



Management of Alternaria Blight of Indian Mustard through Resistance Inducing Chemicals

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ABSTRACT

Field experiments were conducted to identify effective and economic resistance inducing chemicals for the management of Alternaria blight caused by *Alternaria brassicae* (Berk) Sacc. and *Alternaria brassicicola* (Schw.) Wiltshire under field condition by using Benzoic acid, Napthelic acetic acid, Salicylic acid, Phosphoric acid, Isonicotinic acid and Isonicotinic acid at 0.05 and 0.1% concentration. The entire test chemicals, reduced the disease severity on leaves and pods along with enhance yield as compared to check. Minimum disease severity of 25.33% and 27.06% on leaves and pods were recorded with Isonicotinic acid @ 0.1% followed by Benzoic acid @ 0.1% 28.66% and 30.0%, respectively. Maximum seed yield (1983.30 kg/ha) was also recorded with Isonicotinic acid @ 0.1% followed by same chemical @ 0.05% (1858.32 kg/ ha). Maximum net return with benefit cost ratio of 11.70 was recorded with application of Benzoic acid @ 0.05% followed by same chemical @ 0.10% (7.32).

Keywords : Indian mustard, resistance, Alternaria blight, management

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INTRODUCTION

The oilseed crops, especially *Brassica* spp., play a pivotal role in the agricultural economy of India. Rapeseed-mustard are most important *rabi* crops (Singh *et al.*, 2014). Alternaria blight is caused by *Alternaria brassicae* (Berk) Sacc. and *Alternaria brassicicola* (Schw) Wiltshire is one of the most important limiting factors, causing yield losses from 17 to 45% in mustard (*Brassica juncea* L.) (Singh and Singh, 2005^a; Singh and Singh, 2006, Kumar *et al.*, 2009) and even more severe losses (up to 70%) in rapeseed (*Brassica campestris*). The blight also reduces seed size and impairs seed colour and oil content. In the absence of resistant cultivars, fungicides and botanicals (Patani *et al.*, 2005; Singh and Singh, 2005^b and Singh *et al.*, 2013) provided the most reliable means of disease control. Induction of the host resistance through chemicals has not received much attention by the scientists (Singh and Singh, 2006). The efforts

were made to search efficacious and cheaper resistance inducing chemicals as compare to fungicide under field condition for the management of the disease.

MATERIALS AND METHODS

Field experiments were conducted at the University Experiment Station at Kumarganj (26°47'N, 82°12'E, 113 m mean sea level), Faizabad, Uttar Pradesh during *rabi* 2012-13 seasons following recommended agronomic practices including nutrient management *i.e.* 120Kg N, 60Kg P, 60Kg/ha. The cultivar 'varuna' was sown in first week of November in randomized block design having 4m x 3m plot size with 30x10 cm plant spacing in three replications. The effectiveness of different resistance inducing chemicals *viz.* Benzoic acid, Napthelic acetic acid, Salicylic acid, Phosphoric acid, Isonicotinic acid and Isonicotinic acid at 0.05 and 0.1% concentration along with fungicide Mancozeb @ 0.25% were tested against the disease severity and seed yield of the crop. The required amount of each chemical was calculated, weighed and the spray solution was prepared with

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inorganic solvent, then volume was made up to desired level and was sprayed by using high volume Knap-sak sprayer of 10 litre capacity. Three sprays of each chemical, first at appearance of the disease and remaining two after 15 days intervals were applied. The severity of the disease was assessed one week after last spray using 0-6 point scale (0 = No disease; 1 = Up to 5% leaf area infected; 2 = > 5% to 10% leaf area infected; 3 = >10% to 20% leaf area infected; 4 = >20% to 30% leaf area infected; 5 = >30% to 50% leaf area infected and 6 = >50% leaf area infected) and the per cent disease intensity (PDI) was calculated as per formula (Eq. 1) given below:

$$PDI = \frac{\text{Sum of total numerical ratings}}{\text{Total number of leaves observed}} \times \frac{100}{\text{Highest grade}} \quad (\text{Eq. 1})$$

The yield of each plots were recorded in each treatment separately to see the differences and

treatment by using the following formula:

$$\text{Benefit Cost Ratio} = \frac{\text{Additional Income}}{\text{Total cost involved in production}} \quad (\text{Eq. 3})$$

RESULTS AND DISCUSSION

The perusal of table-1 revealed that all the chemicals significantly reduced the disease severity in comparison to untreated plot. The per cent disease severity on leaves after last spray was recorded minimum with Isonicotinic acid @ 0.1% (25.33%) followed by fungicide Mancozeb @ 0.25% (28.06%), Benzoic acid @ 0.1% (28.66), NAA @ 0.10% (30.46%), Isonicotinic acid @ 0.05% (32.06%) and Salicylic acid @ 0.10% (32.26), respectively but statistically all were at par with each other. The maximum per cent disease intensity of 64.30 was found in untreated plot.

