

Effect of Some Fungicides on Foot and Root Rot of Lentil

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Abstract An experiment was carried out to test the efficacy of four fungicides in controlling foot and root rot of lentil under field condition. The test fungicides were Rovral (0.2%), Secure 600wg (0.2%), Bavistin 70wp (0.2%), Captan 50wp (0.2%). BARI masur-1 has been used for this experiment. Tested fungicides significantly decreased incidence of foot and root rot of lentil and increased yield. Among the fungicides highest performance was found with Secure 600wg (0.2%) in controlling the incidence of foot and root rot.

Keywords Fungicides, Secure 600wg, incidence, Foot and Root Rot

1. Introduction

Lentil occupies a unique position in the agriculture of Bangladesh. In Bangladesh pulses constitute an integral part of the daily diet as a direct source of protein for human beings [9]. Lentil (*Lens culinaris*) is one of the oldest and most familiar food legumes in Bangladesh. Lentil is the second most important pulse crop in terms of area (154,000 ha) and production (116,000 t), but ranks the highest in consumer preference and total consumption [5]. Consumption of lentils with small grains provides a balanced diet. It is a cheap source of protein for human beings and also for animals in country [9]. Lentil is also important in crop diversification in the cropping systems of Bangladesh. As the price of animal protein is increasing day by day, the protein storage in the diet system of the people in the country can be met up through lentil. The yield of lentil in Bangladesh is lower (total production 124,000 metric tons; [5]) than that of Syria, Turkey, Canada, USA and Ethiopia. The low yield of lentil is associated with poor management practices, unavailability of quality seeds and specially lack of proper disease management. Diseases play important for yield reduction. Lentil is affected by a wide range of fungal diseases. Productivity of lentil is reduced by pathogens through infection and damage to leaves, stems, roots and pods. It also reduces marketability due to discoloration of the seeds. Lentil suffer from attack of a number seed borne

diseases such as vascular wilt, collar rot, root rot, stem rot, rust, powdery mildew and downy mildew, which are caused by *Fusarium oxysporum f.sp. lentis*, *Sclerotium rolfsii*, *Rhizoctonia solani*, *Uromyces fabae*, *Erysiphe polygoni* and *Peronospora lentis* respectively [10 and 8]. *Fusarium oxysporum* and *Sclerotium rolfsii* are soil-borne pathogens commonly occurs in the tropics and sub-tropics regions of the world causing root and foot rot of many crops [3].

Foot rot (caused by *Fusarium oxysporum* and *Sclerotium rolfsii*) is considered as an important and destructive disease of pulses in almost all legume-growing countries of the world [1]. Foot and root rot of lentil caused by *Fusarium oxysporum* and *Sclerotium rolfsii* [6] are common in Bangladesh. In Bangladesh about 44% lentil plants are infected by foot and root rot disease [1]. It causes seedling death at early stage resulting very poor plant stand which ultimately produces very low yield.

Despite of the many achievements in modern agriculture, chemical control still holds a strong performance in combating certain destructive plant diseases. Farmers use chemicals for controlling the diseases of crop plants in Bangladesh, but limited information on the efficacy of these chemicals exists in our country. No investigation has so far been conducted in the discipline of controlling foot and root rot of lentil by fungicides in Bangladesh. Considering the above facts the present study was undertaken to evaluate efficiency of the fungicides for controlling foot and root rot of lentil in field conditions of Bangladesh and asses foliar application of fungicides on lentil production.

2. Materials and Methods

Lentil Seed Sowing and Application of Treatments

The experiment was carried out at the field laboratory of the Pulse Research Station, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, in the period of October, 2011 to May, 2012. The lentil variety, BARI Masur-1, has been used in the study. The experimental plot was prepared mechanically in November, 2011. Weeds and other materials were removed. The soil was prepared into good tilth by six cross ploughings followed by ladderings. The soil of the field was leveled before seed sowing.

