95, 35.08 and 32.38 respectively. These figures were statistically similar to that of infected plants under control ($T_5$) of treatment. The highest bulk weight of dried capsules (21.8 g) obtained in the healthy plants was measured in $T_4$ which was significantly similar (20.19 g) to that of $T_2$. The lowest bulk weight of dried capsules (11.39 g) was measured in $T_5$ (control) treatment. The highest bulk weight of dried capsules of infected plant was measured (14.82 g) in $T_4$, which was statistically similar (13.99g) in $T_2$. The lowest bulk weight of dried capsules (4.693) in diseased plant was measured in $T_5$ (control) treatment. The bulk dry weight of capsules obtain from infected plants of $T_1$ and $T_3$ were 10.04 and 12.59 respectively. The highest 1000 seed weight (5.988 g) in healthy plant was measured in $T_4$(nitrogen) which was statistically similar (5.653 g) to those in $T_2$ (field sanitation with rouging) where as the lowest 1000 seed weight of 3.753 g was found in $T_5$ (control) treatment. Among the diseased plants, the highest 1000 seed weight (4.908g) was obtained in $T_4$ treatment, which was followed by $T_2$ (4.477g) and $T_3$ (4.243g). These figures were statistically similar. In $T_1$ the diseased plants yielded seeds having 1000 seed weight of 3.888 g which was significantly lower than those of $T_4$, $T_2$ and $T_3$ treatments. The 1000 seed weight of seeds obtained from the diseased plants under $T_1$ treatment was statistically close to that of control ($T_5$). The lowest 1000 seed weight (2.950) of diseased plant was measured in $T_5$ (control) treatment. This was not significantly similar than any other treatment.

Among the treatments used, the treatment $T_4$ (nitrogen) and $T_2$ (field sanitation with rouging) yielded the highest number of capsules per plant, highest bulk weight of dried capsules and highest 1000 seed weight in the healthy plants. The symptom bearing plants also were found to be similarly influenced. However, the other treatments like spraying Malathion 57 EC ($T_1$), and hanging of polythene strips over the plants ($T_3$) have shown significant differences compared to control ($T_5$) treatment, when seed production in healthy plants were considered. As leaf mosaic disease of jute is different from diseases causes by fungi, bacteria and nematodes, curative measures are very difficult to control the leaf mosaic disease of jute. Extra dose nitrogen and field sanitation with rouging may play a vital role in managing the leaf mosaic disease.

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