

Combined efficacy of bio-pesticides and fungicides on stemphylium blight disease of onion (*Allium cepa*)

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ABSTRACT

A field trial was conducted at Regional Research Station, NHRDF, Nashik in three consecutive years during Kharif 2016, 2017 and 2018 on onion variety Agrifound Dark Red for the management of stemphylium blight disease of onion through soil application of bio-pesticide and sequential spray of different fungicides. The pooled result showed that, significantly minimum stemphylium blight incidence (52.22%) with intensity (4.0%) and highest gross yield (218.51 q/ha) with marketable (174.94 q/ha) as well as highest benefit cost ratio (7.83:1) were recorded in the treatment Soil application of Arka Microbial Consortia @ 12.50 kg/ha followed by sequential sprays of Propiconazole @ 0.1% at 25 DAT, Hexaconazole @ 0.1% at 50 DAT and Tricyclazole @ 0.1% at 75 DAT

Key words: Onion, Stemphylium blight, Incidence, Intensity, Bio - pesticides, Fungicides

Introduction

Onion, (*Allium cepa* L.) is one of the main important and oldest vegetable crops grown in India. The Indian onion is famous all over the world for its superior quality and early appearance in the Asian markets. The total production of onion in the country is 31.703 lakh MT from an area of 1.94 lakh ha during 2021-22 (From estimates). Onion although primarily is grown for food, it is also used as traditional medicine. Onion is prone to several different diseases. These often get started on their leaves, and if severe, can reduce bulb growth and yield. The stemphylium blight most important leaf blight disease and commonly affect onion crop in almost all onion growing

pockets causing considerable damage to the crops. The disease is reported to have wide spread occurrence throughout the country. Surveys conducted by NHRDF indicated that stemphylium blight was more severe in the winter/summer than in the rainy season with 1.3-100 per cent incidence (Gupta *et al.*, 1994) and sometime may even cause 100 per cent crop losses (Singh *et al.*, 1992). The low productivity of onion in India is chiefly attributed to prevalence of Stemphylium blight in almost all the onion cultivated areas of Northern and Eastern Regions (Gupta *et al.*, 1996). Shahnaz *et al.* (2013) reported anti fungal activities of bio-agents against *S. vasicarium*. Various management methods like cultural practices, field sanitation, and biological con-

trol can be adopted, but all these methods are effective only when employed well in advance as precautionary measure (Kata, 2000). Therefore, the present study was undertaken to evaluate the combined efficacy of bio-pesticide and fungicides against stemphylium blight of onion in Maharashtra. Since yield parameter is the main focal point of any agronomic practice, therefore whether the applied disease control measures are effective or not, is often judged by the final harvested produce. So the effect of fungicides and bio-pesticides application on the yield of the produce was also assessed. The trial was conducted during *khariif* 2016, 2017 and 2018 on onion variety Agrifound Dark Red at Regional Research Station, NHRDF, Nashik, Maharashtra.

Materials and Methods

The trial was conducted during *khariif*, 2016, 2017 and 2018 on onion variety Agrifound Dark Red at Regional Research Farm, NHRDF, Nashik, Maharashtra. The seedlings of onion were transplanted in bed size of 3.0 X 1.2 m at spacing of 15.0 cm x 10.0 cm on raised bed. Randomized Block Design with three replications was followed. The treatments were evaluated T₁ (Soil application of AMC @ 12.50 kg/ha + sprays of SAAF (Mancozeb + Carbendazim) @ 0.2% at 25 DAT + Nativo (Trifloxystrobin + Tebuconazole) @ 0.2% at 50 DAT + Cabriotop (Pyraclostrobin + Metiram) @ 0.3% at 75 DAT), T₂ (Soil application of AMC @ 12.50 kg/ha + sprays of Propiconazole @ 0.1% at 25 DAT + Hexaconazole @ 0.1% at 50 DAT + Tricyclazole @ 0.1% at 75 DAT), T₃ (Soil application of AMC @ 12.50 kg/ha + sprays of Mancozeb @ 0.25 % at 25