Fertilizers such as Urea, TSP and MOP were applied @ 45, 85 and 35 kg/ha and Cow dung @ 5 ton/ha during the time of final land preparation [4]. The experiment was conducted in Randomized Complete Block Design (RCBD) with three (3) replications. The field was divided into three blocks (replication). Each block was divided into five experimental units. The size of each experimental unit was 6m×4m. The treatments were assigned in each block at random. Four fungicides were used as treatment with one control (Table. 1). Before sowing of lentil seeds furrows were made with power tiller. 20cm distance was maintained between the furrows. The required amounts of seeds for each sub plot were taken in polyethylene bags and seeds are broadcasted at a rate of 40 kg/ha in the furrows immediately. The furrows were covered with soil soon after sowing. Spray solution of each fungicide was prepared respectively in non-metal containers. Spraying was done with the help of a knapsack sprayer. Three liters of spray solution was sprayed in each experiment unit. Spraying was started at 20 days after sowing (DAS) and continued for one month at 7, 10 and 15 days interval. Intercultural operation was done in order to maintain the normal hygienic condition of crop growth. Weeding was performed two times during the growing period of the crop. One weeding was done at 20 days and another at 35 days after sowing. Light irrigation was given after each weeding. Excess water was drained out immediately to save the crop from stagnant water. There were 5 treatments. The treatments are as follows:

- T₁= Rovral 50 wp (0.2%) (Iprodion)
- T₂= Sceure 600wg (0.2%) (Fenamidone + Mancozeb)
- T₃= Bavistin 70 wp (0.2%) (Carbendazim)
- T₄= Captan 50 wp (0.2%) and
- T₅= Control.

Observation, Data Collection and Analysis

The incidence of foot and root rot of lentil was recorded at 10 days interval. The incidence of the disease of lentil was calculated by the following formula:

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

The crop was harvested at fully matured stage. The crop of this field was harvested on 06, March 2012. Five plants from each plot were selected randomly for data collection on Growth parameter. The collected data were analyzed statistically. Analysis of Variance and LSD test were done to find out the significant difference among the treatment means [11].

3. Results

Incidence of foot and root rot of lentil due to application of fungicides at seven days interval

It is indicated in Table 1 that all the treatments had effect over the control in reducing the disease. Among the

treatments, T₂ (Secure 600 wg) was found most effective followed by T₄ (Captan 50 wp) and T₁ (Rovral 50 wp) and differed significantly from the other fungicides tested.

Table 1. Incidence of foot and root rot of lentil due to application of fungicides at seven days interval

Treatment	Disease incidence (%)				
	25 DAS	35 DAS	45 DAS	55 DAS	Mean
T ₁	1.48ab	4.36c	6.28b	7.07c	4.80c
T ₂	0.99d	1.99e	3.66d	5.49d	3.03e
T ₃	1.39c	5.05b	7.96a	11.18b	6.40b
T ₄	1.51ab	3.35d	5.03c	6.96c	4.21d
T ₅	1.67a	6.82a	8.21a	13.30a	7.50a
LSD _{0.05}	0.19	0.55	1.01	0.530	0.57
CV%	7.77	8.28	9.57	3.70	7.33

T₁= Rovral 50 wp; T₂= Secure 600 wg; T₃= Bavistin 70 wp; T₄= Captan 50 wp; T₅= Control

Figures in the column having common letter(s) do not differ significantly at 5% levels by LSD

Incidence of Foot and Root Rot of Lentil Due to Spray at 10 Days Intervals

Incidence of foot and root rot of lentil due to spray at 10 days intervals are shown in Table 2. The incidence was minimum in T₂ (Secure 600 wg) followed by T₃ (Bavistin 70 wp) and T₁(Rovral 50 wp). Here, T₃ and T₁ were statistically similar.

Table 2. Incidence of foot and root rot of lentil due to application of fungicides at 10 days interval

Treatment	Disease incidence(%)				
	25 DAS	35 DAS	45 DAS	55 DAS	Mean
T ₁	4.64a	7.38b	8.75bc	10.66c	7.86b
T ₂	3.00d	5.49d	7.76d	9.84c	6.52c
T ₃	4.22b	6.43c	8.12cd	11.49b	7.57b
T ₄	4.72a	8.37a	10.73a	12.55a	9.09a
T ₅	4.90c	8.56c	11.51b	12.96a	9.48a
LSD _{0.05}	0.39	0.59	0.91	1.29	0.78
CV%	5.38	4.72	5.59	6.24	5.48

T₁= Rovral 50 wp; T₂= Secure 600 wg; T₃= Bavistin 70 wp; T₄= Captan 50 wp; T₅= Control

Figures in the column having common letter(s) do not differ significantly at 5% levels by LSD.

