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Efficacy of triazole fungicides against *Stemphylium* blight of onion

MK Pandey, PK Gupta, RC Gupta, MK Pathak, Satyendra Singh and AK Tailor

Abstract

Onion is one of the most important commercial vegetable crops grown in India. It is valued for its distinct pungent flavour and is an essential ingredient for the cooking in many regions. A number of diseases attack onion crops but *Stemphylium* blight is the most important one and cause huge losses in different parts of world. A field experiment was conducted at Regional Research Station, NHRDF, Nashik in three consecutive years during Kharif 2016, 2017 and 2018 on onion variety Agrifound Dark Red with the objective of the management of *Stemphylium* blight disease through spray of different fungicides. Four sprays were given at 15 days intervals from 30 days after transplanting with six fungicides viz, Propiconazole (0.1%), Tricylazole (0.1%), Epoxiconazole (0.25%), Tebuconazole (0.1%), Hexaconazole (0.1%) and Mancozeb (0.25%) were evaluated and result showed that, significantly minimum *Stemphylium* blight incidence (58.89%) with intensity (5.02%) as well as highest gross yield (217.40 q/ha) with marketable (167.93q/ha) were recorded in spray of Epoxiconazole (0.25%). The highest benefit cost ratio (6.02:1) was recorded in Tebuconazole (0.1%) due to lower rate of fungicide.

Keywords: Onion, *Stemphylium* blight, incidence, intensity, fungicides, triazoles, percent disease control (PDC)

Introduction

Onion is an important bulbous, vegetable grown on a large area at commercial scale. It is cultivated in *Rabi* kharif and late kharif seasons throughout the country. Onion is highly susceptible to many diseases which reduce its yield and quality (Cramer 2000) [3]. *Stemphylium* blight (*Stemphylium vasicarium*) is an important disease affecting kharif onion crop in India. The disease is reported to have widespread occurrence throughout the country. 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) [4]. Various management strategies like cultural practices, field sanitation, and biological control can be adopted, but all these methods are effective only when employed well in advance as precautionary measure (Kata, 2000) [8]. Once the disease has appeared, chemical control offers a good choice to grower for managing the disease as they have the advantage of providing quick, effective and economic management. Many fungicides have been tested for the management of *Stemphylium* blight of onion. Mancozeb 75 WP (@ 0.2%) was found most effective against *Stemphylium* blight (Pandey *et al.*, 2008) [15]. Carbendazim, copper oxychloride, difenoconazole, chlorothalonil and hexaconazole have been reported, in the order of their merit as effective in the management of the *Stemphylium* blight by Gorawar and Hegde (2005) [7] and Kumari *et al.* (2006) [11]. However, presently only 6 registered fungicides are recommended for the use in onion crop viz. difenoconazole 25EC, kitazin 48EC, mancozeb 75WP, tebuconazole 25.9EC, zineb 75WP and metiram + pyraclostrobin 60WG (CIBRC, 2016) [2]. Triazole have been found effective and economically superior in various crops patho systems viz. fruit rot disease of chilli (Kumbhar and More, 2013) [10], groundnut diseases (Sunkad *et al.*, 2010) [16]. To find out the suitable management of *Stemphylium* blight and avoid the losses caused by *Stemphylium* blight in onion bulb crop, the field experiment was conducted at National Horticultural Research and Development Foundation, NHRDF, Regional Research Station, Nashik during three consecutive years in Kharif 2016, 2017 and 2018 on onion variety Agrifound Dark Red through spray of different fungicides for the management of *Stemphylium* blight disease.

Materials and Methods

The trial was conducted during kharif 2016, 2017 and 2018 on onion variety Agrifound Dark Red at Research Farm, NHRDF, Nashik Maharashtra. The seedlings of onion were transplanted in bed size of 3.0 X 1.2 m at spacing of 15.0cm x 10.0cm. Randomized Block Design with three replication was follows. The treatments were evaluated T₁ (Propiconazole 0.1%), T₂ (Tricyclazole 0.1%), T₃ (Epoconazole 0.25%), T₄ (Tebuconazole 0.1%), T₅ (Hexaconazole 0.1), T₆ (Mancozeb 0.25%) and T₇ (Control). The spraying of the different fungicides was started after 30 DAT and a total of four sprays were given at 15 days intervals as per treatments. 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)^[18]. The percent disease control (PDC) and yield (%) increase over untreated check were also computed.