DAT + Copper oxychloride @ 0.30% at 50 DAT + Propineb @ 0.25% at 75 DAT), T₄ (Soil application of AMC @ 12.50 kg/ha + sprays of AMC @ 10 g/L at 25 DAT, 50 DAT and 75 DAT), T₅ (Sprays of Mancozeb @ 0.25% at 25, 50 and 75 DAT) and T₆ (Untreated Control). Three foliar sprays of fungicides at 25 days interval, beginning at 25 days after transplanting were given. The standard agronomical practices were followed uniformly in all the treatments. The irrigation was done at regular intervals to maintain the optimum moisture level in soil. The crop was harvested after attaining the maturity. The data were recorded on incidence and intensity of stemphylium blight before each spray and also recorded the gross and marketable yield of onion bulbs. Disease scoring of foliar disease was done by using 0-5 scale and the intensity or Percent Disease Index (PDI) was drawn as per standard described by Wheeler (1969). The percent disease control (PDC) was also computed.

Results and Discussion

Khariif, 2016

The data presented in Table 1 revealed that, stemphylium blight disease incidence ranged from 23.33 to 66.67% with intensity from 1.20 to 4.80% in different treatments during the cropping period. Further, the incidence and intensity of stemphylium blight did not differ significantly at 50 DAT, whereas, the disease intensity varied from 1.20% to 2.27% and incidence from 23.33% to 40% in all treatments including untreated control. However, at 75 DAT, significantly lowest disease intensity (2.67%)

Table 1. Combined efficacy of bio-pesticides and fungicides on foliar diseases of onion during *Khariif*, 2016

Treatments	Stemphylium blight				Gross yield (q/ha)	Marketable yield (q/ha)
	Before second spray at 50 DAT		Before Third spray at 75 DAT			
	Incidence %	Intensity %	Incidence %	Intensity %		
T1	30.00 (33.00)	1.47 (6.84)	50.00 (45.00)	3.33 (10.52)	189.07	161.85
T2	23.33 (28.78)	1.20 (6.23)	46.67 (43.08)	2.67 (9.39)	209.07	194.83
T3	30.00 (33.21)	1.47 (6.94)	46.67 (43.08)	3.07 (10.05)	194.44	181.75
T4	30.00 (33.21)	1.33 (6.61)	50.00 (45.00)	2.93 (9.83)	195.18	176.85
T5	26.67 (31.00)	1.60 (7.23)	46.67 (43.08)	2.93 (9.84)	207.31	178.33
T6	40.00 (39.15)	2.27 (8.66)	66.67 (54.78)	4.80 (12.63)	161.85	125.00
SEm±	- 3.73	- 0.81	- 2.68	- 0.38	3.54	9.14
CD at 5%	- NS	- NS	- 5.96	- 0.84	7.89	20.37
CV %	- 13.82	- 14.05	- 7.18	- 4.45	2.25	6.59

Note- : Data in the parenthesis shows arcsine transformed values.

was recorded in T₂ (Soil application of AMC @ 12.50 kg/ha + sprays of Propiconazole @ 0.1% at 25 DAT + Hexaconazole @ 0.1% at 50 DAT + Tricyclazole @ 0.1% at 75 DAT) and it was at par with all treatments except T₆ (Untreated Control). However, the lowest incidence (46.67%) was recorded in T₂, T₃, and T₅ which were at par with all other treatments except T₆ (untreated control) at 75 DAT. The highest disease intensity (4.80%) and incidence (66.67%) was recorded in untreated control at 75 DAT.

Gross and marketable yield

The significantly highest gross yield (209.07 q/ha) and marketable yield (194.83 q/ha) were recorded in T₂. However, marketable yield was found at par with T₃, T₄ and T₅. The lowest gross yield (161.85 q/ha) and marketable yield (125.0 q/ha) were recorded in T₆ (untreated control).