Incidence of Foot and Root Rot of Lentil Due to Fungicides Spray at 15 Days Interval

Data on the incidence of foot and root rot of lentil due to fungicides spray at 15 days interval are presented in Table 3. Among the treatments, T₂ (Secure 600 wg) was found most

effective followed by T₁ (Rovral 50wp) and differed significantly from the other fungicides tested. T₃ and T₄ had no significant on reduction of foot and root disease. T₂ (Secure 600 wg) showed 3.53% incidence of foot and root rot disease whereas, T₅ showed

Table 3. Incidence of foot and root rot of lentil due to application of fungicides at 15 days interval

Treatment	Disease incidence(%)				
	25 DAS	35 DAS	45 DAS	55 DAS	Mean
T ₁	1.68c	3.37c	5.14ab	6.64b	4.21b
T ₂	1.34d	2.75c	4.30b	5.74c	3.53c
T ₃	2.12b	4.97a	6.18a	9.39a	5.67a
T ₄	2.26b	4.42a	6.12a	9.31a	5.53a
T ₅	2.85a	4.99a	6.40a	9.75a	5.99a
LSD _{0.05}	0.30	0.71	1.29	0.55	0.71
CV%	9.02	10.05	12.82	3.66	8.89

T₁= Rovral 50wp; T₂= Secure 600 wg; T₃= Bavistin 70 wp; T₄= Captan 50 wp; T₅= Control

Figures in the column having common letter(s) do not differ significantly at 5% levels by LSD

The plants infected with foot and root rot showed brownish at the leaves and stem (Figure1). The roots become rotten. The infected root did not have hairs due to damage by the pathogen (Figure2).



Figure1. Plant showing foot and root rot symptoms in the field

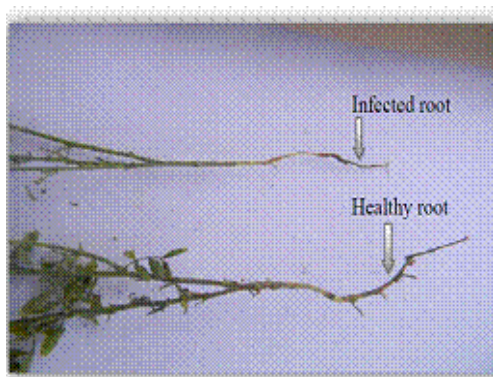


Figure2. Infected root showing foot and root rot symptoms

Effects of Some Fungicides in Relation to Yield and Yield Related Characters of Lentil Due to Weekly Spray of Fungicides

Data of grain yield and yield related characters of lentil due to weekly spray of fungicides are shown in Table 4. Highest mean plant height was obtained in T₂ (Secure 600wg), whereas T₅ (control) showed the lowest plants height (26.80cm). But T₂ is statistically similar in increasing plant height with T₄ and T₁.

T₂ showed highest number of pods per plant (42.27) followed by T₁ and T₄. But effect of T₂ and T₁ on pods/plant were statistically similar. Other hand T₂ showed highest positive effect on 100 seed weight (1.79 gm) and yield per ha (1135.33 kg).

Table 4. Grain yield of lentil due to application of fungicides at 7 days interval

Treatment	Plants Height (Mean) cm	Pods/Plant(Mean)	100 seed weight (gm)	Yield (kg)/ ha
T ₁	28.33ab	40.07a	1.73ab	976.67b
T ₂	30.07a	42.27a	1.79a	1135.33a
T ₃	26.93b	28.53c	1.76a	933.00bc
T ₄	29.87a	36.73b	1.74ab	892.00c
T ₅	26.80b	28.47c	1.68b	680.00d
LSD _{0.05}	2.36	2.53	0.06	58.84
CV%	4.5	4	1.6	3.5

T₁= Rovral 50wp; T₂= Secure 600 wg; T₃= Bavistin 70 wp; T₄= Captan 50 wp; T₅= Control

Figures in the column having common letter(s) do not differ significantly at 5% levels by LSD

Effects of Some Fungicides in Relation to Yield And Yield Related Characters of Lentil Due to 10 Days Interval Spray of Fungicides

Table 5. Grain yield of lentil due to application of fungicides at 10 days interval

Treatments	Plants Height (Mean) cm	Pods/ Plant (Mean)	100 seed weight (gm)	Yield (kg)/ ha
T ₁	26.27b	32.40c	1.81b	828.00 c
T ₂	29.13a	36.67a	1.99a	1019.67a
T ₃	26.40b	33.47bc	1.79b	905.33b
T ₄	28.53a	36.47ab	1.85b	1005.33a
T ₅	25.73 b	31.07c	1.81b	815.00c
LSD 0.05	2.05	3.02	0.12	47.58
CV%	4.14	4.89	3.24	2.86

