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Original Research Article

Management of Alternaria Blight of Indian Mustard in Bihar

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A B S T R A C T

The production of oilseed Brassicas, second largest oilseed crops grown in the world, is gravely hampered by the fungal diseases; Alternaria blight being one of the most destructive fungal disease. The fungus, not only leads to yield reduction by causing foliar damage to the crop, but also damages siliqua in pod formation stage, severely deteriorating both seed and oil yield. Hence, cost-effective, recent strategies, involving newer systemic fungicides are a pre-requisite for Alternaria blight management. With these objective investigations were carried out during three consecutive seasons, viz. Rabi 2013, Rabi 2014 and Rabi 2015 at Research Farm of Tirhut College of Agriculture, Dholi, Muzaffarpur. All the treatments significantly controlled the severity of Alternaria blight (AB) over control (Water spray). Highest yield of 1,233.8 Kg/ha and highest (1:10.4) incremental cost-benefit ratio (ICBR) with lowest disease intensity of 34.2% and 32.1% were recorded on leaf and pod stage, respectively in the treatment when single spray of Mancozeb 64% WP @ 0.2% followed by single spray of Difenconazole 25 EC @ 0.05% was given. Second best management practice has recorded disease intensity of 41.67% and 36.67% on leaf and pod stages, respectively, yield of 1240 Kg/ha with 1:9.03 incremental cost-benefit ratio when single spray of Mancozeb @ 0.2% followed by single spray of Propiconazole 25 EC @ 0.05% was given over control (disease intensity of 53.33% and 47.78% on leaf and pod stage respectively with yield of 890 Kg/ha). However, treatment with single spray of Propiconazole 25 EC (0.05%) gave second highest (1:10.13) incremental cost-benefit ratio, significantly minimizing Alternaria blight (AB) with significant higher yield (1,046.2 Kg/ha) over existing Alternaria blight management practice of single spray of Mancozeb (0.2%).

Keywords

Indian Mustard, Alternaria blight, management

Introduction

Rapeseed-mustard is an economically prodigious and utile oilseed crop of the world. Contributing to 32% of the total oilseed production in the country, it is the main source of edible oil in India after groundnut. Out of 59.93 mt of rapeseed produced over 30.74 m ha in the world, India produces 7.67 mt from an acreage of 6.51 m ha with a productivity of 1179 kg/ha (GOI 2011). India is ranked 3rd largest producer of Rapeseed Mustard in the world accounting 11.3% of production (7.0 million tons) after Canada and China. Indian mustard having potential upto3.5 ton per hectare with bold seeded and up to 42% oil content. It holds a premium position in Rapeseed Mustard economy of the world with 2nd and 3rd rank in area and production, respectively. The development of high yielding varieties coupled with improved production technologies has lead to a considerable increase in the productivity

of rapeseed- mustard in India during past decade. But despite this increase, the yields of oilseed brassicas in India are much below the global average. A huge sum of money (8000-10000 crores/ annum) is being spent on import to meet the current edible oil demand. The wide gap between the potential and realized yields is largely because of the biotic and abiotic stresses. Among the biotic factors, fungal diseases alone are responsible for severe damages to the crop resulting in yield losses up to 70% on a world wide scale. The severe attack of many fungal diseases not only deteriorates the quality of the seed but reduces the oil content considerably in different oil-yielding Brassica species. Amongst the major fungal diseases, Alternaria blight of rapeseed-mustard (*Brassica* sp.) caused by *Alternaria brassicae* (Berk.) Sacc., is one of the most important limiting factors, causing yield losses of up to 35-45% in mustard (*Brassica juncea*) (Kolte *et al*., 1987; Saharan, 1992; Kolte 2002) and even more severe losses (up to 70%) in rapeseed (*Brassica campestris*). *Alternaria brassicae* is the most catastrophic and pervasive disease of oilseed brassicas in Bihar also as it is called as 'Hot Spot' (Dholi region). The present paper discusses the Alternaria blight disease with respect to determination of cost-effective and recent management strategies which will be further used by the farmers of this region.

