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EFFECT OF SOME CULTURAL PRACTICES FOR THE MANAGEMENT OF MUNGBEAN YELLOW MOSAIC DISEASE

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ABSTRACT

A field experiment was conducted for the management of mungbean yellow mosaic disease under natural condition by using different cultural practices. The experiment was conducted at Sher-e-Bangla Agricultural University (SAU) farm, Dhaka. Mungbean variety BARI Mung-5 was used in the experiment. Four polyethylene mulch viz. white, black, yellow and blue sheet, two insect trap namely yellow pot trap and yellow cloth trap and reflective tapes were applied in the investigation. It was observed that all the treatments significantly reduced the incidence and severity of mungbean yellow mosaic disease and increased growth characters (Plant height, number of pods/plant, pod length and number of seeds/pod) and yield of mungbean. Among the different cultural practices yellow polyethylene mulch followed by yellow pot trap and yellow cloth trap performed better in respect of growth characters and yield. Yellow polyethylene mulch increased 25.84% yield of mungbean over untreated control.

Key words: Yellow mosaic, mungbean, cultural practices

INTRODUCTION

Mungbean is the only pulse crop which can be grown during winter and summer seasons in Bangladesh. It ranks second both in acreage and production and contributes 9% of the total pulse production in the country (BBS, 2006). Among constrains for low yield of mungbean, some diseases are considered to be the most important ones (Bakr and Rahman, 1998). Among the diseases, yellow mosaic caused by mungbean yellow mosaic virus (MYMV) is the most serious and destructive disease in both the growing seasons (Jalaluddin and Shaikh, 1981; BARI, 1987) which is considered to be the most important limiting factor (Verma and Sandhu 1992). Jalaluddin and Shaikh (1981) reported 67-100% loss of grain yield in different varieties with different levels of susceptibility to yellow mosaic in the field where no control measures were undertaken. For successful cultivation of mungbean, disease management must be prioritized. The disease management strategies include the use of resistant cultivars, chemical spray and cultural practices. In absence of resistance sources, the indiscriminate use of chemical pesticides may cause environmental pollution and therefore, it is necessary to find out alternative methods of controlling plant disease. In this context use of plastic reflective mulches in order to delay the onset of virus disease has been proved to be successful in many observations (Cohen and Melamed-Madjar 1978, Suwwan *et al.* 1988, Csizinsky *et al.* 1997, Malla *et al.* 2002). The control of insect vector is also considered to be the important way for managing the viral diseases. Disease incidence of tomato yellow leaf curl virus disease was reduced by 5 to 20% depending on the color of the mulch and among the mulches yellow colored mulch was found to be the most effective one (Muqit *et al.* 2006). However, no reports are available on the effect of color mulches on mungbean yellow mosaic virus in Bangladesh. Therefore, the present study was undertaken to evaluate the different cultural practices in controlling yellow mosaic disease of Mungbean in the field.

