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Fungicidal management of Stemphylium blight (*Stemphylium botryosum* Wallr.) of Lentil (*Lens culinaris* Medik)

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Lentil (*Lens culinaris* Medik) is a valuable human food and one of the oldest known protein rich food legumes which is also known as poor men's meat. Owing to biotic and abiotic stresses, the crop yield is below attainable levels which are mainly attributed to pathological factors especially Stemphyliumblight caused by *Stemphylium botryosum* Wallr. A field experiment was carried out during *rabi* season of 2015-16 atthe District Seed Farm (AB Block), Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal to evaluate the efficacy of fungicides in controlling Stemphylium blight of lentil (*Lens culinaris* Medik.). Six fungicides were evaluated under high disease pressure of Stemphylium blight. Two times foliar spray with Captan 70 % + Hexaconazole 5% WP @ 1 g/litre of water at 10 days interval reduced 63.89% disease severity and increased yield of lentil by 32.86 % with highest net incremental cost-benefit ratio (1:9.8). The fungicide may be recommended to control of Stemphylium blight of lentil.

Key words: Fungicide, Lentil, management, Stemphylium blight

INTRODUCTION

Lentil (*Lens culinaris* Medik) is one of the most nutritious cool season food legume and ranks next only to chickpea in India. Lentil contains about 25% protein, 0.7% fat, 2.1% minerals, 0.7% fiber and 59% carbohydrate. It is a rich source of phosphorus and carotene. It is generally grown as a rainfed crop on marginal lands under residual moisture condition. The average yield of lentil in India is lower than the world average. The crop is vulnerable to many diseases. The reasons for low yield are occurrence of various biotic and abiotic factors at different growth stages. Diseases like rust, wilt, root rot, stemphylium blight reduce the productivity of lentil by 20 – 25 % (Sharma, and Shukla, 2014). Among the diseases, Stemphylium blight is a major one. Stemphylium blight caused by *Stemphylium botrysum* in West Bengal is of economic importance. Generally, it appears at flowering stage of the crop. Most of the research on infection by *Stemphylium* spp. of different hosts has confirmed that temperature and moisture are the most important environmental factors. In S.E. Asia and India, temperatures of 18 to 22°C and a relative humidity of over 85% have been reported to favour the development of the disease (Erskine and Sarker, 1997; Sinha and Singh, 1993). Use of fungicide is the most dependable method to control plant disease. Therefore, the present experiment was conducted to test six fungicides to control Stemphylium blight of lentil.

MATERIALS AND METHODS

Investigations were carried out in November, 2015 to March, 2016 at the District Seed Farm (AB Block), Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal. Trials were conducted

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using a randomized block design with six fungicidal treatments (T1-T6) and a control (T7) replicated thrice (Table 1) using Asha (B-77), a susceptible variety of Stemphylium blight. Seeds were sown on 21st November, 2015 and grown under prevailing epiphytotic condition for the disease. The experimental plot was divided into 21 sub-plots arranged in three blocks-R1, R2 and R3, representing the three replications 1.5 m apart. The area of each sub-plot was 5 m x 4 m with plants arranged in 20 rows, 25 cm apart. Plant to plant distance was 10 cm. Nitrogen (N), Phosphate (P_2O_5) and Potash (K_2O) fertilizers were applied at the rate of 30:40:20 kg ha^{-1}. Irrigation was given thrice whenever required. First spray was applied at disease appear and second spray was done 10 days after first spray. Ten plants were randomly selected and tagged in all treatments, for disease assessment. Disease severity for was assessed using 0-9 scale (Hashemi *et al*. 2005) where, 0= No infection, 1= below 10% of foliage affected, 3= 30% of foliage affected, 5=50% of foliage affected, 7=70% of foliage affected, 9= above 70% of foliage affected. Percentage Disease Incidence was worked out using the formula PDI = [Sum of numerical rating/total number of observations taken x maximum disease score] x 100. The yield and test weight of grains of each plot was recorded after threshing. Finally the disease severity percent, increase in yield over the control, net profit from additional yield and the economics of the foliar sprays were also calculated. An economic evaluation of the fungicide treatments was based on the value of the additional yield obtained after foliar spray subtracting the cost of the fungicides.

RESULTS AND DISCUSSION

All fungicidal sprays significantly reduced Stemphylium blight severity (Table 2) and increased yield in comparison to the untreated control. Lowest Stemphylium blight severity was observed in T6 (24.9%) followed by T4 (28.9%) and T2 (45.2%). Maximum reduction Stemphylium blight severity was reported in T6 (68.83%) followed by T4 (63.89%) and T2 (43.52%). Maximum yield was obtained from T6 (1445.00 kg ha^{-1}) followed by T4 (1401.67 kg ha^{-1}) and T2 (1321.67 kg ha^{-1}). Highest increase of yield was recorded from T6 (36.97%) followed by T4 (32.86%) and T2 (25.28%). No significant difference in test weight was observed (Table 3). Maximum increase of test weight was reciprocated the same for the above mentioned treatments.

