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Management of purple blotch of onion caused by *Alternaria porri* by using some novel fungicides under field condition in western Odisha

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ABSTRACT

A field experiment was conducted at Regional Research and Technology Transfer Station, OUAT, Chiplima, Sambalpur, Odisha, India for the management of purple blotch of onion. From the experiment it was found that all the treatments were effective to reduce the severity of the disease as compared to untreated control. Among the treatments, seed treated with Carboxin 37.5%+Thiram 37.5%@ 2g/kg and three foliar sprays of Trifloxystrobin + Tebuconazole @0.4g/l of water at 10 days interval starting from initiation of the disease was most effective in reducing the purple blotch disease of onion (69.5% disease control) and was closely followed by seed treated with Carboxin 37.5%+Thiram 37.5% @ 2 g/kg and three foliar sprays of Tebuconazole @ 1.0ml/l of water (62.3% disease control). A maximum increase of yield (83.4%) with highest cost benefit ratio (1.97) was also achieved with the same treatment.

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INTRODUCTION

Onion (*Allium cepa* L.) is one of the most useful spice crop as well as vegetable crop in India. During the year 2017-18 area under onion in India was 1285 thousand hectare, production was 23262 thousand MT and productivity was 18.1 MT/ha (Anonymous, 2018). The prominent onion growing states are Maharastra, Gujarat, Uttar Pradesh, Odisha, Karnataka, Tamil Nadu and Andhra Pradesh (Kareem *et al.,* 2018). In the state of Odisha, area, production and productivity of onion were 33.47 thousand hectare, 379.34 thousand MT and 11.33 MT/ha, respectively during 2017-18 (Anonymous, 2018). Onion crop is attacked by 66 diseases out of which 10 are bacterial, 38 fungal, 6 by nematodes, 3 viral, 1 phytoplasmal, 1 by phanerogamic plant parasite and 7 miscellaneous diseases and disorders (Wanggikar *et al*., 2014 and Yadav *et al.,* 2013). Among the fungal diseases

Purple blotch caused by *Alternaria porri* is a serious disease of onion (Chethana *et al*., 2012 and Savitha *et al.,* 2014) which is prevalent in almost all onion growing areas in India. The disease affects both bulb and seed production (Dhiman and Chadha, 1986) by breaking of floral stalks (Ahmed and Hossain, 1985 and Munoz *et al.*, 1984). Temperature and humidity are two important weather parameters for development and progression of the disease. The disease is favoured by moderate temperature varying from 24-30^0 C and high relative humidity of more than 90 per cent (Rodriguez *et al.,* 1994).

Typical symptoms of the disease appear on foliage and on foliage sheath. Small white sunken spots develop on the leaves which enlarge, become zonate and under moist conditions, turn purple and are also prominent on the inflorescence and stalks. In moist weather the surface of the spot is covered with brown or almost black sporulation of the fungus. At harvest time or later, the bulbs of the affected plants may show decay (Singh, 2013).

Yield loss due to the disease depends upon several factors. The yield loss of onion in India due to this disease under favourable condition varies from 5.0 to 96 per cent (Gupta and Pathak, 1988 and Gupta *et al.,* 1994). It is also reported that yield losses may extend upto 100 per cent due to purple blotch disease (Sharma, 1986 and Shahanaz *et al.,* 2007).

Keeping all these points in view, the present investigation was carried out to find out the most suitable fungicide to manage purple blotch of onion disease in western Odisha.

MATERIAL AND METHODS

An experiment was conducted for the management of purple blotch of onion, during two consecutive years *i.e.,* 2017-18 and 2018-19 in the research field of Regional Research and Technology Transfer Station, Chiplima, Sambalpur, Odisha, India (20^{0}21'N latitude and 80^{0}55'E longitude with an elevation of 178.8 m above mean sea level) to study the effect of certain selected novel fungicides *viz.,* Carboxin 37.5%+Thiram 37.5% (Vitavax power), Azoxystrobin 23 SC (Mirador), Tebuconazole 250 EC (Folicur), Propiconazole 25EC (Tilt), Hexaconazole 5SC (Contaf plus), Difenoconazole 25 EC (Score), Mancozeb 75 WP (Indofil M-45), Chlorothalonil 75WP (Kavach), Tebuconazole+trifloxystrobin75 WG (Nativo). A popular onion variety of the region, Nasik Red (N-53) was used for the study. Thirty days old seedlings were transplanted in plots of 5 x 3 m (15 m^2 area) with a spacing of 15 x 10 cm in Randomized Block Design with 10 treatments and 3 replications. Fertilization and all other agronomic practices were followed as per the local recommendations. Natural occurrence of the disease was permitted. A total of nine fungicides were tested along with an untreated control.

The list of different fungicides used for the study along with their dose, nature, trade name and source are mentioned in Table A. The first spraying of all the treatments was done at 35 days after transplanting and a second and third spraying was given 10 days interval.