Kharif, 2017

The data presented in Table 2 revealed that, stemphylium blight disease incidence ranged from 23.33 to 96.67% with intensity from 1.73 to 13.73% in different treatments during the cropping period. Further, the incidence and intensity of stemphylium blight did not differ significantly at 50 DAT, whereas, the disease intensity varied from 1.73% to 3.07% and incidence from 23.33% to 43.33% in all treatments including untreated control. However, at 75 DAT, lowest intensity (6.13%) and incidence (43.33%) were recorded in T₂ (Soil application of AMC @ 12.50 kg/ha + sprays of Propiconazole @ 0.1% at 25 DAT + Hexaconazole @ 0.1% at 50 DAT + Tricyclazole @ 0.1% at 75 DAT) and the intensity was found at par with other treatments except T₆

(untreated control) however, incidence was found at par with T₃, T₄ and T₅ at 75 DAT. The highest disease intensity (13.73%) and incidence (96.67%) were recorded in untreated control at 75 DAT.

Gross and marketable yield

The significantly highest gross yield (207.13 q/ha) and marketable yield (167.87 q/ha) were recorded in T₂. The lowest gross yield (153.18 q/ha) and marketable yield (95.38 q/ha) were recorded in T₆.

Kharif, 2018

The data presented in Table-3 revealed that, stemphylium blight disease incidence ranged from 30.0 to 80.0% with intensity from 2.40 to 14.40% in different treatments during the cropping period. Further, data revealed that stemphylium blight disease intensity varied from 2.40% to 4.67% and incidence from 30.0% to 53.33% in all treatments including untreated control at 50 DAT. However, at 75 DAT, lowest intensity (3.20%) and incidence (43.33%) were recorded in T₂ (Soil application of AMC @ 12.50 kg/ha + sprays of Propiconazole @ 0.1% at 25 DAT + Hexaconazole @ 0.1% at 50 DAT + Tricyclazole @ 0.1% at 75 DAT). The highest disease intensity (14.40%) and incidence (80.0%) were recorded in untreated control at 75 DAT.

Gross and marketable yield

The significantly highest gross yield (239.35 q/ha) and marketable yield (199.25 q/ha) were recorded in T₂ and at par with T₃. The lowest gross yield (153.18 q/ha) and marketable yield (110.64 q/ha) were recorded in T₆ (untreated control).

Table 2. Combined efficacy of bio-pesticides and fungicides on foliar diseases of onion during Kharif, 2017

Treatments	Stemphylium blight				Gross yield (q/ha)	Marketable yield (q/ha)
	Before Second spray at 50 DAT		Before Third spray at 75 DAT			
	Incidence%	Intensity%	Incidence%	Intensity%		
T1	30.00 (33.00)	1.87 (7.82)	80.00 (63.93)	6.60 (14.60)	171.57	119.25
T2	23.33 (28.78)	1.73 (7.55)	66.67 (54.78)	6.13 (14.26)	207.13	167.87
T3	30.00 (33.21)	1.87 (7.84)	70.00 (57.00)	6.67 (14.92)	184.63	128.42
T4	26.67 (31.00)	1.73 (7.55)	73.33 (59.00)	7.73 (16.08)	162.40	98.61
T5	33.33 (35.01)	2.00 (8.10)	73.33 (59.00)	8.00 (16.42)	172.22	120.92
T6	43.33 (41.07)	3.07 (10.00)	96.67 (83.86)	13.73 (21.75)	153.18	95.38
SEm±	- 4.63	- 0.80	- 5.20	- 1.72	9.45	9.43
CD at 5%	- NS	- NS	- 11.59	- 3.83	21.04	21.00
CV %	- 16.83	- 12.02	- 10.13	- 12.89	6.60	9.48

Note:- Data in the parenthesis shows arcsine transformed values.