Result and discussion

(Kharif, 2016)

Stemphylium blight

The data presented in Table-1 revealed that *Stemphylium* blight disease was not found at 30 DAT in all treatments including control. The significantly lowest *Stemphylium* blight incidence (23.33%) was recorded in T₁ (Propiconazole 0.1%) and T₃ (Epoconazole 0.1%) which was found at par with T₂ (Tricyclazole 0.1%) and T₅ (Hexaconazole 0.1%), however, significantly lowest intensity (1.07%) was recorded in treatments T₁ and T₃ and it was found at par with all the treatments at 45 DAT. At 60 DAT the significantly lowest incidence (40.0%) was recorded in treatment T₁ and T₃ and it was found at par with T₄ and T₅, however, significantly lowest intensity (2.27%) was recorded in treatment T₁ and found at par with all other treatments except T₇ (Control). Before 4th spray at 75 DAT, the significantly lowest incidence (50.0%) was recorded in treatment T₃ however, significantly lowest intensity (3.73%) was recorded in treatment T₃ which was found at par with T₁, T₂, T₄ and T₅. The highest disease incidence (86.67%) with intensity (7.73%) was recorded in untreated control at 75DAT.

Gross and marketable yield

Significantly highest gross yield (212.40 q/ha) and marketable yield (163.79 q/ha) were recorded in treatment T₃ (Epoconazole @ 0.1%). The lowest gross yield (160.92 q/ha) and marketable yield (111.20 q/ha) were recorded in untreated control.

Table 1: Efficacy of triazole fungicides against *Stemphylium* blight and yield of onion during Kharif, 2016

Treatments	<i>Stemphylium</i> blight									
	Before First spray at 30 DAT		Before Second spray at 45 DAT				Before Third spray at 60 DAT			
	Incidence%	Intensity%	Incidence%		Intensity%		Incidence%		Intensity%	
T1	0	0	23.33	(28.78)	1.07	(5.84)	40.00	(39.23)	2.27	(8.65)
T2	0	0	26.67	(31.00)	1.20	(6.29)	46.67	(43.08)	2.67	(9.39)
T3	0	0	23.33	(28.78)	1.07	(5.90)	40.00	(39.23)	2.27	(8.63)
T4	0	0	30.00	(33.21)	1.33	(6.61)	43.33	(41.15)	2.53	(9.15)
T5	0	0	26.67	(31.00)	1.20	(6.23)	43.33	(41.15)	2.27	(8.65)
T6	0	0	40.00	(39.23)	2.13	(8.39)	56.67	(48.85)	3.47	(10.68)
T7	0	0	50.00	(45.00)	2.53	(9.13)	66.67	(54.78)	4.93	(12.82)
SEm±	-	-	-	2.56	-	0.67	-	2.47	-	0.63
CD at 5%	-	-	-	5.57	-	1.46	-	5.37	-	1.38
CV%	-	-	-	9.25	-	11.86	-	6.88	-	7.98

Treatments	<i>Stemphylium</i> blight				Gross yield (q/ha)	Market-able yield (q/ha)
	Before Fourth spray at 75 DAT					
	Incidence%		Intensity%			
T1	63.33	(52.78)	4.00	(11.53)	184.53	133.70
T2	63.33	(52.78)	4.27	(11.92)	175.09	116.76
T3	50.00	(45.00)	3.73	(11.12)	212.40	163.79
T4	63.33	(52.78)	4.13	(11.73)	182.59	132.13
T5	63.33	(52.78)	4.13	(11.73)	166.75	125.74
T6	76.67	(61.71)	5.20	(13.14)	166.66	112.77
T7	86.67	(68.86)	7.73	(16.14)	160.92	111.20
SEm±	-	3.65	-	0.45	3.80	6.26
CD at 5%	-	7.94	-	0.99	8.28	13.63
CV%	-	8.08	-	4.46	2.61	5.98

