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To Evaluate the Effectiveness of Fungicides and Bio-pesticides Against Purple Blotch in *kharif* Onion

M.K. Pandey[1]*, P.K. Gupta[2], R.C. Gupta[3] and M.K. Pathak[4]

[1]Technical Officer, Department of Plant Pathology, Regional Research Station (RRS), National Horticultural Research and Development Foundation (NHRDF), Nashik (Maharashtra), India.
[2]Director, National Horticultural Research and Development Foundation (New Delhi), India.
[3]Assistant Director, Department of Plant Pathology, Regional Research Station (RRS), National Horticultural Research and Development Foundation (NHRDF), Nashik (Maharashtra), India.
[4]Technical Officer, Department of Entomology, Regional Research Station (RRS), National Horticultural Research and Development Foundation (NHRDF), Karnal (Haryana), India.

(Corresponding author: M.K. Pandey)*
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ABSTRACT: Purple blotch, a fungal disease in onion is one of the major causes of incurred loss of onion bulbs in Kharif season. This present study aimed to determine the effectiveness of different fungicides and bio - pesticides against purple blotch disease of onion in field conditions. A field trial was carried out at Regional Research station, NHRDF, Nashik for two consecutive years during *Kharif* 2019 and 2020 on onion variety Agrifound Dark Red for the management of purple blotch disease of onion through sequential spray of different fungicides with bio - pesticides. The result showed that, significantly minimum purple blotch incidence (38.75%) with intensity (4.65%) and highest gross yield (163.47 q/ha) with marketable (130.17q/ha) were recorded in Spray of Propiconazole @ 0.15 % at 30 DAT + spray of *Ps. fluorescencs* @ 5.0g/L at 45DAT + spray of Trifloxystrobin 25% + Tebuconazole 50%@0.2% at 60 DAT + spray of *T. viride* @5.0g/ L at 75DAT.

Keywords: Onion, Purple blotch, Incidence, Intensity, Bio-pesticides, Fungicides.

INTRODUCTION

Onion is commercially important, bulbous crop that covers large area of production. In India, all the three agri-seasons *viz*., *rabi, kharif* and *late Kharif,* witness the production of onion crop, however, the production efficiency varies with season. Onion bulbs are vulnerable to attack of various foliar diseases that reduce their quality and yield (Cramer, 2000). The fungus, *Alternaria porri,* causal agent of purple blotch disease majorly affects the onion bulbs during *kharif* season in India.

In India, under favorable conditions, purple blotch fungus causes yield loss in onion crops, that varies from 5.0-96.5 % (Mishra and Gupta 2008). The purple blotch is reported to have widespread occurrence throughout the country and chiefly responsible for low productivity of onion along with Stemphylium blight disease (Gupta *et al*., 1996). Studies have found, abrasions on onion bulbs enclose spores of either *Altenaria porri* alone or *Stemphylium vasicarium* alone or mixture of both that are morphologically complex to differentiate (Suheri and Price 2000; Uddin *et al*., 2006). However, studies have demonstrated, primarily *Stemphylim vasicarium* invades the bulb and initiates infection, followed by the invasion of *Alterneria porri* that, upsurges the infection and hence, the disease is designated as purple blotch. It is required to have protective measures to mitigate the emergence of diseases in onion crops for obtaining maximum yield. In this view, many workers have reported that, a plant growth promoting rhizobacteria (PGPR), *Psedomonas fluorescens* have antagonistic capacity against harmful plant pathogens and helps in inducing systemic resistant (Glick, 1995; Hoffland *et al.,* 1996). Now at this time several fungicides and bio pesticides available in the market, which are required to be evaluated for their effectiveness against purple blotch of onion under, field conditions in *kharif* season. Keeping in the view, an experimental trial was designed for onion variety Agrifound Dark Red during *kharif*, 2019 and 2020 at RRS, Nashik to evaluate the efficiency of various fungicides and bio-pesticides against purple blotch.

MATERIALS AND METHODS

The experiment was piloted at Research Farm of National Horticultural Research and Development Foundation (NHRDF), Regional Research Station (RRS) Nashik, Maharashtra for the two consecutive *Kharif* season (2019 and 2020) on the Agrifound Dark Red variety of onion.

