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Research Article

STUDIES ON EFFECTIVENESS OF SOME FUNGICIDES IN CONTROLLING STEMPHYLIUM BLIGHT OF ONION

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Abstract: Stemphylium blight has become a very serious disease of onion causing considerable yield loss in onion production. In the absence of resistant cultivars, management of Stemphylium blight disease has relied principally on application of synthetic fungicides. The present study evaluated the effects of fungicides on Stemphylium blight disease of onion and investigated the efficacy on yield of onion. The field experiment was laid in a randomized block design with five treatments and four replications in subtropical climatic condition of West Bengal at Department of Plant Pathology, Regional Research Sub-Station (Red & Laterite Zone), Sekhampur, Birbhum, 731129 during *Rabi*, 2020-21 and *Rabi*, 2021-22. The highest disease control was in Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water (64.30%) followed by Metiram 55% + Pyraclostrobin 5% WG @ 1.0 g/litre of water (58.62%) and Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/litre of water (61.38 %) at 15 days after 2nd spray. Maximum increase of marketable onion bulbs yield (69.36%) was obtained by the spray of Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water as compared to other treatments.

Keywords: *Stemphylium blight disease, Fungicides, Onion*

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Introduction

Onion (*Allium cepa* L.) often called as "Queen of kitchen" is one of the oldest known and an important vegetable crop. It is valued for its distinctive pungent smell. Besides being used as food articles; onion has a variety of medicinal effects. It is one of the most important winter vegetable crops of India. It is a nutritious vegetable and contains a good amount of Vitamin A and C, rich source of minerals (calcium, manganese and iron) and dietary fibers. The total annual production in India is 18.73 million tonnes from an area of 0.88 million hectares and the productivity is 21.2 t/ha [1]. The major onion growing states of India are Maharashtra, Bihar, Karnataka, Gujarat, Andhra Pradesh, Uttar Pradesh, Orissa and Madhya Pradesh. In India, about 60 percent of onion is cultivated during winter followed by 20% each in kharif and late kharif seasons. To cope up with these continuous challenges under field conditions, plants have evolved efficient mechanism to obtain an adequate defence and one more such mechanism against pathogen attack is the synthesis of vast array of low molecular weight components with disparate functions in plant pathogen interactions [2]. Stemphylium vesicarium (Wall.) Simmons is the causal organism of the leaf blight in onion [3] in the main production areas of the world. In Egypt (Assiut Governorate) Stemphylium blight in onion caused by S. Vesicarium was reported in first [4]. One of the major factors responsible for this low productivity is a regular attack of several diseases and pests in this crop. Like purple blotch, stemphylium blight is also an important foliage disease of onion crop prevalent in almost all the onion cultivated areas of Northern and Eastern India [5]. Surveys conducted by National Horticultural Research and Development Foundation (NHRDF) indicated that Stemphylium blight was more severe in the winter/summer than in the rainy season with 1.3-100 per cent incidence [6] and sometimes may even cause 100 per cent crop losses [7]. Under favorable environmental conditions, complete failure of the crop takes place and there is no bulb formation or seed set in both bulb and seed crops. Control of stemphylium blight is primarily accomplished by the application of fungicides [8]. As there is no resistant variety presently available for cultivation in the state, the only alternative to reduce the damage caused by this disease is through the foliar application of fungicides in existing cultivars. Therefore, exploration of more effective fungicides for the control of this disease is unwarranted, which is the subject matter of the present studies. Keeping this in view, a field experiment was conducted to study the effect of fungicides on disease reaction of onion.