Note: Data in the parenthesis shows Arcsine transformed values

Inc: Incidence, Int: Intensity, DAT: Days after transplanting

(Kharif, 2017)

Stemphylium blight

The data presented in Table -2 revealed that *Stemphylium* blight disease was not found at 30 DAT in all treatments including control. The significantly lowest *Stemphylium* blight incidence (13.33%) were recorded in treatment T₃

(Epoconazole 0.1%) however, significantly lowest intensity (0.93%) was recorded in treatment T₃ which was at par with treatment T₁ (Propiconazole 0.1%), T₂ (Tricyclazole 0.1%), T₅ (Hexaconazole 0.1%) and T₄ (Tebuconazole 0.1%) respectively except treatment T₆ (Mancozeb 0.25%) at 45

DAT. At 60 DAT the significant lowest intensity (36.67%) was recorded in treatment T₃ and found at par with treatment T₁, T₄ and T₅ however, significantly lowest intensity (2.53%) was recorded in treatment T₃ (Epoxyconazole 0.1%) which was found at par with T₁, T₂, T₅ and T₄. Before 4th spray at 75 DAT the significantly lowest incidence (76.67%) was recorded in treatment T₃ and found at par with the all treatments except control however, the significantly lowest intensity (7.60%) was recorded in T₃ which was found at par with all other treatments except control. The highest disease

incidence (96.67%) with intensity (14.80%) was recorded in untreated control at 75 DAT.

Gross and marketable yield

The significantly highest gross yield (200.73 q/ha) and marketable yield (161.66 q/ha) were recorded in treatment T₃ and the marketable yield was at par with treatment T₄. The lowest gross yield (117.59 q/ha) and marketable yield (105.55 q/ha) were recorded in untreated control.

Table 2: Efficacy of triazole fungicides against *Stemphylium* blight and yield of onion during Kharif, 2017

Treatments	<i>Stemphylium</i> blight									
	Before First spray at 30 DAT		Before Second spray at 45 DAT				Before Third spray at 60 DAT			
	Incidence%	Intensity%	Incidence%		Intensity%		Incidence%		Intensity%	
T1	0	0	23.33	(28.78)	1.60	(7.23)	43.33	(41.15)	3.20	(10.29)
T2	0	0	30.00	(33.21)	1.60	(7.27)	46.67	(43.08)	3.20	(10.29)
T3	0	0	13.33	(21.14)	0.93	(5.52)	36.67	(37.22)	2.53	(9.15)
T4	0	0	30.00	(33.21)	1.87	(7.84)	43.33	(41.07)	3.07	(10.05)
T5	0	0	26.67	(31.00)	1.47	(6.90)	43.33	(41.15)	2.93	(9.83)
T6	0	0	36.67	(37.22)	2.53	(9.12)	56.67	(48.85)	4.27	(11.86)
T7	0	0	53.33	(46.92)	3.47	(10.73)	66.67	(54.78)	6.40	(14.64)
SEm±	-	-	-	2.30	-	0.46	-	3.39	-	0.72
CD at 5%	-	-	-	5.02	-	1.01	-	7.38	-	1.56
CV%	-	-	-	8.53	-	7.27	-	9.44	-	8.09

Treatments	<i>Stemphylium</i> blight				Gross yield (q/ha)	Marketable yield (q/ha)
	Before Fourth spray at 75 DAT					
	Incidence%		Intensity%			
T1	83.33	(66.14)	8.67	(17.11)	166.94	119.16
T2	83.33	(66.14)	8.80	(17.21)	167.31	116.38
T3	76.67	(61.22)	7.60	(15.99)	200.73	161.66
T4	80.00	(63.43)	8.67	(17.11)	180.37	136.48
T5	83.33	(66.14)	8.93	(17.35)	171.48	114.35
T6	80.00	(63.93)	9.87	(18.26)	137.40	108.98
T7	96.67	(83.86)	14.80	(22.56)	117.59	105.55
SEm±	-	5.15	-	1.31	4.88	12.25
CD at 5%	-	11.21	-	2.85	10.62	26.69
CV%	-	9.37	-	8.93	3.66	12.18