Materials and Methods

Investigations were carried out during three consecutive seasons, viz. Rabi 2013, Rabi 2014 and Rabi 2015 at experimental plot of Tirhut College of Agriculture, Dholi, Muzaffarpur. Trials were conducted using a Randomized Block Design with 12 treatments and 3 replications. The variety Varuna was sown with plot size 5 m x 3 m with row to row spacing 30 cm and plant to plant 10 cm. Recommended doses of N P K fertilizers were applied. Different treatments viz., Single spray of Mancozeb (0.2%), Single spray of Metalaxyl 8%+ Mancozeb 64% WP (0.2%), Single spray of Hexaconazole 25 EC (0.05%), Single spray of Difenconazole 25 EC (0.05%), Single spray of Propiconazole 25 EC (0.05%), Seed treatment with Propiconazole @ 0.1 % followed by its foliar spray @ 0.1% and combinations of the treatments like Single spray of Mancozeb (0.2%) + Single spray of Metalaxyl 8%+ Mancozeb 64% WP (0.2%), Single spray of Mancozeb (0.2%) + Single spray of Hexaconazole 25 EC (0.05%), Single spray of Mancozeb (0.2%) + Single spray of Difenconazole 25 EC (0.05%), + Seed treatment with Propiconazole @ 0.1 % followed by its foliar spray @ 0.1% + Single spray of Mancozeb (0.2%) were tested.

For rating reaction of Alternaria blight (0-9) Scale were followed:

(I) = Immune/No lesions

(HR) = Non-sporulating pinpoint size or small brown necrotic spots, less than 5% leaf area covered by lesions.

(R) = Small roundish slightly sporulating larger brown necrotic spots, about 1-2 mm in diameter with distinct margin or yellow halo, 5-10% leaf area covered by lesions.

(MR) = Moderately sporulating, non-coalescing larger brown spots, about 2-4 mm in diameter with a distinct margin or yellow halo, 11-25% leaf area covered by the spots.

(S) = Moderately sporulating, coalescing larger brown spots about 4-5 mm in diameter, 26-50% leaf area covered by lesions.

(HS) = Profusely sporulating, rapidly coalescing brown to black spots measuring more than 6mm diameter without margins covering more than 50% leaf area.

Average severity score =

$$\frac{(N\text{-}1 \times 0) + (N\text{-}2 \times 1) + (N\text{-}3 \times 3) + ((N\text{-}4 \times 5) + (N\text{-}5 \times 7) + (N\text{-}6 \times 9)}{\text{Number of leaf samples}}$$

Where N-1 to N-6 represents frequency of leaves in the respective score.

Ten plants, randomly selected and tagged after each treatment application, were assessed. The yield of each micro-plot was recorded after threshing. The 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.

All data in percentage were analysed after arc sin transformation and both actual and transformed value of mean with CD ($P<0.05$). Data were analysed as per the design using ANOVA.

Results and Discussion

The present investigations were carried out to find out the fungicidal effect of some newer chemical compounds for the management of Alternaria blight disease of Indian mustard. The investigation was carried out for three consecutive seasons continuously from Rabi 2013to Rabi 2015. The data from table shows that during Rabi 2013, all the treatments significantly controlled the severity of Alternaria blight over control. Lowest disease intensity of 27.07% and 20.87% was recorded on leaf and pod stage respectively with highest yield of 1231 Kg/ha in treatment T_9 (Single spray of Mancozeb @ 0.2% followed by single spray of Difenconazole 25 EC @ 0.05%) followed by disease intensity of 26.60% and 22.93% on leaf and pod stage respectively with yield of 1170 Kg/ha in treatment T_{10} (Single spray of Mancozeb @0.2% followed by single spray of Propiconazole 25 EC @0.05%) against control where the disease intensity of 58.47% and 52.53% on leaf and pod stage were observed respectively with yield of 729 Kg/ha.