Table 1 : Effect of chemicals on blight severity and seed yield of mustard cv. Varuna

Treatment	Plant height (cm)	Per cent disease intensity		1000 Weight (g)	Avoidable Weight loss(%)	Seed (kg/ha)	Avoidable loss (%)
		On Leaves	On Pods				
Benzoic acid 0.05%	174.13	36.66 (37.22)	35.80 (36.75)	5.63	8.06	1708.30	2.683
Benzoic acid 0.10%	173.83	28.66 (32.31)	30.00 (33.2)	5.65	10.90	1833.30	31.822
Napthalic acetic acid 0.05%	171.03	39.33 (38.83)	40.00 (39.27)	5.56	11.87	1674.93	25.376
Napthalic acetic acid 0.10%	169.80	30.46 (33.44)	38.66 (38.42)	5.53	11.39	1804.99	30.754
Salicylic acid 0.05%	190.56	42.43 (40.64)	40.33 (39.42)	5.60	12.50	1596.60	21.714
Salicylic acid 0.10%	189.66	32.26 (34.60)	39.60 (38.99)	5.30	7.54	1666.66	25.005
Phosphoric acid 0.05%	188.66	46.83 (43.18)	41.20 (39.93)	5.36	8.58	1383.32	9.644
Phosphoric acid 0.10%	187.10	35.50 (36.56)	40.53 (39.54)	5.63	12.43	1499.99	16.673
Isonicotinic acid 0.05%	180.40	32.06 (34.48)	30.66 (33.62)	5.733	11.39	1858.32	32.740
Isonicotinic acid 0.10%	184.90	25.33 (30.21)	27.06 (31.34)	5.85	14.52	1983.30	36.978
Mancozeb 0.25%	184.90	28.06 (31.97)	41.20 (39.92)	5.06	3.16	1804.90	30.749
Control	156.13	64.30 (53.36)	53.46 (46.1)	4.90		1249.90	
SEm±	2.72	1.11	0.72	5.37		54.16	2.72
LSD 0.05	7.98	3.25	2.11	0.36		158.33	7.98

Figure in parenthesis are angular transformed value.

yield/ha was calculated. The avoidable yield loss (AYL) was calculated by employing following formula (Eq. 2):

$$AYL = \frac{Y_p - Y_{up}}{Y_p} \times 100 \quad (\text{Eq. 2})$$

Where,

Y_p = yield under protected conditions

Y_{up} = yield under unprotected conditions

The benefit-cost ratio ((Eq. 3) was calculated, on the basis of seed yield of each

In case of pod infection, all the treatments also significantly reduced the disease severity as compared to control plot. Minimum disease severity of 27.06% was recorded with Isonicotinic acid @ 0.10% followed by Benzoic acid 0.10% (30.0%), Isonicotinic acid @ 0.05% (30.66) and Benzoic acid 0.05% (35.80%), respectively. Maximum plant height was recorded with Salicylic acid @ 0.05% (190.56 cm) followed by the same chemical @ 0.10% (189.66 cm), Phosphoric acid @ 0.05% (188.66 cm) Phosphoric acid @ 0.10% (187.10 cm) as compared to untreated plot (156.33 cm).