The purple blotch disease intensity was recorded applying 0-5 point disease rating scale (Mayee and Datar, 1986). The scales are given in Table B.

Table A : List of fungicides used against purple blotch disease of onion

Sr. No.	Active ingredients	Dose	Nature	Trade Name	Source
1.	Carboxin 37.5%+Thiram 37.5%	2.0 g/ kg seed	Systemic + contact	Vitavax power	Dhanuka
2.	Azoxystrobin 23 SC	1.0 ml/l	Systemic	Mirador	Adama
3.	Tebuconazole 250 EC	1.0 ml/l	Systemic	Folicur	Bayer
4.	Propiconazole 25EC	1.0 ml/l	Systemic	Tilt	Syngenta
5.	Hexaconazole 5SC	2.0 ml/l	Systemic	Contaf plus	Tata Rallis
6.	Difenoconazole 25 EC	0.6 ml/l	Systemic	Score	Syngenta
7.	Mancozeb 75 WP	2.5 g /l	Contact	Indofil M 45	Indofil
8.	Tebuconazole+trifloxystrobin75 WG	0.4 g /l	Systemic	Nativo	Bayer
9.	Chlorothalonil 75 WP	2.0 g/l	Contact	Kavach	Syngenta

Table B : Disease rating scale	
Score/grade	Description
0	Healthy (no disease)
1	Traces (<5% leaf area affected)
2	Light (6-10% leaf area affected)
3	Moderate (11-25% leaf area affected)
4	High (26-50% leaf area affected)
5	Very high (> 50% leaf area affected)

Based on numerical ratings/scale observed, per cent disease intensity (PDI) was worked out applying the formula given by Mckinny (1923):

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{No. of observations x Maxmimum rating}} x100$$

The yield of onion was recorded from each plot on weight basis and computed to per ha. Cost benefit ratio was calculated in all the treatments.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

All the treatments were statistically significant in checking the disease compared to untreated control (Table 1). During 2017-18 the lowest disease severity of 18.67% was recorded in seed treatment with Carboxin 37.5%+Thiram 37.5% @2 g/kg and three foliar sprays of Trifloxystrobin + Tebuconazole @ 0.4g/l as compared to untreated control. It was followed by seed treatment with Carboxin 37.5%+Thiram 37.5% @ 2 g/kg and three foliar sprays of spraying of Tebuconazole @ 1.0ml/l. Similar trend were also observed during 2018-19. The least disease severity of 12.67 per cent was recorded in seed treatment with Carboxin 37.5%+Thiram 37.5% @ 2 g/kg and three foliar sprays of Trifloxystrobin + Tebuconazole @ 0.4g/l as compared to untreated control. It was followed by seed treatment with Carboxin 37.5%+Thiram 37.5% @ 2 g/kg and three foliar sprays of Tebuconazole @ 1.0ml/l.

The pooled data in respect of disease severity of purple blotch revealed that, the lowest severity *i.e.*, 15.67 per cent was found in seed treatment with Carboxin 37.5%+Thiram 37.5% @2 g/kg and three foliar sprays of Trifloxystrobin + Tebuconazole @ 0.4g/l. The highest per cent efficacy of disease control *i.e.* 69.5 per cent was achieved with the same treatment. The next best treatment was seed treatment with Carboxin 37.5%+ Thiram 37.5%@2 g/kg and three foliar sprays of spraying of Tebuconazole @ 1.0ml/l which performed 62.3 per cent disease control over untreated control plot.

Seed treatment followed by foliar spraying of fungicides can effectively manage the alternaria blight disease (Maude, 1977 and Mandal *et al.,* 2019). The present findings are in agreement with Aujla *et al.* (2013). They also reported maximum per cent disease control

Table 1 : Effect of different treatment on purple blotch disease severity in onion during *Rabi*, 2017-18 and 2018-19