During 2014 also, all the treatments significantly controlled the severity of the disease over control. Lowest disease intensity of 35.00% and 31.11% were recorded on leaf and pod stage respectively in treatment T_{11} (T_6 followed by T_1- Seed treatment with Propiconazole 25 EC @ 0.1% followed by its foliar spray@ 0.1% + Single spray of Mancozeb @ 0.2%) with yield of 1185 Kg/ha where as highest yield of 1245 Kg/ha with 38.33% and 35.00% severity were recorded on leaf and pod stage respectively in treatment T_9 (Single spray of Mancozeb @ 0.2% followed by single spray of Difenconazole 25 EC @ 0.05%) which was followed by disease intensity of 41.67% and 36.67% on leaf and pod stage respectively with yield of 1240 Kg/ha in treatment T_{10} (Single spray of Mancozeb @ 0.2% followed by single spray of Propiconazole 25 EC @ 0.05% against control (disease intensity of 53.33% and 47.78% on leaf and pod stage respectively with yield of 890 Kg/ha).

Same type of pattern has been during 2015 also. All the treatments significantly controlled the severity of Alternaria blight (AB) over control.

Table.1 Evaluation of fungicides against Alternaria Blight diseases of Indian Mustard

Treatments	2013-14			2014-15			2015-16			Pooled			Increased yield over control	ICBR
	Intensity on leaves (%)	Intensity on leaves (%)	Intensity on leaves (%)	Intensity on leaves (%)	Intensity on pods (%)	Yield (Kg/ha)	Intensity on leaves (%)	Intensity on pods (%)	Yield (Kg/ha)	Intensity on leaves (%)	Intensity on pods (%)	Yield (Kg/ha)		
T_1 - Single spray of Mancozeb (0.2%)	45.66	45.66	45.66	49.99	42.22	933	58.57	37.27	903.67	45.8	39.7	912.2	85.5	1:3.99
T_2 - Single spray of Metalaxyl 8%+ Mancozeb 64% WP (0.2%)	40.4	40.4	40.4	49.44	45.56	967	54.40	40.07	935.50	43.9	40.8	953.3	126.6	1:3.41
T_3 - Single spray of Hexaconazole 25 EC (0.05%)	40.8	40.8	40.8	48.89	44.45	964	50.60	38.67	927.00	43.1	39.9	940.3	113.6	1:7.08
T_4 - Single spray of Difenconazole 25 EC (0.05%)	38.3	38.3	38.3	45.56	38.89	1046	45.97	32.50	999.17	41.1	36.6	1,008.7	182.0	1:9.89
T_5 - Single spray of Propiconazole 25 EC (0.05%)	33.87	33.87	33.87	46.11	35.56	1078	47.97	29.80	1041.33	40.7	34.8	1,046.2	219.5	1:10.13
T_6- Seed treatment with Propiconazole @ 0.1 % followed by its foliar spray @ 0.1%	32.67	32.67	32.67	44.45	38.33	1118	44.47	38.33	1096.00	39.5	37.1	1,087.4	260.7	1:5.91
T_7 - T_1 followed by T_2	29.26	29.26	29.26	43.33	40.00	1162	42.53	34.13	1130.00	38.2	36.3	1,129.1	302.4	1:5.17
T_8 - T_1 followed by T_3	29.57	29.57	29.57	40.00	28.33	1170	38.10	22.53	1141.17	36.8	30.9	1,122.0	295.3	1:7.86
T_9 - T_1 followed by T_4	26.07	26.07	26.07	38.33	35.00	1245	30.87	29.57	1225.50	34.2	32.1	1,233.8	407.1	1:10.4
T_{10} - T_1 followed by T_5	28.43	28.43	28.43	41.67	36.67	1240	38.37	30.83	1200.00	36.9	33.2	1,203.5	376.8	1:9.03
T_{11} – T_6 followed by T_1	26.60	26.60	26.60	35.00	31.11	1185	32.37	28.9	1160.00	34.0	32.3	1,163.9	337.2	1:7.04
T_{12} - Water spray (Control)	58.47	58.47	58.47	53.33	47.78	890	64.77	41.57	861.33	50.1	43.4	826.7	-	-
CD (p=0.05)	**5.70**	**5.70**	**5.70**	**3.97**	**3.25**	**216.09**	**2.245**	**1.308**	**171.22**	**3.3**	**3.6**	**105.74**	**-**	**-**
CV (%)	**9.38**	**9.38**	**9.38**	**11.64**	**9.54**	**11.78**	**2.879**	**2.279**	**9.55**	**4.8**	**5.9**	**5.89**	**-**	**-**
SEm (±)	**1.94**	**1.94**	**1.94**	**16.40**	**14.80**	**73.67**	**0.761**	**0.443**	**58.22**	**1.1**	**1.2**	**35.82**	**-**	**-**