Combined data of *Kharif*, 2016, 2017 and 2018

The combined data of three years presented in Table 4 revealed that stemphylium blight disease intensity varied from 1.78 to 10.98% with incidence from 25.56 to 81.11% due to effect of different treatments. The data revealed that the significantly lowest stemphylium blight incidence 25.56% and intensity 1.78% was recorded in T₂ at 50 DAT. Further, the significantly lowest stemphylium blight intensity (4.0%) was recorded in T₂ at 75 DAT. The lowest incidence (52.22%) was also recorded in T₂ and it was at par with the treatments T₃ at 75 DAT.

The present study is in accordance with the reports by Kamal *et al.* (2017) was found alternative application of bio-pesticide (*Trichoderma harzianum*) and fungicide Metallaxyl 4.0% + Mancozeb 64.0% most effective for controlling of Stemphylium blight of onion. Ureba *et al.* (1998) found Tebuconazole effective in controlling garlic leaf spots. Bhatia and Chahal (2014) reported that Tebuconazole 25.9EC,

Propiconazole 25EC etc are effective in managing stemphylium blight in onion. Results of field trials by Gupta *et al.* (2021) showed that alternative spray of Paraclostrobin+ Metiram, Trifloxistrobin + Tebuconazole, Zineb+ Hexaconazole and Carbendazim + Mancozeb were most effective in reducing stemphylium leaf blight, purple blotch as well as increased yield. Mishra *et al.* (2018) reported that 5 spray of difenaconazole as most effective for control of stemphylium blight as well as increased yield which is supporting the finding of the present study that 3 alternative spray of different fungicides are providing the better stemphylium blight disease control. Gupta and Gupta (2014) have also observed Propiconazole, Tebuconazole and Mancozeb as effective against *S. vesicarium* by increasing bulb yield in onion. Similar findings have been reported in case of Mancozeb against *S. vesicarium* in garlic (Kumar *et al.*, 2011). Jhala, and Mali. (2017) reported that use of fungicides and botanicals and bio-pesticides can be best control of purple blotch disease in onion. These

Table 3. Combined efficacy of bio-pesticides and fungicides on foliar diseases of onion during *Kharif*, 2018

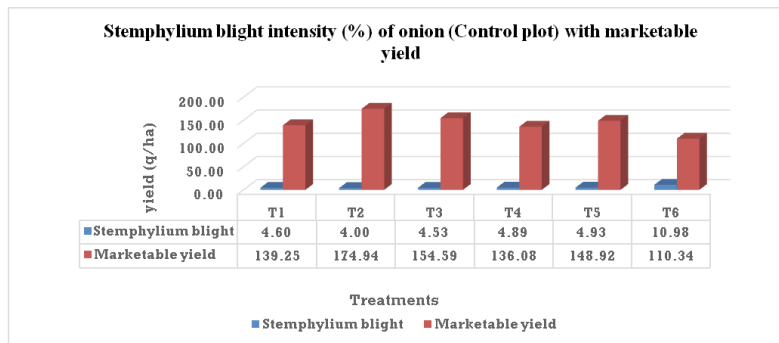
Treatments	Stemphylium blight				Gross yield (q/ha)	Market-able yield (q/ha)
	Before Second spray at 50 DAT		Before Third spray at 75 DAT			
	Incidence%	Intensity%	Incidence%	Intensity%		
T1	46.67 (43.08)	3.20 (1.92)	50.00 (45.00)	3.87 (2.08)	215.00	136.66
T2	30.00 (33.21)	2.40 (1.69)	43.33 (41.15)	3.20 (1.92)	239.35	162.12
T3	30.00 (33.21)	3.07 (1.89)	50.00 (45.00)	3.87 (2.09)	236.76	153.61
T4	46.67 (43.08)	4.13 (2.15)	53.33 (46.92)	4.00 (2.12)	211.76	132.77
T5	36.67 (37.22)	3.07 (1.88)	50.00 (45.00)	3.87 (2.09)	220.28	147.50
T6	53.33 (46.92)	4.67 (2.27)	80.00 (63.43)	14.40 (3.86)	199.25	110.64
SEM±	- 2.08	- 0.15	- 2.53	- 0.16	5.96	4.49
CD at 5%	- 4.63	- 0.34	- 5.64	- 0.35	13.27	10.01
CV %	- 6.45	- 9.40	- 6.49	- 8.06	3.31	3.92

Note- : Data in the parenthesis shows arcsine transformed values.

