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Effect of Nutrients and Weeding on the Incidence of Mungbean Mosaic

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Abstract: A field experiment was conducted to study the effects of boron, zinc and sulphur as affected by weeding on the incidence and severity of yellow mosaic disease of mungbean. The crop was exposed to natural infection of yellow mosaic virus. The disease incidence, severity and mosaic leaves (%) were minimum in with B + Zn + S plots when weeding was done. Consequently there was significant increase in yield as compared to the plots when weeding was not done. Disease incidence and severity was also low in the boron or zinc or sulphur plots when weeding was done as compared to boron or zinc or sulphur plots when weeding was not performed respectively. The percentage of reduction in plant height, pod length, 100-seeds weight and seed yield due to yellow mosaic disease was minimum in B + Zn + S plot with weeding as compared to boron or zinc or sulphur or B + Zn + S plot without weeding.

Key words: Mosaic, weeding, nutrients, severity and yield

Introduction

Mungbean (*Vigna radiata* L. Wilczek) is an important pulse crop of Bangladesh. The agro-ecological condition of this country is favourable for its cultivation. It can be grown in summer and winter season (Bose, 1982). It ranks fifth both in acreage and production (Anonymous, 1999). Mungbean contains 51 % carbohydrate, 26 % protein, 10 % moisture, 4 % minerals and 3 % vitamins (Khan, 1981). The average yield of mungbean is very low (612.99 kg ha^{-1}) in Bangladesh (Anonymous, 1999). There are many constraints responsible for low yield. Among these, diseases are the most important (Bakr and Rahman, 1998). A total of sixteen diseases of mungbean have been recorded in Bangladesh (Nene, 1973). Yellow mosaic disease incited by mungbean yellow mosaic virus (MYMV) (Nariani, 1960; Williams *et al.*, 1968) is most damaging (Jalauddin and Shaikh, 1981). Winter mungbean genotypes are highly susceptible to yellow mosaic disease showed 67-100 % loss of grain yield in the field (Jalaluddin and Shaikh, 1981). Appropriate supply of plant nutrients including micronutrients may help the crop to grow successively. They may increase or reduce the disease incidence and severity (Agrios, 1979). It has been demonstrated that plant nutrition reduced the infection and the incidence of papaya ring spot virus and increased production of papaya (Roy *et al.*, 1999). Pramanik and Ali (2001) reported that the single application of boron (2 kg ha^{-1}) significantly reduced the severities of YM and increased grain yield (24.8 to 30.6 %). Weeds have been reported to harbor the viruses and act as a primary source of inoculum (Verma and Subramanyam, 1986). A high incidence of virus-like symptoms were also observed on several weed species growing in or adjacent to the crop (Dahal, 1990). Weeding resulted in a 56.9 and 43.9 % reduction in disease incidence and severity of anthracnose of cowpea respectively (Adebitan, 1996).

Little work has been done regarding the effects of plant nutrients (B, Zn and S). In light of the above background, this study was designated to find out the effects of plant nutrients and weeding on the incidence and severity of yellow mosaic disease, as well as growth, yield and yield components of winter mungbean.

Materials and Methods

The experiment was conducted during September 2000 to February 2001 at the Bangladesh Agricultural University Farm, Mymensingh. The design of the experiment was RCB. Recommended dose of other fertilizers were applied and the experimental field was finally prepared for sowing. Seeds were shown @ 30 kg ha^{-1} in 4x 2.5 m^2 size unit plot with 25 cm line to line distance. The field was divided into three blocks and each block was divided into 10 experimental units. The treatments of the experiment were borax (10.6 % boron), zinc sulphate (24 % zinc) and gypsum (18 % sulphur) applied to the soil @ 2, 2 and 20 kg ha^{-1}, respectively. Combination of borax, zinc sulphate and gypsum at the same dose was also included as a treatment. The treatments were tested under two conditions such as weeding at 21 and 35 days after sowing (DAS) and without weeding. Ten possible treatment combinations of plant nutrients with weeding and without weeding were made and then was assigned to the experimental unit at random. A complete set of treatment combinations (10) was assigned in each block. Disease incidence (%), severity and mosaic leaves (%) were recorded at 40 and 60 DAS. Disease severity was recorded following the severity scale (0-9) as used by Jalaluddin *et al.* (1994). Ten diseased plants and 10 apparently healthy plants were selected randomly in each unit plots and used for data collection. The parameters for data collection were plant height (cm), number of pods/plants, pod length (cm), number of seeds/pod, 100 seed weight and seed yield (kg/pod). The percentage of reduction in plant height, pod length, 100-seeds weight and seed yield were estimated by subtracting the mean values of infected plant from that of healthy plants for each parameter.

