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Performance of Chemical and Botanicals against Cercospora Leaf Spot (CLS) of Mungbean

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Authors' contributions

This work was carried out in collaboration between all authors. Author EN prepared the study proposal, set the experimental plots and write draft manuscript. Author JD collected data, prepared samples and helped to write the final article. Author RH collected and analyses data. Author AUD proofread the manuscript and made comparison among data. Author AHMH provided lab materials and reviewed the study and manuscript. All the authors read and finally approved the final manuscript.

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ABSTRACT

Cercospora leaf spot is one of the major disease in Bangladesh and may be considered as one of the chief limiting factors where mungbean is cultivated. Advancement in resistant varieties are the positive approach for controlling the disease while several protective fungicides effectively control the disease. But sustainable resistance could not be activated so far. We conducted this experiment to know the effects of botanicals and chemicals on Cercospora leaf spot disease of mungbean and direct effects on mungbean yield. A high yielding, disease tolerant variety (BARI mung-4) was used as experimental sample and treatment plots were set in Sylhet in 2014. Total seven different treatments were applied randomly. Different variation in germination of mungbean seeds in the field were found. Minimum disease incidence (5.87%) and disease severity (2.30%) were found in combined treatment of Bavistin 50WP+Secure 600WP (T_5) and gave better response in yield (1482.67 kg/ha). The result of the present study suggest that the integrated use of these treatments effectively minimize the incidence and severity of Cercospora leaf spot, as well as increase its yield.

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Keywords: Integrated; mungbean; botanicals; incidence; severity.

1. INTRODUCTION

Mungbean (*Vigna radiata*) is one of the most important pulse crops in Bangladesh and the agro ecological condition of this country is favorable for its cultivation [1]. It can fix atmospheric nitrogen through symbiotic relationship with soil bacteria and improve the soil fertility [2]. There are many constraints responsible for the lower yield of mungbean in our country where, diseases are considered dominant constraints [3]. In Bangladesh, sixteen diseases of mungbean have been recorded [4] [5]. Among them, Cercospora leaf spot (*C. cruenta* Sacc.) and the yellow mosaic (Mungbean yellow mosaic virus) are the most important and damaging diseases that up to 58% yield loss has been reported [6]. Considering the two diseases, Cercospora leaf spot (*C. cruenta* Sacc.) is a serious one where mungbean is grown [7]. Four species of *Cercospora* viz. *C. cruenta*, *C. conescens*, *C. kikuchii* and *C. caracallae* are the causal agent of the disease and *C. cruenta* is the most prevalent species [8]. Maturity delayed in the diseased plants, resulting poor pod formation. Seeds that developed on severely infected plants are small and immature [9]. Eco-friendly management like use of plant extract is a recent approach to plant diseases management and it has drawn the special attention of the plant pathologist all over the world [10,11,12,13]. In addition, it reported that, plant extracts have antifungal properties and potentially used against many plant diseases. The use of neem leaves extracts are effective for minimizing Cercospora leaf spot incidence, severity and increasing yield of mungbean [14]. In the light of above background, the present research work has been undertaken to know the effects of different botanicals and chemicals on the incidence and severity of the Cercospora leaf spot disease that affect on yield and yield contributing characters of mungbean.