The raised bed of 3.0 × 1.2 m in size was made to transplant the seedlings at the space of 15.0cm × 10.0 cm. The trial was designed with Randomized Block Design with four replications. Four sequential foliar sprays of fungicides and bio – pesticides were done, starting after 30 days of transplanting, at the interval of

15 days. The standard practices of agriculture were followed unvaryingly for all the treatments. Optimum moisture was maintained in soil through regular irrigation. The data was recorded for the incidence and intensity of purple blotch before each spray. Scoring of the disease was done on the scale of 0-5, while Percent Disease Index (PDI) or disease intensity was recorded as described by Wheeler (1969). The percent disease control (PDC) for the crop was also recorded. After attaining maturity crop was harvested from all the treatments for further assessment. The harvested bulbs were dried and cured separately for each treatment. The pesticide residue was estimated in the Pesticide Residue Analysis Laboratory, NHRDF Chittegaon, Nashik, by using the technique of gas chromatophy and tandem mass spectrometry (GC MS/MS) and liquid chromatophy and tandem mass spectrometry (LC MS/MS). Standard method for pesticide analysis was followed at recovery ranges between 80% - 120% with relative standard deviation (RSD) < 10%. Finally, gross and marketable yield of onion bulbs were recorded.

The details of treatments are as follow:

T_1: Spray of Propiconazole @ 0.15 % at 30 DAT + spray of *Ps. fluorescencs* @ 5.0g/L at 45DAT + spray of Trifloxystrobin 25% + Tebuconazole 50%@0.2% at 60 DAT + spray of *T. viride* @5.0g/L at 75DAT.

T_2: Spray of *Ps. fluorescencs*@ 5.0g/L at 30 DAT + spray of Tricylazole @0.2% at 45DAT + spray of *T. viride* @5.0g/L at 60 DAT + Hexaconazole @ 0.2% at 75DAT.

T_3: Spray of Difenaconazole @0.2% at 30 DAT+ *Bacillus subtillis* @5.0g/L at 45DAT + Carbendazim @ 0.1%at 60 DAT +*Bacillus subtillis* @5.0g/Lat 75DAT.

T_4: Spray of *Bacillus subtillis* @5.0g/L at 30 DAT + Mancozeb @0.25% at 45 DAT + *Bacillus subtillis* @5.0g/L at 60 DAT + Azoxystrobin @ 0.1% at 75DAT.

T_5: Control.

RESULTS AND DISCUSSION

***Kharif*, 2019.** Purple blotch disease was not appeared before first spray at 30 days after transplanting and before second spray at 45 days after transplanting in all treatments including control. The data presented in table 1 revealed that incidence of purple blotch disease was observed before the third spray at 60 days after transplanting with significantly lowest intensity (0.90%) and incidence (15.0%) in treatment T_1 (Spray of Propiconazole @ 0.15% at 30 DAT + spray of *Ps. fluorescens* @ 5.0g/L at 45 DAT + spray of Trifloxistrobin 25% + Tebuconazole 50% @ 0.2% at 60 DAT + spray of *T. viride* @ 5.0g/L at 75 DAT). The disease intensity (2.7%) and incidence (37.5%) was recorded in untreated control (T_5) before the third spray at 60 DAT. The significantly lowest intensity (6.1%) and incidence (32.5%) was recorded in onion bulbs of treatment T_1 before fourth spray also at 75 days after transplanting while, the highest disease intensity (9.3%) and incidence (67.5%) was recorded in untreated control during the same period of observations.

Yield: Onion bulbs of treatment T_1, showed the highest gross yield (181.73 q/ha) and marketable yield (127.36 q/ha) while, the gross yield was found at par with treatment T_2. The lowest gross yield (126.46 q/ha) and marketable yield (90.83 q/ha) were noted in untreated control.

Table 1: Management of purple blotch in onion through sequential spray of different fungicides with bio-pesticides and their residue status during *Kharif,* 2019.

Treatments	Purple blotch disease incidence and intensity								Gross yield (q/ha)	Marketable yield (q/ha)
	Before 3rd Spray at 60 DAT				Before 4th Spray at 75 DAT					
	Incidence (%)		Intensity (%)		Incidence (%)		Intensity (%)			
T_1	15.00	(22.50)	0.90	(1.18)	32.50	(34.72)	6.10	(2.57)	181.73	127.36
T_2	22.50	(28.23)	1.30	(1.34)	45.00	(42.12)	7.50	(2.83)	174.30	118.67
T_3	22.50	(28.23)	1.70	(1.48)	55.00	(47.88)	8.00	(2.91)	165.13	114.65
T_4	32.50	(34.72)	2.50	(1.73)	65.00	(53.78)	8.20	(2.95)	156.32	106.87
T_5	37.50	(37.73)	2.70	(1.79)	67.50	(55.28)	9.30	(3.13)	126.46	90.83
S.Em±	**-**	**2.65**	**-**	**0.08**	**-**	**2.39**	**-**	**0.09**	**5.64**	**2.54**
CD at 5%	**-**	**5.77**	**-**	**0.17**	**-**	**5.21**	**-**	**0.20**	**12.29**	**5.53**
CV %	**-**	**12.36**	**-**	**7.18**	**-**	**7.22**	**-**	**4.19**	**4.96**	**3.21**

Note: Data in the parenthesis shows Square root/*arcsine transformed values.