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MATERIALS AND METHODS

The experiment was conducted at the Farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from March to July 2008. The seeds of BARI Mung-5 were used and the seeds were collected from Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. There were eight treatments used in this experiment and these were: T_1 = White polyethylene mulch, T_2 = Black polyethylene mulch, T_3 = Yellow polyethylene mulch, T_4 = Blue polyethylene mulch, T_5 = Yellow pot trap, T_6 = Yellow cloth trap, T_7 = Reflective tape and T_8 = Control. Four different colored (white, black, yellow and blue polyethylene) mulches were placed between two rows of mungbean at 20 DAS in the field. The mulches were withdrawn at 50 DAS. Yellow pot trap was prepared with a yellow plastic container and yellow cloth trap was prepared by using yellow cloth for attracting white fly. Some oily substances (Griz) were kept on yellow plastic container and cloth for trapping whitefly. Two traps were used per plot ($3m^2$). Traps were set at 20 DAS and they stayed upto 50 DAS. Traps were replaced in every week. Reflective tape of cassette was used for avoiding whitefly. The experiment was laid out in Randomized complete Block Design (RCBD) with three replications. The layout of the experiment was prepared for distribution of the treatment combinations in each plot of each block. There were 24 unit plots altogether in the experiment. The size of the plot was 1.5m×1.5m. The distance between two blocks and two plots were 1.0 m and 0.5m, respectively. The selected experimental plot was opened in the first week of March 2008 with a power tiller and was exposed for one week for sun drying. After one week the land was harrowed, ploughed and cross-ploughed several times. Fertilizers were applied as per recommendation of Bangladesh Agricultural Research Institute (BARI, 2004) for Mungbean in Bangladesh. Well decomposed cowdung as per treatment was applied at the time of final land preparation. The entire amounts of TSP, MP were applied during final land preparation. Only urea was applied in two equal installments at 20 and 30 Days after sowing (DAS). After emergence of seedlings, various intercultural operations like loosening of the soil, weeding was done for better growth and development. Light over-head irrigation was provided with a watering can to the plots immediate after germination of seed. Irrigation was also applied two times considering the moisture status of field. Weeding was done three times in these plots considering the optimum time for removal. The experimental plots were examined at 10 days interval for the appearance of viral mosaic. The incidence of mosaic was recorded four times. The first counting was made at 20 DAS and the following counting was made at 10 days interval. The mosaic infected plants were identified by visual observation as yellow patches on mungbean leaves coalesced to form a larger patch that develops into a yellow mottle; eventually the entire leaf could turn yellow. The green areas appear as dark green islands interspersed in yellow chlorotic areas; the infected leaf blade appears wavy (Ahmed, 1985). The incidence of yellow mosaic diseases was calculated as follows:

$$\% \text{ Yellow mosaic infected plants} = \frac{\text{Number of infected plant in each plot}}{\text{Total number of plants in each plot}} \times 100$$

Yellow mosaic severity was recorded at 20, 30, 40 and 50 DAS. For scoring the severity of both (0-9 scale) of the disease, ten infected plants were selected randomly from each replicate plot. Five trifoliate leaves were selected from each selected plant for scoring the disease severity data. Disease severity was determined by calculating the PDI as follows:

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of disease rating}}{\text{Total number of leaves observed} \times \text{Highest grade in scale}} \times 100$$

The severity of yellow mosaic disease was recorded following the 0-9 grading scale as used by Jalaluddin *et al.* (1994) where. 0 = No visible symptoms on leaves, plant growth, flowering and pod formation normal, 1 = Yellow chlorotic spots or flecks few in number and scattered over younger leaves; plant growth, flowering and pod formation normal, 3 =Yellow chlorotic flecks or mottle larger in size and covered about 25% of leaf area; Some coalesced and formed a patch; plant growth, flowering and pod formation slightly affected, 5 = Yellow chlorotic mosaic covered 50% of leaf area or some leaves. Some coalesced and formed irregular patches, plant moderately stunted, flowering and pod formation moderately reduced, 7 = Yellow chlorotic mosaic covered about 75% of leaf of several leaves, leaves reduced in size, pod formation restricted with yellow and curved pods; plants considerably stunted, 9 = Young leaves completely yellow, plant severely stunted, flowering and pod formation severely affected with very few small yellow curved pods that contained yellow shriveled seeds or without any pod formation.

The crop was harvested at full ripening stage. Before harvesting 5 apparently healthy plants and 5 infected plants (which have initially produced the symptoms) in each unit plots were selected randomly and collected data on plant height (cm), number of pods per plant, pod length (cm), number of seeds per pod, yield per plot(kg) and yield per hectare (ton). The data obtained for different characters were analyzed. The analysis of variance was performed by using MSTAT Program. The significance of the difference among the treatment means was estimated by DMRT (Duncan's Multiple Range Test) at 5% level of probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