2. MATERIALS AND METHODS

The field experiment was conducted at Laxmi Pasha union, at Golapgonj, Sylhet during February-June, 2014. The soil of experimental site was grey, sandy loams in texture and organic matter content of soils is moderate. A high yielding and disease tolerant variety (BARI mung-4) was used as experimental sample. Bangladesh Agricultural Research Institute (BARI) developed the variety, which is suitable for all season in Bangladesh. A number of 15 samples (300 gm in each) were collected from the farmer's storage according to the rules of International Seed Testing Association [15] and kept them in refrigerator at 5±1℃. Seven treatments mainly chemicals and plant leaf extracts, namely T_1 (Bavistin-50WP), T_2 (Secure-600WP), T_3 (Neem leaf extracts), T_4 (Biskatali), T_5 (Bavistin+Secure), T_6 (mixed spray: Neem leaf extracts+Biskatali) and T_7 (water spray) were applied during experiment. The extracts were prepared by using the method of [10]. For getting extract, weighted plant parts were blended and added with distilled water. The pulverized plant tissue was squeezed through three folds of fine cotton cloth. Almost 400 ml distilled water added to get 1:4 (w/v) ratios with 100 g plant parts. In case of control, seeds treated only with distilled water. Randomized Complete Block Design (RCBD) was followed to partition the experimental field with three replications. There were 21 unit plots altogether in the experiment with 2.0 m × 3.0 m plot size. In case of foliar spray in field, spraying was done 3 times at 15 days of interval. The incidences and severity of disease were recorded for three times. The counting was made from 20 to 50 days after sowing (DAS) at 15 days interval, which includes the percent plant infection at different DAS to compare with other treatments. Ten infected plants were selected randomly from each replication plot to identify disease severity. Disease severity were assessed using a 0-8 scale of [16]. Disease incidence and Percent disease index (PDI) was calculated according to the following formula [16]

- % Disease Incidence = (number of infected plants in each plot ÷ total number of plants in each plot) × 100

- Percent Disease Index (PDI) = {sum of total rating ÷ (total number of observation × highest grade in the scale)} × 100

Before harvesting, 10 diseased plants and 10 apparently healthy looking plants from each unit plots were selected randomly to find out data of the effects of treatment on different yield parameters and yield of mungbean. All data were analyzed statistically and differences was estimated following Least Significance Difference (LSD) at 5% level of probability.

3. RESULTS AND DISCUSSION

3.1 Germination Percentage

Significant variation in germination of mungbean seeds in the field were found under different treatments (Table 1). The highest germination (69.67%) was recorded at 5 DAS by treating seeds with T_5 while the lowest germination (40.96%) was recorded in T_7. At 10 DAS and 15 DAS, the highest germination (88.22%) and (91.00%) respectively observed while treated with T_5, where the lowest (67.50%) and (72.11%) found in T_7. Seed treated with Secure 600WP and Bavistin increased plants germination by 28.56% and 27.97%, respectively over control [17].

3.2 Disease Incidence

It has been observed that integrated application of Bavistin 50WP+Secure 600WP and Neem leaf + Biskatali leaf extract resulted significant reduction of Cercospora leaf spot of mungbean over untreated (T_7= control) (Fig. 1). The efficacy of nine fungicides evaluated to control *C. canescens* and found that Bavistin, Benlate, Calixin, Emisan-6, Thiram and Captan were highly inhibitory to the pathogen and growth was not observed in the culture media amended with that fungicide [18]. Disease incidence of Cercospora leaf spot of mungbean under different treatments at 20, 35 and 50 DAS were varies significantly. In overall, the highest disease incidence (34.23%) was recorded from control plot (T_7) and the lowest disease incidence (5.87%) was recorded from the treatment T_5 (Bavistin 50WP + Secure 600WP) treated plot.

3.3 Disease Severity

It is evident that the treatments showed significant effect in respect of disease severity (0-8 scale) at 20, 35 and 50 DAS (Fig. 2). It was observed that integrated application of Bavistin-50WP + Secure-600WP resulted significant reduction of Cercospora leaf spot of mungean. On the other hand, the highest disease severity observed with treatment T_7 (control). Results also revealed that the individual use of Secure 600WP (T_2) and Bavistin 50WP (T_1) were also effective than Neem leaf (T_3) and Biskatali leaf (T_4) extracts. Neem seed extract/cake effectively applied against *Bipolaris sorokiniana*. The extract inhibited the growth of the fungus and also reduced its pathogenecity on wheat leaves [19].