Note: Data in the parenthesis shows Arcsine transformed values

Inc: Incidence, Int: Intensity, DAT: Days after transplanting (Kharif, 2018)

Stemphylium blight

The data presented in Table-3 revealed that *Stemphylium* blight disease was not found at 30 DAT in all treatments including control. The lowest *Stemphylium* blight intensity (1.20%) and incidence (30.0%) were recorded in all the treatments except T₆ and control at 45 DAT. The disease incidence and intensity of *Stemphylium* blight increased as the age of the crop progressed in all the treatments. Further, significantly lowest disease intensity (2.93%) and incidence (36.67%) was recorded in treatment T₃ (Epoxyconazole 0.1%) at 60 DAT and found at par with all other treatments except T₆ and control. The significantly lowest disease incidence (50.0%) was recorded in treatment T₃ and found at par with

all treatment except T₆ and control however, significantly lowest intensity (3.73%) was recorded in treatment T₃ at 75 DAT and found at par with all other treatments except T₆ and control. The highest disease intensity (12.67%) and incidence (86.67%) were recorded in control at 75 DAT.

Gross and marketable yield

The significantly highest gross yield (239.07 q/ha) and marketable yield (178.33 q/ha) were recorded in treatment T₃ (Epoxyconazole 0.1%) and it was found at par with treatment T₄ (Tebuconazole @ 0.1%). The lowest gross yield (200.74 q/ha) and marketable yield (123.61 q/ha) were recorded in control.

Table 3: Efficacy of triazole fungicides against *Stemphylium* blight and yield of onion during Kharif, 2018

Treatments	Before First spray at 30 DAT		Before Second spray at 45 DAT			
	Incidence%	Intensity%	Incidence%		Intensity%	
T1	0	0	30.00	(33.21)	1.20	(6.29)
T2	0	0	30.00	(33.21)	1.20	(6.29)
T3	0	0	30.00	(33.21)	1.20	(6.29)
T4	0	0	30.00	(33.21)	1.20	(6.29)
T5	0	0	30.00	(33.21)	1.20	(6.29)
T6	0	0	40.00	(39.23)	2.00	(8.10)
T7	0	0	46.67	(43.08)	2.93	(9.84)
SEm±	-	-	-	1.03	-	0.36
CD at 5%	-	-	-	2.24	-	0.78
CV%	-	-	-	3.55	-	6.18

Treatments	<i>Stemphylium</i> blight								Gross yield (q/ha)	Market-able yield (q/ha)
	Before Third spray at 60 DAT				Before Fourth spray at 75 DAT					
	Incidence%	Intensity%	Incidence%	Intensity%	Incidence%	Intensity%	Incidence%	Intensity%		
T1	40.00	(39.23)	3.07	(10.08)	53.33	(46.92)	4.13	(11.73)	212.88	149.63
T2	43.33	(41.15)	3.47	(10.73)	53.33	(46.92)	4.27	(11.91)	214.07	151.94
T3	36.67	(37.22)	2.93	(9.86)	50.00	(45.00)	3.73	(11.14)	239.07	178.33
T4	43.33	(41.15)	3.20	(10.29)	53.33	(46.92)	4.27	(11.92)	235.28	172.68
T5	40.00	(39.23)	3.47	(10.73)	53.33	(46.92)	4.00	(11.53)	219.81	162.31
T6	60.00	(50.77)	4.40	(12.10)	70.00	(56.79)	5.20	(13.18)	210.92	140.83
T7	70.00	(56.79)	6.27	(14.48)	86.67	(68.86)	12.67	(20.83)	200.74	123.61
SEm±	-	1.90	-	0.42	-	2.71	-	0.48	5.29	3.67
CD at 5%	-	4.15	-	0.92	-	5.91	-	1.04	11.53	7.99
CV%	-	5.34	-	4.61	-	6.49	-	4.45	2.96	2.91

Note: Data in the parenthesis shows arcsine transformed values.