Sr. No.	Treatments	Per cent disease index (PDI)			PEDC**
		2017-18	2018-19	Pooled	
1.	T_1 =Seed Treatment with Carboxin 37.5%+Thiram 37.5%@ 2 gm/kg (ST)	38.67 (38.40)*	34.67 (36.03)	36.67 (37.22)	28.6
2.	T_2= ST + Spraying of Azoxystrobin @ 1.0ml/l	31.33 (34.0)	28.0 (31.85)	29.67 (32.94)	42.2
3.	T_3= ST + Spraying of Tebuconazole @ 1.0ml/l	20.67 (27.0)	18.0 (25.07)	19.33 (26.03)	62.3
4.	T_4= ST + Spraying of Propiconazole @ 1.0ml/l	28.0 (31.85)	30.67 (33.60)	29.33 (32.75)	42.9
5.	T_5= ST + Spraying of Hexaconazole @ 2ml/l	30.67 (33.54)	28.67 (32.30)	29.67 (32.93)	42.2
6.	T_6= ST + Spraying of Difenoconazole @ 0.6ml/l	26.67 (31.03)	25.33 (30.18)	26.0 (30.61)	49.3
7.	T_7= ST + Spraying of Mancozeb @ 2.5g/l	24.67 (29.71)	26.67 (31.06)	25.67 (30.40)	50.0
8.	T_8= ST + Spraying of Chlorothalonil @ 2.0g/l	22.0 (27.90)	24.67 (29.71)	23.33 (28.85)	54.5
9.	T_9= ST + Spraying of Trifloxystrobin + Tebuconazole @ 0.4g/l	18.67 (25.54)	12.67 (20.75)	15.67 (23.27)	69.5
10.	T_{10}= Untreated control	52.0 (46.15)	50.67 (45.36)	51.33 (45.75)	-
C.D. (P=0.05)		5.73	4.57	4.71	-
SE (m)		1.91	1.53	1.57	-

* Figure in the parenthesis is angular transformed value. **PEDC= Per cent efficacy of disease control

Table 2 : Effect of different treatment of yield in onion during *Rabi* 2017-18 and 2018-19

Sr. No.	Treatments	Yield (q/ha)			Percent increase yield over control	B:C ratio
		2017-18	2018-19	Pooled		
1.	T_1 =Seed Treatment with Carboxin 37.5%+Thiram 37.5%@ 2 gm/kg (ST)	128.89	123.34	126.12	8.6	1.26
2.	T_2= ST + Spraying of Azoxystrobin @ 1.0ml/l	155.56	143.33	149.45	28.7	1.28
3.	T_3= ST + Spraying of Tebuconazole @ 1.0ml/l	213.34	191.12	202.23	74.2	1.63
4.	T_4= ST + Spraying of Propiconazole @ 1.0ml/l	166.67	151.11	158.89	36.8	1.54
5.	T_5= ST + Spraying of Hexaconazole @ 2 ml/l	148.89	138.89	143.89	23.9	1.39
6.	T_6= ST + Spraying of Difenoconazole @ 0.6ml/l	162.23	146.67	154.45	24.8	1.48
7.	T_7= ST + Spraying of Mancozeb @ 2.5g/l	198.89	178.9	188.9	62.7	1.89
8.	T_8= ST + Spraying of Chlorothalonil @ 2.0gm/l	206.67	185.56	196.12	68.9	1.91
9.	T_9= ST + Spraying of Trifloxystrobin + Tebuconazole @ 0.4g/l	221.45	204.45	212.95	83.4	1.97
10.	T_{10}= Untreated control	117.78	114.45	116.12	-	1.17
C.D. (P=0.05)		40.97	31.04	27.02	-	-
SE (m)		13.68	10.37	9.03	-	-

with foliar sprays of Trifloxystrobin + Tebuconazole @ 0.6g/l. Further, foliar sprays of Tebuconazole 25 EC (Folicur) @0.1 per cent at fortnightly interval most effectively managed purple blotch complex of onion under field conditions (Yadav *et al.,* 2017).

The data in respect of bulb yield in onion during *Rabi*, 2017-18 and 2018-19 is presented in Table 3. From the pooled data significantly minimum yield was observed in untreated control (116.12q/ha). Maximum yield of onion was recorded due to seed treatment with Carboxin 37.5%+Thiram 37.5% @2 g/kg and three foliar sprays of Trifloxystrobin + Tebuconazole @ 0.4g /l (212.95 q/ ha). The same treatment recorded 83.4% yield increase over control and highest cost benefit ratio (1.97). The next best yield (202.23q/ha) was obtained from seed treatment with Carboxin 37.5%+Thiram 37.5% @ 2 g/ kg and three foliar sprays of spraying of Tebuconazole @ 1.0ml /l.

Maximum seed yield (106.0 kg/acre) was also recorded in case of Nativo -75WG @ 0.06 per cent and avoided 33.5 per cent yield loss by Aujla *et al.* (2013) which is inline with present findings.

Yadav *et al.* (2017) also recorded highest bulb yield in Trifloxystrobin 25%+ Tebuconazole 50%WG (18.54 t/ha) followed by Tebuconazole 25 EC (18.12 t/ha) and Difenoconazole 25 EC (17.64 t/ha), respectively.

So, seed treatment of onion variety Nasik Red (N-53) having 135 days crop duration with Carboxin 37.5%+Thiram 37.5% @ 2g/kg of seed and three spraying with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.4 g/lit of water (T_9) at 10 days interval starting from initiation of the disease (35 DAT) was most effective in reducing the purple blotch disease of onion by 69.5 per cent and increasing the bulb yield by 83.4 per cent (212.95q/ha) in comparison to untreated control (T_{10}).

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