3.4 Effects of Different Treatments on Yield Parameters and Yield of Mungbean

The performance of treatment, T5 (Bavistin 50WP + Secure 600WP) and integrated application of T6 (Neem + Biskatali leaf extracts) were more effective than other treatments (Table 2). The tallest (78.74 cm) plant was recorded from plot that sprayed with Bavistin 50WP + Secure 600WP (T5). A maximum (9.00) number of seed per pod was recorded in T5 treated plots, which was statistically similar with T6 (8.67%) and T2 (8.00%). Significant variation was also recorded for pod length in different treatment. The maximum (10.24 cm) pod length was recorded while treated with T5 and the minimum (5.47 cm) pod length was recorded in control plot. The chemicals and plant extracts were given the maximum value for these parameters than control. This result supported, as plant extracts are effective to control plant diseases by the report of [20,21,22]. [23] evaluated eight plant extracts including Vitavax-200 against leaf spot of wheat. Those plant extracts showed statistically similar grain yield as of seed treatment with vitavax-200. Seed treatment with biskatali extract increased grain yield up to 29.74% over untreated control.

Table 1. Percent germination (Sq m^2) in the field condition

Treatments	Percentage of germination (%)		
	5 DAS	10 DAS	15 DAS
T_1= Bavistin 50WP	55.89 c	74.22 d	78.22 c
T_2= Secure 600WP	58.00 bc	78.11 c	82.00 b
T_3= Neem leaf extract	51.89 d	70.89 e	75.11 cd
T_4= Biskatali leaf extract	49.66 d	69.55e f	73.34 d
T_5= Bavistin 50WP + Secure 600WP	69.67 a	88.22 a	91.00 a
T_6= Neem Leaf Extract + Biskatali	60.56 b	81.89 b	84.33 b
T_7= Control	40.96 e	67.50 f	72.11 d
LSD (P≥ 0.050%)	3.141	3.342	3.680
CV (%)	3.34	2.62	3.37

***Different letter (s) in the same column showed the significant different at 0.05 level of probability*

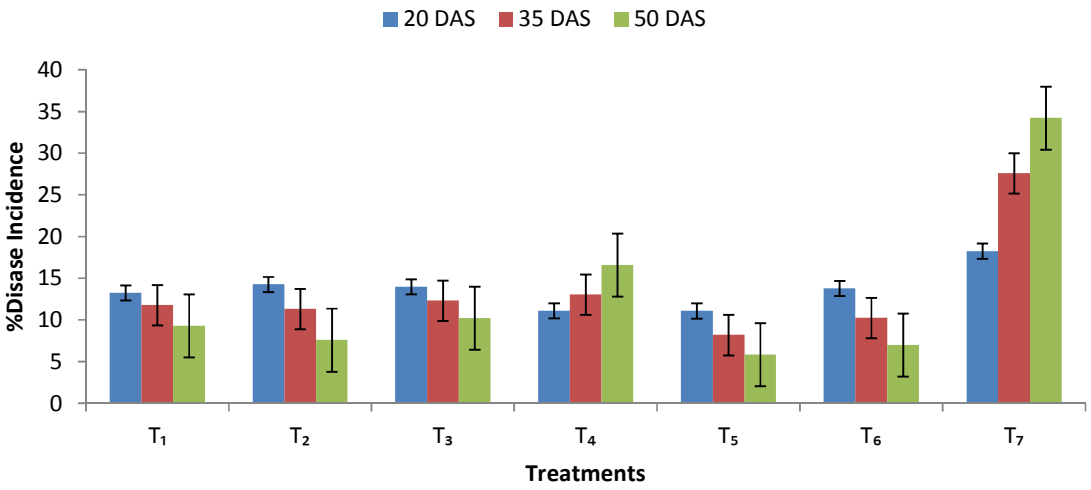

Fig. 1. Effect of seven different treatments on the disease incidence of CLS of mungbean
(Error bars indicate standard error)