Table 4. Combined efficacy of bio-pesticides and fungicides on foliar diseases of onion (Combined *Kharif*, 2016, 2017 and 2018)

Treatments	Stemphylium blight				B:C ratio	Gross yield (q/ha)	Market-able yield (q/ha)
	Before Second spray at 50 DAT		Before Third spray at 75 DAT				
	Incidence%	Intensity%	Incidence%	Intensity%			
T1	35.56 (36.36)	2.18 (1.61)	60.00 (51.31)	4.60 (2.22)	191.88	139.25	2.14:1
T2	25.56 (30.26)	1.78 (1.49)	52.22 (46.34)	4.00 (2.08)	218.51	174.94	7.83:1
T3	30.00 (33.21)	2.13 (1.61)	55.56 (48.36)	4.53 (2.21)	205.27	154.59	4.64:1
T4	34.44 (35.76)	2.40 (1.66)	58.89 (50.31)	4.89 (2.27)	189.78	136.08	3.52:1
T5	32.22 (34.41)	2.22 (1.63)	56.67 (49.03)	4.93 (2.28)	199.93	148.92	5.92:1
T6	45.56 (42.38)	3.33 (1.93)	81.11 (67.36)	10.98 (3.31)	171.43	110.34	-
SEM±	- 2.10	- 0.08	- 2.12	- 0.11	3.90	4.63	-
CD at 5%	- 4.28	- 0.16	- 4.34	- 0.22	7.97	9.45	-

Note- : Data in the parenthesis shows arcsine transformed values.



finding are also supported with our study that fungicide and bio-pesticides application for the management of stemphylium blight disease.

Percent Disease Control (PDC)

The highest percent disease control (PDC) of stemphylium blight (63.57%) was recorded in Treatment T₂ (Soil application of AMC @ 12.50 kg/ha + sprays of Propiconazole @ 0.1% at 25 DAT + Hexaconazole @ 0.1% at 50 DAT + Tricyclazole @ 0.1% at 75 DAT) over control at 75 DAT. Similar findings have been reported by Mishra *et al.* (2017) under field condition azoxystrobin + flutriafol was found most effective in reducing the disease severity as well as providing better disease control.

Gross and marketable yield

The highest gross yield (218.51 q/ha) and marketable yield (174.94 q/ha) were recorded in T₂ (Soil application of AMC @ 12.50 kg/ha + sprays of Propiconazole @ 0.1% at 25 DAT + Hexaconazole @ 0.1% at 50 DAT + Tricyclazole @ 0.1% at 75 DAT).

Benefit cost ratio

The higher benefit cost ratio (7.83:1) was recorded in T₂ (Soil application of AMC @ 12.50 kg/ha + sprays of Propiconazole @ 0.1% at 25 DAT + Hexaconazole @ 0.1% at 50 DAT + Tricyclazole @ 0.1% at 75 DAT) followed by T₅ (5.61:1) and T₃ (4.64:1).

Conclusion

The combined data of trials conducted at RRS, Nashik during *Kharif*, 2016, 2017 and 2018 on onion variety Agrifound Dark Red revealed that treatment. Soil application of Arka Microbial Consortia @ 12.50 kg/ha followed by sequential sprays of Propiconazole @ 0.1% at 25 DAT, Hexaconazole @ 0.1% at 50 DAT and Tricyclazole @ 0.1% at 75 DAT

performed better for management of stemphylium blight with 63.57% disease control (PDC) and increasing the marketable yield by 58.54% over untreated control. However, all other treatments were also found at par for management of stemphylium blight in onion except untreated control. The higher benefit cost ratio (7.83:1) was recorded in T₂ followed by T₅ (5.61:1) and T₃ (4.64:1).

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