All the treatments also increased the seed yield over check (untreated control) significantly. Maximum seed yield of 1983.30 kg/h was recorded with the treatment Isonicotinic acid @ 0.10% followed by same chemical @ 0.05% (1858.32 kg/h) and Benzoic acid @ 0.10% (1833.3 kg/h), respectively which were at par with each other. The latter was also at par with treatments NAA @ 0.10% (1804.99kg/ ha), Mancozeb @ 0.025% (1804.9 kg/h), Benzoic acid @ 0.05% (1708.3 kg/h), NAA @ 0.05% (1674.93 kg/h), and Salicylic acid @ 0.10% (1666.66 kg/h), respectively. Highest test weight was also recorded with Isonicotinic acid 0.10% (5.85g) followed by same chemical at 0.05 % concentration (5.73g), and Benzoic acid @ 0.10% (5.65g).

acid @ 0.10% > Salicylic acid @ 0.05% > Mancozeb @ 0.025% > Salicylic acid @ 0.10% > Phosphoric acid @ 0.05% > Phosphoric acid @ 0.10% > Isonicotinic acid @ 0.05% > Isonicotinic acid @ 0.10% > NAA @ 0.05% > NAA @ 0.10%. The maximum benefit cost ratio (11.70) was obtained with Benzoic acid @ 0.05% followed by Benzoic acid @ 0.10% (7.32) Salicylic acid @ 0.05% (4.77), respectively (Table 2).

Concurrent with present findings Concurrent with present finding, Atwal *et al.*, (2004) also reported the effectivity of Salicylic acid against *Alternaria brassicae* causing blight disease in mustard, while Singh and Singh (2006) reported maximum effective NAA followed by Salicylic acid against *Alternaria* blight of linseed. Sanjula *et al.*, (2010)

Table 2 : Economics of different treatment

Treatment and doses	Yield (kg/ha)	Yield increase over control (kg/ha)	Additional income (Rs./ha)	Cost of treatment (Rs./ha)	Net Income (Rs./ha)	Benefit cost ratio
Benzoic acid 0.05%	1708.30	458.40	13978.15	1100.0	12878.15	11.70
Benzoic acid 0.10%	1833.30	583.40	17946.20	2155.0	15791.20	7.32
Napthalic acetic acid 0.05%	1674.93	425.03	12963.50	11045.0	1918.50	0.17
Napthalic acetic acid 0.10%	1804.99	555.09	16930.20	21145.0	-4214.80	-0.19
Salicylic acid 0.05%	1596.6	346.70	10574.35	1837.5	8736.85	4.75
Salicylic acid 0.10%	1666.66	416.76	12711.18	2730.0	9981.18	3.65
Phasporic acid 0.05%	1383.32	133.42	4069.30	1905.0	2164.31	1.13
Phasporic acid 0.10%	1499.99	250.09	7627.77	2850.0	4777.70	1.67
Isonicotinic acid 0.05%	1858.32	608.42	18556.81	6620.0	11936.81	1.80
Isonicotinic acid 0.10%	1983.30	733.40	22368.70	12295.0	10073.70	0.81
Mancozeb 0.25%	1804.90	555.00	16927.50	3345.0	13582.50	4.00
Control	1249.90					

Mustard price- Rs. 3050/q; Labour charge- Rs. 100/day ; Spray charge- Rs. 15/day; Benzoic acid- Rs. 500/kg ; NAA-Rs. 800/100g; Salicylic acid- Rs. 720/kg; Phosphoric acid-Rs. 4540/kg;

All the treatments avoided test weight loss of 3.16 % to 14.52%, maximum being with Isonicotinic acid 0.10% followed by Salicylic acid @ 0.05% (12.5%), Phosphoric acid @ 0.10% (12.43%) and Isonicotinic acid @ 0.05% (11.39%), respectively (Table 1). Yield loss was also avoided from 9.677 to 36.978 per cent with different treatment. Maximum yield loss of 36.978 per cent was avoided with treatment Isonicotinic acid @ 0.10% followed by Isonicotinic acid @ 0.05 % with avoidable loss of 32.74 per cent and Benzoic acid @ 0.10% with 31.82 per cent, NAA @ 0.10% with 30.75 per cent, respectively.

On the basis of benefit-cost ratio all the chemicals were ranked as Benzoic acid @ 0.05% > Benzoic

have reported effective Salicylic acid with combination of Benzothiadiazole in defense mechanism by increasing peroxidase activity and Phenolic content in the host against the *Alternaria brassicae*.

CONCLUSION

It was concluded from this experiment that all the test chemicals, reduced the disease severity on leaves and pods along with enhance yield as compared to check. Minimum disease severity of 25.33% and 27.06% on leaves and pods were recorded with Isonicotinic acid @ 0.1%. Consequently maximum seed yield (1983.30 kg/ha) was also recorded with Isonicotinic acid @

0.1%. Application of Isonicotinic acid @ 0.1% is recommended for efficient management of *Alternaria brassicae* causing blight disease in mustard.

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