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

Treatments	Plant height (cm)	Pod length (cm)	Number of seed per pod	1000 seed weight (gm)	Yield per plot (kg/plot)	Yield (Kg/ha)
T_1=Bavistin-50WP	70.44 b	8.77 bc	7.33 bc	26.60 cd	0.78 b	1299 b
T_2=Secure-600WP	71.12 b	9.43 ab	8.00 ab	27.90 c	0.80 b	1328 b
T_3=Neem leaf extract	69.46 b	8.50 bc	7.00 bc	26.33 d	0.77 b	1280 b
T_4=Biskatali leaf extract	68.67 b	8.20 c	6.67 c	25.30 d	0.64 c	1074.33 c
T_5=Bavistin 50WP + Secure 600WP	78.74 a	10.24 a	9.00 a	31.40 a	0.89 a	1482.67 a
T_6=Neem Leaf Extract + Biskatali	73.48 ab	10.06 a	8.67 a	29.68 b	0.80 b	1336.67 b
T_7= Control	53.37 c	5.47 d	5.30 d	23.68 e	0.51 d	856.67 d
LSD at 0.05%	6.425	1.094	1.268	1.369	0.05626	101.3
CV (%)	5.2	7.09	9.59	2.82	4.64	4.60

Different letter (s) in the same column showed the significant different at 0.05 level of probability

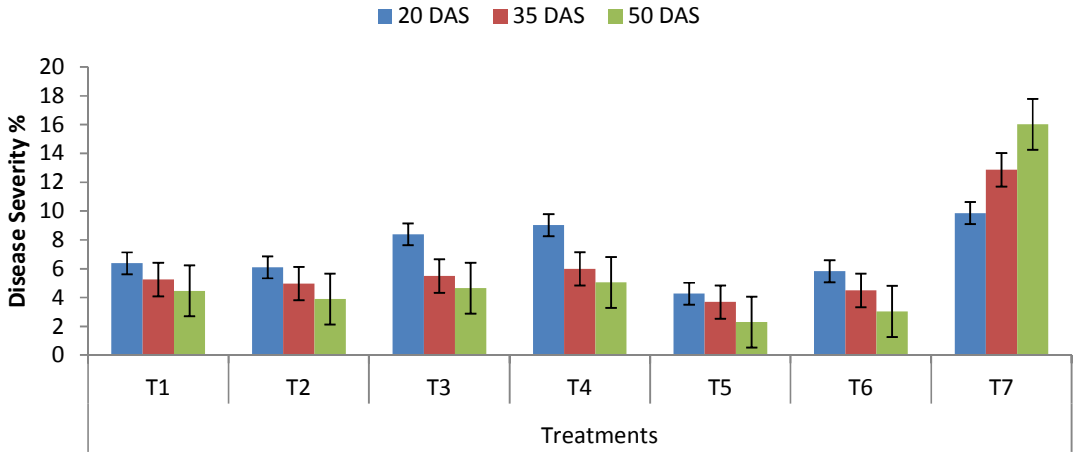

Fig. 2. Effect of seven different treatments on the disease severity of CLS of mungbean
(Error bars indicate standard error)

Increase of yield per hectare over control showed variation for different management approaches under the present experiment. The highest 1000 seed weight (31.40 gm) was recorded from the treatment T_5 and the lowest (23.68 gm) recorded from the treatment T_7 (control). A significant differences in yield per plot was found under different treatments where the maximum yield per plot (0.89 kg) was recorded in treatment of T_5. The maximum (1482.67 kg) yield was recorded from the treatment T_5, which is follwed by T_6 (1336.67 kg), T_2 (1328 kg), T_1 (1299 kg), T_3 (1280) and T_4 (1074.33 kg). [24] evaluated five fungicides to manage anthracnose caused by *Collectotrichum dematium* and *C. lindemuthianum* and Cercospora leaf spots disease (*C. canescens* and *C. cruenta)* of *Vigna mungo* and found maximum net profit when they used two sprays of Carbendazim (Bavistin-50 WP).

4. CONCLUSION

In the field experiment, the lowest disease incidence (5.87%) and disease severity (2.30%) was found in treatment T_5 (Bavistin 50WP + Secure 600WP) and gave better response in yield (1482.67 kg ha^{-1}). Treatment T_5 (Bavistin 50 WP + Secure 600 WP) has also given the best result regarding yield contributing characters such as plant height, pod length, number of seeds pod^{-1} and 1000 seeds weight as compared to other chemical and botanical treatments. The results of the present study suggested that the integrated use of these chemicals effectively minimizing Cercospora leaf spot disease and increase its yield.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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