***Kharif*, 2020.** Purple blotch disease was not appeared before first spray at 30 days after transplanting and before 2nd spray at 45 days after transplanting in all treatments including control. The data in table-2 demonstrates, that purple blotch disease appeared before third spray at 60 days after transplanting with significantly lowest intensity (1.7%) and incidence (25.%) in treatment T_1 (Spray of Propiconazole @ 0.15% at 30 DAT + spray of *Ps. fluorescens* @ 5.0g/L at 45 DAT + spray of Trifloxistrobin 25%+Tebuconazole 50%@ 0.2% at 60 DAT + spray of *T. viride* @ 5.0g/L at 75 DAT). The disease intensity and incidence were recorded as 4.0% and 45.0%, respectively in untreated control before third spray at 60 DAT. Further, the significantly lowest intensity (3.20%) was recorded in treatment T_1 before fourth spray also at 75 days after transplanting. The lowest incidence (45.0%) was also recorded in treatment T_1 and it was found at par with treatment T_2. The highest disease intensity (5.6%) and incidence (65.0%) were recorded in untreated control during the same period of observations.

Yield: The highest gross yield (145.20 q/ha) and marketable yield (132.98 q/ha) were also recorded in treatment T_1 and it was found at par with treatment T_2. The lowest gross yield (105.61 q/ha) and marketable yield (97.08 q/ha) were recorded in untreated control.

Table 2: Management of purple blotch in onion through sequential spray of different fungicides with bio-pesticides and their residue status during *kharif*, 2020.

Treatments	Purple blotch								Gross yield (q/ha)	Marketable yield (q/ha)
	Before 3rd Spray at 60 DAT				Before 4th Spray at 75 DAT					
	Incidence (%)		Intensity (%)		Incidence (%)		Intensity (%)			
T_1	25.00	(29.89)	1.70	(1.48)	45.00	(42.12)	3.20	(1.92)	145.20	132.98
T_2	30.00	(33.21)	2.00	(1.58)	50.00	(45.00)	3.60	(2.02)	138.19	124.37
T_3	32.50	(34.72)	2.40	(1.70)	55.00	(47.95)	4.20	(2.16)	128.12	112.84
T_4	35.00	(36.22)	3.20	(1.92)	55.00	(47.88)	4.70	(2.27)	112.36	103.19
T_5	45.00	(42.12)	4.00	(2.11)	65.00	(53.78)	5.60	(2.47)	105.61	97.08
S.Em±	**-**	**1.79**	**-**	**0.07**	**-**	**3.10**	**-**	**0.09**	**3.74**	**4.03**
CD at 5%	**-**	**3.90**	**-**	**0.15**	**-**	**6.75**	**-**	**0.20**	**8.15**	**8.78**
CV %	**-**	**7.17**	**-**	**5.79**	**-**	**9.27**	**-**	**5.79**	**4.20**	**4.99**

Note: Data in the parenthesis shows Square root/*arcsine transformed values

Combined data (*Kharif*, 2019 and 2020). The collective data of two years represented in Table -3 reveals that, significantly lowest intensity (1.30%) and incidence (20.0%) of purple blotch were recorded in treatment T_1 (Spray of Propiconazole @ 0.15% at 30 DAT + spray of *Ps. fluorescens* @ 5.0g/L at 45 DAT + spray of Trifloxistrobin 25% + Tebuconazole 50% @ 0.2% at 60 DAT + spray of *T. viride*@ 5.0g/L at 75 DAT) at 60 DAT. The disease intensity and incidence were recorded as 3.35% and 41.25%, respectively in untreated control before third spray at 60 DAT. Further, the significantly lowest intensity (4.65%) and incidence (38.75%) were recorded in treatment T_1 before fourth spray also at 75 DAT. The highest disease intensity (7.45%) and incidence (66.25%) were recorded in untreated control during the same period of observations. The findings of the current study are in accordance with the reports by Abdel-Hafez *et al.* (2014) who suggested that use of plant extract and bio agents as an effective agent to reduce the incidence of purple blotch disease of onion. Kamal *et al.* (2017) reported that use of bio-agents were most effective in reducing stemphylium blight disease as well as increased seed yield of onion. Jhala and Mali (2017) reported use of Difenaconazole and Azadirachtin can be effective to control of purple blotch disease in onion. Henery *et al.* (2011); Hill *et al.* (2013) also suggested that the tebucanazole and propiconazole fungicides control of purple blotch disease. Yadav *et al.* (2017) reported that tebuconazole most effective in reducing the purple blotch disease. Deshmukh *et al.* (2007), reported that tebuconazole and propiconazole fungicides control the purple blotch disease.