Different fungicidal treatments gave different net profits as well as different Incremental cost benefit ratio (ICBR) and Net incremental cost benefit ratio (NICBR). The profit or net monetary return varied from Rs. 7041.67 ha^{-1} to Rs. 20865.00 ha^{-1} in different treatments (Table 3). The highest net profit was obtained from the T6 (Rs. 20865.00 ha^{-1}), followed by T4 (Rs. 20451.33 ha^{-1}) and T2 (Rs.14447.33 ha^{-1}). The economics of various fungicides revealed that the highest net realization over control was obtained from the treatment T6 (Rs. 25350.00 ha^{-1}), followed by T4 (Rs. 22533.33 ha^{-1}) and T2 (Rs. 17333.33 ha^{-1}). In contrast to the net profits, a different trend was observed with ICBR and NICBR. ICBR was worked out for each treatment during 2015-16 by calculating prevailing market prices of fungicides, lentil grains and cost of labours (Table 3). Most favorable NICBR was registered from T4 (1:9.8), followed by T2 (1:5.0) and T3 (1:4.9). This difference between the net profit and NICBR can perhaps be attributed to the cost of the fungicides involved. From the above results it may be concluded that the highest benefit-cost ratio was registered in the treatment T4 *i.e.* Captan 70 % + Hexaconazole 5% WP @ 1g/litre of water.

Table 1 : Treatment, chemical name, strength, trade name and dose of fungicides

Treatment	Chemical name, Strength and Trade name	Dose
T_1	Thiophanate methyl 70% SC (Roko)	1 g/litre of water
T_2	Chlorothalonil 75 WP (Kavach)	2 g/litre of water
T_3	Tebuconazole 25.9 % EC (Folicur)	1 ml/litre of water
T_4	Captan 70 % + Hexaconazole 5% WP (Taqat)	1 g/litre of water
T_5	Mancozeb 50 % + Carbendazim 25 % WS (Sprint)	2 g/litre of water
T_6	Trifloxystrobin 25% + Tebuconazole 50% (Nativo)	0.75 g/litre of water
T_7	Water spray (Control)	-

Results of the present investigation revealed that foliar spray of all the tested fungicides reduced the disease severity and increased yield of lentil compared to control. Out of six fungicides, four fungicides i.e. Trifloxystrobin 25% + Tebuconazole 50%, Captan 70 % + Hexaconazole 5% WP, Chlorothalonil 75 WP and Tebuconazole 25.9 % EC showed better performance than other two i.e. Thiophanate methyl 70% SC and Mancozeb 50 % + Carbendazim 25 % WS. Similar findings had been recorded by many researchers

Table 2 : Lentil Stemphylium blight severity, yield and test weight (100 seeds) in different treatments during *rabi,* 2015-16

Treatment	PDI (% Disease Index)		Decrease of disease Severity (%)	Test weight (g)	Increase of Test weight (%)	Yield (kg/ha)	Increase of Yield (%)
T_1	73.3	(58.9)	8.33	1.60	13.11	1193.33	13.11
T_2	45.2	(42.2)	43.52	1.66	25.28	1321.67	25.28
T_3	53.6	(47.1)	33.02	1.63	22.12	1288.33	22.12
T_4	28.9	(32.5)	63.89	1.68	32.86	1401.67	32.86
T_5	63.7	(53.0)	20.37	1.61	18.48	1250.00	18.48
T_6	24.9	(30.0)	68.83	1.70	36.97	1445.00	36.97
T_7	80.0	(63.4)	0.00	1.59	0.00	1055.00	0.00
GM				1.64		1279.29	
SEm(±)	3.00			0.03		26.92	
CD (0.05)	9.26			0.09		82.99	
CV (%)	11.1			3.09		3.64	

Figures in parentheses are angular transformed values

Table 3 : Economics of various fungicides used for control of Stemphylium blight disease

Treatment	Yield (Kg/ha)	Total cost of fungicides and labours (Rs./ha) (P)	Gross realization over control (Rs./ha)	Net realization over control (Rs./ha)(A)	Net Profit (Rs/ha) (A-P)	ICBR (A/P)	NICBR (A-P)/P
T_1	1193.33	1950	77566.67	8991.67	7041.67	4.6	3.6
T_2	1321.67	2886	85908.33	17333.33	14447.33	6.0	5.0
T_3	1288.33	2580	83741.67	15166.67	12586.67	5.9	4.9
T_4	1401.67	2082	91108.33	22533.33	20451.33	10.8	9.8
T_5	1250.00	2754	81250.00	12675.00	9921.00	4.6	3.6
T_6	1445.00	4485	93925.00	25350.00	20865.00	5.7	4.7
T_7	1055.00		68575.00				
GM	1279.29						
SE(m)±	26.92						
CD(P=0.05)	82.99						
CV (%)	3.64						

Labour charge per ha Rs. 1110 for 5 labours, Lentil grains @ Rs.65 per kg, Water necessary for spray 600 lt. ha^{-1}, ICBR- Incremental cost benefit ratio, NICBR- Net incremental cost benefit ratio

(Shahiduzzaman *et al*. 2015; Sardar, 2005). Various fungicides control the alternaria blight disease with dissimilar cost-benefit ratio (Das, 2015). So, the findings of the present investigation are comparable with the findings of the previous researchers. Based on findings of the present study, it may be concluded that two times foliar spray with Captan 70 % + Hexaconazole 5% WP @ 1 g/litre of water at an interval of 10 days may be recommended to manage the Stemphylium blight of lentil.

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