Inc: Incidence, Int: Intensity,

DAT: Days after transplanting

Combined data of Kharif, 2016, 2017 and 2018

Effect of treatment on *Stemphylium* blight

The combined data of three years presented in Table-4 revealed that *Stemphylium* blight disease was not found at 30 DAT in all treatments including control. The data revealed that the significantly lowest *Stemphylium* blight intensity (1.07%) with incidence (22.22%) was recorded in T₃ (Epoconazole 0.25%) at 45 DAT. Further, the lowest *Stemphylium* blight intensity (2.58%) with incidence (37.78%) were recorded in T₃ at 60 DAT. The lowest *Stemphylium* blight intensity (5.02%) with incidence (58.89%) was also recorded in T₃ at 75 DAT. The results of present study is in accordance with the reports by Ureba *et al.* (1998) [17] found Tebuconazole effective in controlling garlic leaf spots. Bhatia and Chahal (2014) [1] reported that Tebuconazole 25.9EC, Propiconazole 25ECetc are effective in managing *Stemphylium* blight in onion. Results of field trials by Gupta *et al.* (2021) [5] showed that alternative spray of Propiconazole + 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) [6] 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 4 spray of Epoconazole @ 0.1% are providing the better *Stemphylium* blight disease control. Gupta and Gupta (2014) [6] 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) [9]. These finding are also supported with our study that fungicide Mancozeb application not only manages the *Stemphylium* blight but also increases the yield of onion in comparison of untreated plot.

Percent Disease Control (PDC)

The highest percent disease control (PDC) of *Stemphylium* blight (57.20%) was recorded in Treatment T₃ (Epoconazole @0.1%) over control at 75 DAT.

Gross and marketable yield

Significantly highest gross yield (217.40 q/ha) and marketable yield (167.91 q/ha) were recorded in T₃ (Epoconazole @ 0.25%). These results are in accordance with the studies of Mohan *et al.* (2004) [12] working on onion and chilli, who recorded those triazole fungicides, also produced the highest yields. Mishra and Singh (2018) [6] reported that triazole fungicides very effective for the management of *Stemphylium* blight and increasing yield in comparison to other fungicides.

Benefit cost ratio

The higher benefit cost ratio (6.02:1) was recorded in T₄ (Tebuconazole 0.1%) followed by T₅ (Hexaconazole 0.1%) 5.85:1 and T₃ (Epoconazole 0.25%) 4.68:1.

Table 4: Efficacy of triazole fungicides against *Stemphylium* blight, yield and benefit cost ration of onion (Combined Kharif, 2016, 2017 & 2018)

Treatments	Before First spray at 30 DAT		Before Second spray at 45 DAT			
	Incidence%	Intensity%	Incidence%		Intensity%	
T1	0	0	25.56	(30.26)	1.29	(1.33)
T2	0	0	28.89	(32.47)	1.33	(1.35)
T3	0	0	22.22	(27.71)	1.07	(1.25)
T4	0	0	30.00	(33.21)	1.47	(1.40)
T5	0	0	27.78	(31.73)	1.29	(1.33)
T6	0	0	38.89	(38.56)	2.22	(1.64)
T7	0	0	50.00	(45.00)	2.98	(1.86)
SEm±	-	-	-	1.20	-	0.04
CD at 5%	-	-	-	2.43	-	0.09