Analysis of variance of the parameters was done by the use of RCBD programme software. 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

There was significant effect of weeding and plant nutrients on the incidence and severity of yellow mosaic of mungbean in both counting periods (Table 1). Disease incidence in the control plot was as high as 50 and 71 % respectively at 40 and 60 days after sowing (DAS) when weeding was not practiced and only 26 and 38 % respectively at 40 and 60 DAS when weeding was done. Disease incidence was nearly similar in boron, zinc and sulphur plot. However, incidence was comparatively low when weeding was done and high when weeding was not practiced. Weeding in the B + Zn + S plots showed minimum 21 and 26 % infection at 40 and 60 DAS and 25 and 43 % infection without weeding, respectively in this study. This may because of increased metabolic activity and resistance in plants by plant nutrients (B, Zn, S). The results proved that micronutrients may also provide balance condition with other nutrients. This finding also revealed the benefit of weeding. Weeding may perform ideal sanitation in the crop field and promise indirect influence on virus spread. However no literature has been reviewed regarding the effect of plant nutrients (B, Zn and S) and weeding on the incidence of yellow mosaic disease.

Sixty three and 81 % of the leaves showed mosaic symptoms in control plot when weeding was not practiced at 40 and 60 DAS whereas only 32 and 41 % leaves were observed with mosaic symptoms respectively in control plot when weeding was done. There was slight variation in mosaic leaves (%) between boron, zinc and sulphur plots. Mosaic leaves (%) was minimum in B + Zn

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Table 1: Effect of nutrients as influenced by weeding on the incidence and severity of yellow mosaic of mungbean

	Incidence (%)		Severity (0-9)		Mosaic leaves (%)	
	Days after sowing (DAS)		Days after sowing (DAS)		Days after sowing (DAS)	
Treatments	40	60	40	60	40	60
Weeding						
Boron (B)	23.0f (28.66)	28.0e (31.95)	2.0c	3.0d	27.0d (31.31)	49.0e (44.43)
Zinc (Zn)	24.0e (29.33)	30.0e (33.21)	2.0c	3.0d	28.0d (31.95)	51.0f (45.57)
Sulphur (S)	24.0e (29.33)	31.0d (33.83)	2.0c	4.0c	30.0b (30.21)	52.0g (46.15)
B+Zn+S	21.0g (27.27)	26.0f (30.66)	2.0c	2.0e	23.0f (28.66)	39.0g (38.65)
Control	26.0c (30.66)	38.0c (38.06)	3.0d	4.0c	32.0b (34.45)	41.0b (39.81)
Without weeding						
Boron (B)	27.0c (31.31)	44.0b (41.55)	3.0d	4.0c	34.0c (35.67)	53.0c (46.72)
Zinc (Zn)	28.0b (31.95)	44.0b (41.55)	4.0b	5.0b	35.0b (36.27)	55.0c (47.87)
Sulphur (S)	29.0b (32.58)	45.0b (42.13)	4.0b	4.0c	36.0b (36.87)	57.0d (49.02)
B+Zn+S	25.0d (30.0)	43.0b (40.98)	3.0d	4.0c	33.0c (35.06)	63.0g (52.53)
Control	50.0a (45.0)	71.0a (57.42)	6.0a	9.0a	63.0a (52.53)	81.0a (64.16)

Table 2: Effect of nutrients as influenced by weeding on the reduction in some growth and yield parameters of yellow mosaic infected plants

	% Reduction in			
Treatments	Plant height	Pod length	100 seed wt.	Seed yield
Weeding				
Boron (B)	11.0e (19.37)	12.0f (20.27)	10.0d (18.43)	13.0e (21.13)
Zinc (Zn)	11.0e (19.37)	13.0e (21.13)	11.0d (19.37)	14.0e (21.97)
Sulphur (S)	12.0d (20.27)	14.0d (21.97)	11.0d (19.37)	15.0e (22.79)
B+Zn+S	10.0e (18.43)	11.0d (19.37)	10.0d (18.43)	12.0f (20.27)
Control	12.0d (20.27)	16.0f (23.58)	13.0c (21.13)	17.0d (24.35)
Without weeding				
Boron (B)	15.0c (22.79)	19.0b (25.84)	15.0b (22.79)	20.0b (26.57)
Zinc (Zn)	16.0b (23.58)	19.0b (25.84)	16.0b (23.58)	22.0b (27.97)
Sulphur (S)	17.0b (24.35)	20.0b (26.57)	16.0b (23.58)	23.0b (28.66)
B+Zn+S	13.0c (21.13)	17.0c (24.35)	13.0c (21.13)	18.0c (25.10)
Control	26.0a (30.66)	28.0a (31.95)	19.0a (25.84)	32.0a (34.45)

Values are average of three replications. Values within the same column with a common letter are not significantly (P = 0.01) different by DMRT. Data were analyzed after transformation by arcsine method. Values within the parentheses are transformed data.

+ S plots when weeding was done. Number of mosaic leaves in these plots was significantly high when weeding was not practiced.