T₁= Rovral 50wp; T₂= Secure 600 wg; T₃= Bavistin 70 wp; T₄= Captan 50 wp; T₅= Control

Figures in the column having common letter(s) do not differ significantly at 5% levels by LSD

T₂ showed profound effect on grain yield and yield related characters of lentil due to fungicides spray at 10 days interval (Table 5). Plants height (mean) was 25.73 cm in T₅ as compared to 26.27 cm in T₁. Maximum plant height was 29.13 cm obtained in T₂. Pods/plant was highest in T₂, whereas minimum no of pods/plant was 31.07 in T₅. T₃ showed significant yield (905.33 kg/ha), but best yield was obtained 1019.67 kg/ha in T₂. T₅ showed the minimum yield per hector (815.00 kg/ha).

Effects of Some Fungicides in Relation to Yield Contributing Characters and Yield Of Lentil Due to Fungicides Spray a 15 Days Interval

Effects of some fungicides in relation to yield contributing characters and of lentil due to fungicides spray at 15 days interval are presented in Table 6. In mean plants height, T₁ showed significant result (29.93 cm) in comparison with 29.67 cm in T₄ and minimum 28.87 cm in T₅. Maximum plants height was 32.80 cm in T₂. Maximum no of pods/plant was 39.93 in T₂ as compared to 39.07 in T₃. They were statistically insignificant. T₂ showed the significant result (1.81 gm) of 100 seeds weight as compared to 1.75 gm in both T₄ and T₅. Maximum yield per ha is 1043.33 kg/ha in T₂ and insignificant to 772.67 kg/hector in T₅. T₁ had 873.33 kg/ha in T₁ is significant to 855.33 kg/ha in T₃. T₄ showed statistically insignificant result (994.33 kg/ha)

Table 6. Grain yield of lentil due to application of fungicides at 15 days interval

Treatments	Plants height (Mean) cm	Pods/pl ant (Mean)	100 seed weight (gm)	Yield (kg)/ ha
T ₁	29.93b	35.47b	1.77ab	873.33c
T ₂	32.80a	39.93a	1.81a	1043.33a
T ₃	31.87a	39.07a	1.76abc	855.33c
T ₄	29.67b	33.10c	1.72abc	994.33b
T ₅	28.87b	32.33c	1.69c	772.67d
LSD _{0.05}	1.71	1.41	0.06	41.32
CV%	3.08	2.16	1.29	2.50

T₁= Rovral 50wp; T₂= Secure 600 wg; T₃= Bavistin 70 wp; T₄= Captan 50 wp; T₅= Control

Figures in the column having common letter(s) do not differ significantly at 5% levels by LSD

4. Discussion

It is quite evident that foot and root rot of lentil is caused by *Fusarium oxysporum* and *Sclerotium rolfsii* [6] and have immense impact on germination, disease incidence, seedling mortality and yield. The experiment was conducted to asses' foliar application of fungicides on lentil production and to select a fungicide for controlling foot and root rot of lentil. From the result it was observed that all the fungicides have enormous effect on reducing

disease incidence of lentil. All the fungicides significantly reduce disease incidence of lentil. Among the treatments, secure 600wg gave lower percentage of disease incidence. Secure 600wg showed 3.03%, 6.52%, 3.53% disease incidence due to weekly spray, spray at 10 days interval and at 15 days interval respectively. Control showed 13.30%, 12.96%, and 9.75% at the respective plots. Efficacy of fungicides was tested and Secure 600 WG was found to show the lowest disease severity followed by Rovral-50 WP in controlling foot and root rot of lentil [2]

Mean plants height was 30.07cm at Secure 600wg applied plots while control showed the lower plants height (26.80cm) at weekly spray. Mean pods per plant was highest (42.27) at secure 600wg weekly spray. Secure 600wg showed the highest (1135.33 kg/ha.) yield against 680.00 kg/ha. in control plots at weekly spray. In respect of spray at 10 days interval plots, Secure 600wg showed 1019.67 kg/ha while control plots gave 815.00 kg/ha. yield of lentil grain. While spray was at 15 days interval yield (kg/ha.) ranged from 1043.33 to 772.67 kg/ha. Secure 600wg plots showed significantly higher yield of 1043.33 kg/ha.

The result of the present study clearly indicates that, spraying the fungicides in this experiment which promotes yield promoting characters and increased yield and thus considerably reduced foot rot diseases. However, findings of this study suggested for extensive further study in this discipline.

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