A remarkable variation was recorded for disease incidence in application of different treatments at 20 DAS. The lowest disease incidence (1.33%) was recorded T_3 and T_6, which was statistically identical, with T_5 (1.67%)/. While the highest disease incidence (3.67%) was recorded in T_8 followed by T_1, T_2 and T_7. At 30 DAS a significant difference was recorded in disease incidence for different treatments. The lowest disease incidence (4.00%) was recorded for treatment T_3 which was statistically identical with T_5 (4.01%), T_6 (4.67%) and T_7 (5.67%), while the highest disease incidence (12.00%) was recorded for treatment T_8 which was closely followed by treatment T_1 (10.33%). At 40 DAS, different treatments showed significant variation in respect of disease incidence for managing mungbean yellow mosaic virus. The lowest disease incidence (6.33%) was recorded for treatment T_3, which was closely followed by T_5 (7.67%) and T_6 (8.00%) treatment. On the other hand, the highest disease incidence (17.33%) was recorded for T_8 which was closely followed by treatment T_1 (15.00%). At 50 DAS, different treatments showed significant variation in disease incidence for the management mungbean yellow mosaic virus. The lowest disease incidence (6.33%) was recorded for treatment T_3 which was statistically identical with T_5 (8.33%), T_6 (9.00%) and T_7 (11.33%) and the highest disease incidence (24.00%) was recorded for treatment T_8 which was closely followed by treatment T_2 (19.33%). Results of the present study are in agreement with the findings of the previous authors. Effectiveness of yellow polyethylene mulches in delaying TYLCV infection has been reported by several investigators (Suwwan *et al.* 1988, Csizinsky *et al.* 1995, Muqit *et al.* 2006). Muqit *et al.* 2006 reported that disease incidence was reduced by 5 to 20% depending on the color of the mulch. Among the mulches, yellow colored mulch was found to be the most effective in reducing the disease incidence of TYLCV of mungbean.

Different cultural practices used for the management of mungbean yellow mosaic diseases in the present trial showed a statistically significant variation in respect of disease severity that were calculated at 20, 30, 40 and 50 DAS (Table 1). At 20 DAS, variation recorded on disease severity was non significant. The lowest disease severity (1.25) was recorded in T_3, and the highest disease severity

(1.65) for treatment T_8. A significant variation was recorded for disease severity in application of different treatments at 30 DAS. The lowest disease severity (1.91) was recorded for treatment T_3 which was statistically identical and with treatment T_6 (1.98) and T_5 (2.09) and the highest disease severity (5.02) was recorded from T_8. At 40 DAS a significant differences was recorded in disease severity from different treatments for the management of mungbean yellow mosaic diseases.

Table 1. Effect of different cultural practices on incidence and severity of yellow mosaic disease of mungbean at different days after sowing

Treatments	Disease incidence				Disease Severity			
	20 DAS	30DAS	40DAS	50DAS	20 DAS	30DAS	40 DAS	50 DAS
T_1 (White polythene mulch)	3.00 ab	10.33 a	15.00 ab	16.67 b	1.64	3.24 b	3.93 d	7.87 c-e
T_2 (Black polythene mulch)	2.67 ab	9.00 ab	13.67 bc	19.33ab	1.59	2.52 bc	4.98 b	8.74 a-c
T_3 (Yellow polythene mulch)	1.33 b	4.00 c	6.33 e	8.00 c	1.25	1.91 c	3.03 e	6.91 e
T_4 (Blue polythene mulch)	2.00 ab	6.67 bc	12.00 c	18.00 b	1.59	3.32 b	4.62 bc	9.17 ab
T_5 (Yellow pot trap)	1.67 b	4.01 c	7.67 de	8.33 c	1.30	2.09 c	3.88 d	7.31 de
T_6 (Yellow cloth trap)	1.33 b	4.67 c	8.00 de	9.00 c	1.34	1.98 c	3.57 d	8.47 bc
T_7 (Reflective tape)	2.00 ab	5.67 c	9.00 d	11.33 c	1.62	2.57 bc	4.41 c	8.24 b-d
T_8 (Control)	3.67 a	12.00 a	17.33 a	24.00 a	1.65	5.02 a	7.61 a	9.69 a

Means within the same column having a common letter (s) do not differ significantly (P=0.05)

The lowest disease severity (3.03) was recorded from T_3, while the highest disease severity (7.61) was recorded from T_8. At 50 DAS different treatments also showed a significant variation in disease severity for the management of mungbean yellow mosaic virus. The lowest disease severity (6.91) was recorded from T_3 which was statistically identical with T_5 (7.31) and the highest disease severity (9.69) was recorded from T_8 which was statistically similar with T_4 (9.17). The result of the present study demonstrated that all the four polyethylene mulches used in the mungbean field were found to reduce the prevalence of MYMV over control. However, T_3 (Yellow polyethylene mulch) appeared to be the best than that of the rest. The colored polyethylene mulches used in the mungbean field was found to reduce the incidence of geminivirus like TYCLV and TCLV (Benlinger *et al.* 1988 and Polston. Yellow colored polyethylene mulch is known for its high reflectance which disorients whiteflies and increased heat which kills the soft bodied insect (Hilje *et al.* 2001). Different cultural practices that were used for managing mungbean yellow mosaic diseases in this trial showed a statistically significant difference for growth characters except plant height and yield of Mungbean (Table 2). No significant difference was found in case of plant height of Mungbean.