Treatments	Stemphylium blight								Gross yield (q/ha)	Market-able yield (q/ha)	B:C Ratio
	Before Third spray at 60 DAT				Before Fourth spray at 75 DAT						
	Incidence%		Intensity%		Incidence%		Intensity%				
T1	41.11	(39.87)	2.84	(1.82)	66.67	(55.28)	5.60	(2.43)	188.12	134.16	4.49:1
T2	45.56	(42.44)	3.11	(1.90)	66.67	(55.28)	5.78	(2.47)	185.49	128.36	4.32:1
T3	37.78	(37.89)	2.58	(1.75)	58.89	(50.41)	5.02	(2.31)	217.40	167.93	4.68:1
T4	43.33	(41.13)	2.93	(1.85)	65.56	(54.38)	5.69	(2.45)	199.41	147.09	6.02:1
T5	42.22	(40.51)	2.89	(1.83)	66.67	(55.28)	5.69	(2.44)	186.01	134.13	5.85:1
T6	57.78	(49.49)	4.04	(2.12)	75.56	(60.81)	6.76	(2.66)	171.66	120.86	2.36:1
T7	67.78	(55.45)	5.87	(2.52)	90.00	(73.86)	11.73	(3.46)	159.75	113.45	-
SEm±	-	1.53	-	0.06	-	2.29	-	0.08	2.71	4.75	-
CD at 5%	-	3.11	-	0.11	-	4.64	-	0.16	5.50	9.62	-

Note: Data in the parenthesis shows arcsine transformed values.

Inc: Incidence, Int: Intensity, DAT: Days after transplanting

SB- *Stemphylium* blight & MY- Marketable yield

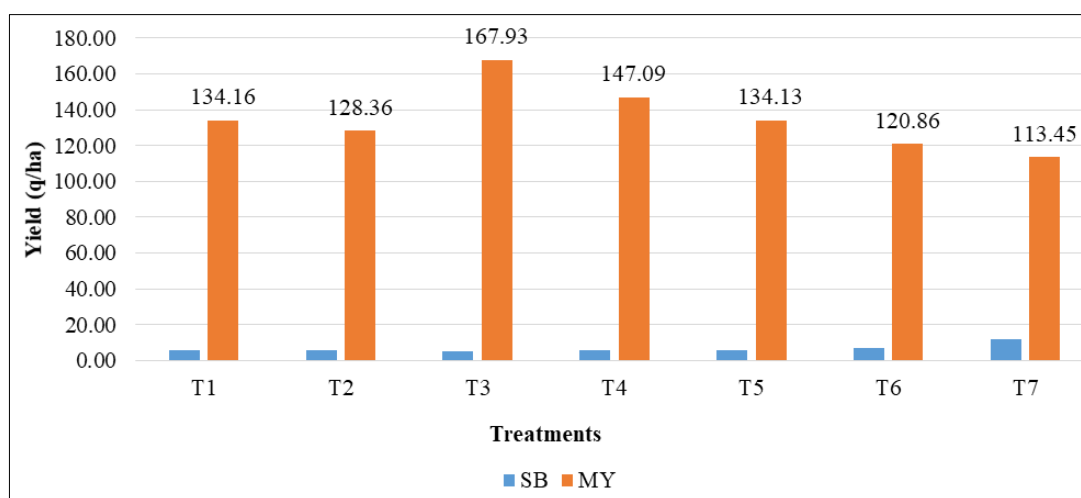


Fig 1: Stemphylium blight intensity (%) of onion with marketable yield

Conclusion

The combined data of trials conducted at RRS, Nashik during Kharif, 2016, 2017 and 2018 on onion variety Agrifound Dark Red revealed that sprays of Epoxyconazole 0.1% at 30 DAT and subsequently at fortnightly intervals proved better for management of *Stemphylium* blight with 57.20% disease control (PDC) and increasing the marketable yield by 32.44% over untreated control. However, all other treatments of triazole fungicides were also found at par for management of *Stemphylium* blight in onion. The higher benefit cost ratio (6.02:1) was recorded in Tebuconazole 0.1% followed by Hexaconazole 0.1% (5.85:1) and Epoxyconazole 0.1% (4.68:1). The present study conducted that the spray of Epoxyconazole @0.1% at 15 days interval from 30 Days after transplanting can be advocated as effective strategy for management of *Stemphylium* blight in onion as well as

increased the yield during Kharif season. Farmers are suggested to use of Epoxyconazole @ 0.1% fungicide for improved their yield and quality of onion.

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