Consequently mosaic disease was very severe in the control plots without weeding while disease severity was comparatively low in control plots with weeding. Disease severity was moderate (3-4) in boron, zinc and sulphur plots either under weeding or without weeding condition. On the contrary, result showed that minimum disease severity was recorded in B + Zn + S plots in association with weeding. The findings of Pramanik and Ali (2001) confirmed the findings of this study with reference to boron. But no literature was found on the effect of weeding on the severity of yellow mosaic disease of mungbean for better comparison. It was observed that plant nutrients (B, Zn and S) and weeding had remarkable effect on reducing the disease severity. This may due to the induced resistance and vigorous growth by plant nutrients as well as removal of virus source through weeding.

It was observed that the effect of plant nutrients as influenced by weeding on the % reduction of plant height, pod length, 100-seeds weight and seed yield due to yellow mosaic disease was significant (Table 2). Percent reduction in plant height, pod length, 100-seed weight and seed yield was high in control plots when weeding was not done while the reduction comparatively low in control plots when weeding was practiced. Weeding in B + Zn + S plots showed the minimum reduction in plant height, pod length, 100-seed weight and seed yield as compared to the plants grown in plots with B+Zn+S where weeding was not practiced. Reduction in plant height, pod length, 100 seed weight and seed yield was moderate in boron, zinc and sulphur plots where weeding was performed. On the contrary, without weeding in boron, zinc and sulphur plots showed comparatively higher percentage of reduction. The literature on the effect of plant nutrients (B, Zn and S) and weeding are not available for the confirmation of the findings. But the findings of Chand and Varma (1983) may be the support these findings based on the lower disease incidence and severity. They observed that plant height was reduced up to 38.2 % due to mungbean yellow mosaic virus. The results proved that lower percentage of disease severity give rise to minimum percentage of reduction in growth and yield parameters of mungbean due to yellow mosaic disease. This is because of lower disease severity ensured by plant nutrients and weeding. However, the findings of Jain *et al.* (1995) proved indirectly the findings of this study with lower disease incidence and severity against each treatment. They reported that the reduction in grain yield ranged from 39.9 to 51.5 % due to mungbean yellow mosaic virus.

Significant effect of weeding and plant nutrients was found on number of pods/plant, number of seed/pod, 100 seed weight (g) and seed yield (kg/plot) (Table 3). Minimum number of pods/ plant,

Table 3: Effect of nutrients as influenced by weeding on the yield and yield components of mungbean

Treatments	No. of Pods/plant	No. of seeds/pod	100 seed wt.(g)	Seed yield (g/plot)
Weeding				
Boron (B)	21.0a	15.0a	3.0b	1096.00a
Zinc (Zn)	20.0b	14.0a	3.0b	1071.00a
Sulphur (S)	20.0b	14.0a	3.0b	1066.00a
B+Zn+S	21.0a	14.0a	4.0a	1134.00a
Control	19.0b	14.0a	3.0b	894.00b
Without weeding				
Boron (B)	17.0c	12.0b	3.0b	689.00c
Zinc (Zn)	16.0c	12.0b	3.0b	660.00c
Sulphur (S)	16.0c	11.0c	3.0b	620.00c
B+Zn+S	18.0c	14.0a	3.0b	753.00d
Control	30.0d	10.0d	3.0b	527.00e

Values within the same column with a common letter are not significantly different (P = 0.01)

number of seed/pod, 100-seed weight (g) and seed yield (g/plot) were obtained in control plots where weeding was not practiced but plants grown in control plots with weeding yielded comparatively higher number of pods/plant, number of seed/pod, 100-seed weight (g) and seed yield (g/plot). Weeding along with B + Zn + S showed the highest number pods/plant, number of seed/pod, 100-seed weight (g) as compared to other treatments. Consequently the maximum seed yield (g/plot) was also found in the same plots. Comparatively higher number of pods/plant, number of seed/pod, 100-seed weight (g) and seed yield (g/plot) were obtained from the plots with single use of boron, zinc and sulphur where weeding was done in comparison to individual use of boron, zinc and sulphur without weeding. The findings of this study proved the findings of Singh *et al*. (1996). They reported that yield increase (0.81 ton ha^{-1}) compared with (0.88 ton ha^{-1}) in weed free plots with increase in weed free condition during the first 45 DAS. The yield and yield component are high due to balanced fertilization and increased metabolic activity by reducing the severity and incidence of the disease. On the other hand, weeding in combination with plant nutrients showed better results by elimination of source of the virus and meeting up nutritional requirements of the crop. But a few literature was found regarding the effect of micronutrients on the yield and yield components of mungbean. The findings of Pramanik and Ali (2001) support finding of this study. They reported that single application of Boron increased grain yield 24.8 to 30.6 %.

These findings preliminary indicate the role of plant nutrients (B, Zn and S) and weeding on the reduction of incidence and severity of yellow mosaic disease and increased yield of mungbean. Further studies considering the effect of plant nutrients and weeding are needed.

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