Lowest disease intensity of 30.87 % and 29.57 % were recorded on leaf and pod stage respectively in treatment T_9 (Single spray of Mancozeb @ 0.2% followed by single spray of Difenconazole 25 EC @ 0.05%) with highest yield of 1225 Kg/ha. This treatment followed by treatment T_{10} (Single spray of Mancozeb @ 0.2% followed by single spray of Propiconazole 25 EC @ 0.05%) with yield of 1200 kg/ha against control where disease intensity of 64.77 % was observed on leaf and 41.57% on pod stage with yield of 861.33 Kg/ha.

When all the three years data were pooled, the table clearly indicates that all the treatments significantly controlled the severity of Alternaria blight. The lowest disease intensity of 34.2% and 32.1% were recorded on leaf and pod stage respectively in the treatment when single spray of Mancozeb 64% WP @ 0.2% followed by single spray of Difenconazole 25 EC @ 0.05% was given with highest yield of 1,233.8 Kg/ha. This treatment was followed by the treatment with single spray of Mancozeb @ 0.2% followed by single spray of Propiconazole 25 EC @ 0.05%
with yield of 1,203.5 kg/ha against control where disease intensity of 50.1 % was observed on leaf and 43.4% on pod stage with yield of 826.7 Kg/ha. These findings corroborate those of other workers such as Kaushik *et al.* (1983); Shivpuri *et al.* (1988); Khan *et al*. (1991); Chatopadhyaya and Baghchi (1994); Vishwanath and Kolte (1997); and Godika *et al.* (2001).

In context with incremental cost benefit ratio (ICBR), Highest (1:10.4) ICBR is obtained in the treatment when single spray of Mancozeb 64% WP @ 0.2% followed by single spray of Difenconazole 25 EC @ 0.05% which was followed by the treatment with single spray of Propiconazole 25 EC (0.05%) (1:10.13). This difference between the net profit and benefit ratios can perhaps be attributed to the cost of the fungicides involved. These results were corroborated by the finding of earlier workers, who reported some similar observations, Kolte *et al*., (1979), Mansour, (1980), Khan *et al*., (2007), Meena *et al*. (2011).

In conclusion, all the treatments significantly controlled the severity of Alternaria blight (AB) over control (Water spray). Highest yield of 1,233.8 Kg/ha and highest (1:10.4) incremental cost-benefit ratio (ICBR) with lowest disease intensity of 34.2% and 32.1% were recorded on leaf and pod stage, respectively in the treatment when single spray of Mancozeb 64% WP @ 0.2% followed by single spray of Difenconazole 25 EC @ 0.05% was given. Second best management practice has recorded disease intensity of 41.67% and 36.67% on leaf and pod stages, respectively, yield of 1240 Kg/ha with 1:9.03 incremental cost-benefit ratio when single spray of Mancozeb @ 0.2% followed by single spray of Propiconazole 25 EC @ 0.05% was given over control (disease intensity of 53.33% and 47.78% on leaf and pod stage respectively with yield of 890 Kg/ha). However, treatment with single spray of Propiconazole 25 EC (0.05%) gave second highest (1:10.13) incremental cost-benefit ratio, significantly minimizing Alternaria blight (AB) with significant higher yield (1,046.2 Kg/ha) over existing Alternaria blight management practice of single spray of Mancozeb (0.2%).

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