Table 2. Effect of different cultural practices on yield contributing characters and yield of mungbean

Treatment	Plant height (cm)	No. of pods plant^{-1}	Pod length (cm)	No. of seeds/pod	Yield plot^{-1} (kg)	Yield (t ha^{-1})	% Yield (t ha^{-1}) increased over control
T_1 (White polythene mulch)	40.52	20.01 b	7.46 bc	8.57 bc	2.20 b-e	0.98 b-e	10.11
T_2 (Black polythene mulch)	42.09	20.42 b	7.75 bc	9.75 a-c	2.28 b-d	1.01 b-d	13.48
T_3 (Yellow polythene mulch)	44.32	21.82 ab	8.72 a	10.13 a	2.52 a	1.12 a	25.84
T_4 (Blue polythene mulch)	41.65	20.86 bc	7.92 b	9.82 a-c	2.16 c-e	0.96 c-e	7.87
T_5 (Yellow pot trap)	43.13	22.62 a	8.52 a	10.00ab	2.43 ab	1.08 ab	21.34
T_6 (Yellow cloth trap)	43.27	21.31 ab	8.62 a	9.52 a-c	2.36 a-c	1.05 a-c	17.98
T_7 (Reflective tape)	40.12	19.37 bc	7.32 c	9.46 a-c	2.08 de	0.92 de	3.37
T_8 (Control)	39.01	17.01 c	7.23 c	8.39 c	2.00 e	0.89 e	

Means within the same column having a common letter (s) do not differ significantly (P=0.05)

The tallest (44.32 cm) plant was recorded for treatment T_3 and the shortest (39.01 cm) plant was recorded for treatment T_8. A remarkable variation for number of pods per plant was recorded for different treatments. The highest (22.62) number of pods per plant was recorded for treatment T_5 which was statistically similar (21.82, 21.31) with T_3 and T_6, while the lowest (17.01) number of pods per plant was recorded for treatment T_8 which was closely followed by T_7 and T_4. Different treatments showed a remarkable variation for pod length (Table 2). The maximum (8.72 cm) pod length was recorded from T_3 which was statistically similar with T_6 and T_5. On the other hand the minimum (7.23 cm) pod length was recorded from T_8 which was statistically similar (7.32 cm) with T_7. A remarkable variation for number of seeds per pod was recorded for different cultural practices that were used for managing mungbean yellow mosaic diseases. The maximum (10.13) number of seeds per pod was recorded for treatment T_3 which was statistically similar (10.00) with T_5 while the minimum (8.39) number of seeds per pod was recorded for T_8. Yield of mungbean varied significantly for different treatment. The highest yield (2.52 kg plot^{-1} and 1.12 t ha^{-1}) was recorded from T_3, which was statistically similar (2.43 kg plot^{-1} & 1.08 t ha^{-1}) with T_5, while the lowest yield (2.00 kg plot^{-1} and 0.89 t ha^{-1}) was recorded from T_8 which was statistically similar with T_7. Yield increased over control also varied differently for different treatments. The maximum yield increased over control was recorded for T_3 (25.84%) and the minimum (3.37%) was recorded for treatment T_7. The results of the present study were also supported by the findings of the previous researchers. Hossain (2007) found that yellow pot trap significantly reduced the incidence and severity of mungbean yellow mosaic disease and increased 11.73 % yield of mungbean over control. Karim *et al.* (2006) reported that yellow polythene mulch increased the yield and yield contributing characters of tomato by suppressing the TPVV infection.

Considering results of the present study, it may be concluded that yellow polyethylene mulch, yellow pot trap and yellow cloth trap proved to be effective in reducing the incidence and severity of mungbean yellow mosaic disease and improving yield contributing characters as well as yield of mungbean.

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