Yield: The highest gross yield (163.47 q/ha) and marketable yield (130.17 q/ha) were also recorded in treatment T_1. The lowest gross yield (116.03 q/ha) and marketable yield (93.96 q/ha) were recorded in untreated control. The highest B: C ratio (9.01:1) was recorded in T_2 because of the lower cost of the fungicides.

Status of pesticide residue in onion bulbs. The results of pesticide residues were found to be negative for onion bulbs from all the treated group as well as for the control.

Percent Disease Control (PDC). The highest percent disease control (PDC) of stemphylium blight (37.58%) was recorded in Treatment T_1 (Spray of Propiconazole @ 0.15% at 30 DAT + spray of *Ps. fluorescens* @ 5.0g/L at 45 DAT + spray of Trifloxistrobin 25% + Tebuconazole 50%@ 0.2% at 60 DAT + spray of *T. viride* @ 5.0g/L at 75 DAT).

Table 3: Management of purple blotch in onion through sequential spray of different fungicides with bio-pesticides and their residue status (Combined *kharif*, 2019 & 2020).

Treatments	Purple blotch								Gross yield (q/ha)	Marketable Yield (q/ha)	B:C ratio
	Before 3rd Spray at 60 DAT				Before 4th Spray at 75 DAT						
	Incidence (%)		Intensity (%)		Incidence (%)		Intensity (%)				
T_1	20.00	(26.20)	1.30	(1.33)	38.75	(38.42)	4.65	(2.24)	163.47	130.17	5.82:1
T_2	26.25	(30.72)	1.65	(1.46)	47.50	(43.56)	5.55	(2.42)	156.25	121.52	9.01:1
T_3	27.50	(31.47)	2.05	(1.59)	55.00	(47.92)	6.10	(2.54)	146.62	113.75	5.59:1
T_4	33.75	(35.47)	2.85	(1.82)	60.00	(50.83)	6.45	(2.61)	134.34	105.03	7.38:1
T_5	41.25	(39.92)	3.35	(1.95)	66.25	(54.53)	7.45	(2.80)	116.03	93.95	-
S.Em±	**-**	**1.30**	**-**	**0.04**	**-**	**1.60**	**-**	**0.05**	**2.76**	**1.94**	**-**
CD at 5%	**-**	**2.64**	**-**	**0.09**	**-**	**3.23**	**-**	**0.10**	**5.58**	**3.93**	**-**

Note: Data in the parenthesis shows Square root/*arcsine transformed values.

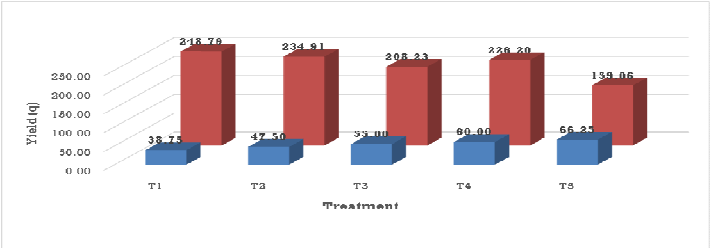

Fig. 1. Purple blotch incidence (%) of onion (control plot) with yield.

CONCLUSIONS

The combined data of trial conducted at RRS, Nashik during *kharif*, 2019 and 2020 on onion variety Agrifound Dark Red revealed that the treatment T_2: Spray of *Ps. fluorescens* @ 5.0g/L at 30 DAT + spray Tricyclazole@ 0.2% at 45 DAT + spray of *T. viride* @ 5.0g/L at 60 DAT + spray of Hexaconazole@ 0.2% at 75 DAT performed at par with purple blotch disease intensity (5.55%) as well as highest B:C ratio (9.01:1) because of the lower cost of the fungicides. The onion bulbs were found free from pesticide residue tested after harvest. While the treatment T_1: spray of Propiconazole @ 0.15% at 30 DAT + spray of *Ps. fluorescens* @ 5.0g/L at 45 DAT + spray of Trifloxistrobin 25% + Tebuconazole 50%@ 0.2% at 60 DAT + spray of *T. viride* @ 5.0g/L at 75 DAT performed with lowest purple blotch intensity (4.65%) in comparison to intensity in untreated control (7.45%). However, the B: C ratio (5.82:1) was recorded because of the higher cost of the fungicides.

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Conflict of Interest. None.

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