Materials and methods

The investigation was carried in a randomized block design with five treatments and four replications in subtropical climatic condition of West Bengal at Regional Research Sub-Station (Red & Laterite Zone), Bidhan Chandra Krishi Viswavidyalaya, Sekhampur, Birbhum, West Bengal, India.The experiment was conducted on variety Sukhsagar during *Rabi*, 2020-21 and *Rabi*, 2021-22. The treatments were imposed as per details of spray schedules given in [Table-2]. Observations were recorded 15 days after spraying by randomly selecting 10 plants. First foliar application of these fungicides was started just after the appearance of disease symptoms followed by one more sprays at an interval of 15 days. On the basis of Percent Disease Index (PDI), the disease scoring was done by taking five plants from each plot on a disease rating scale *i.e*., 0 to 5, where 0 = no lesions, 1 = 1 to 4 lesions, 2 = 5 to 10 lesions, 3 = 11 to 20 lesions, 4 = 21 to 30 lesions and 5 = more than 30 lesions on each floral stalk [9]. The observations regarding disease incidence were recorded before each spray. Percentage Disease Index was worked out using the formula, PDI = [Sum of all numerical rating/total number of observations taken x maximum disease score] x 100 [10]. The PDI values were transformed by angular transformation and analyzed statistically. The yield data was also analyzed statistically. Marketable yield of bulb (t /ha) was recorded. Finally, the disease severity percent and yield over the control were also calculated.

Results and discussion

Results presented in [Table-2] and [Fig-1] from the experimental trials revealed that all the treatments reduced the disease severity of stemphylium blight disease over (T_5) control.

Table-1 Treatments details of fungicides

Treatments	Fungicides	Dosage (Per litre)
T_1	Metiram 55% + Pyraclostrobin 5% WG	1.0 g
T_2	Boscalid 26.7%+Pyraclostrobin 13.3% WG	1.0 g
T_3	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	1.0 ml
T_4	Mancozeb 75 % WP	2.5 g
T_5	Control (Water only)	--

Table-2 Effect of fungicides for control of Stemphylium blight disease of onion during 2020-21 and 2021-22 under natural condition

Treatments	Fungicides	Dose (per litre)	Pooled analysis of 2021 and 2022		
			PDI (before spray)	PDI (15 days after 2nd spray)	Per cent reduction over control
T_1	Metiram 55% + Pyraclostrobin 5% WG	1 g	2.45(9.01)	14.12(22.07)	58.62
T_2	Boscalid 26.7%+Pyraclostrobin 13.3% WG	1.5 ml	3.20(10.30)	12.18(20.43)	64.30
T_3	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	1 ml	3.85(11.32)	16.59(24.04)	51.38
T_4	Mancozeb 75 % WP	2.5 g	2.65(9.37)	20.46(26.89)	40.04
T_5	Control (Water only)	--	2.80(9.63)	34.12(35.74)	0.00
	S Em (±)		0.456	0.450	
	CD 5%		NS	1.39	

Table-3 Effect of fungicidal management on bulbs yield of onion during 2020-21 and 2021-22

			Pooled analysis of 2021 and 2022	
Treatments	Fungicides	Dose (per litre)	Bulbs Yield (t/ ha)	Yield increase over control (%)
T_1	Metiram 55% + Pyraclostrobin 5% WG	1 g	23.20	58.69
T_2	Boscalid 26.7%+Pyraclostrobin 13.3% WG	1.5 ml	24.76	69.36
T_3	Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC	1 ml	21.85	49.45
T_4	Mancozeb 75 % WP	2.5 g	17.48	19.56
T_5	Control (Water only)	--	14.62	0.00
	SEm (±)		0.52	
	CD 5%		1.59	

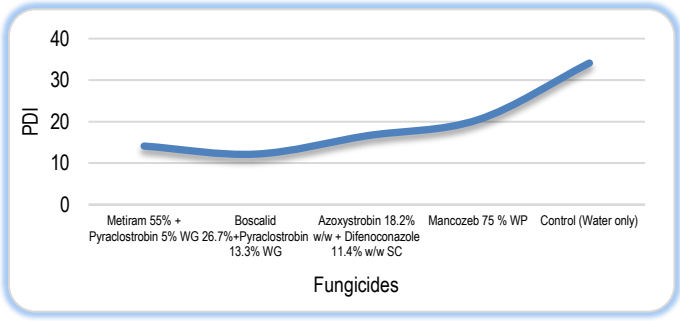

Fig-1 Percent disease index (PDI) in different fungicides against Stemphylium blight disease of onion

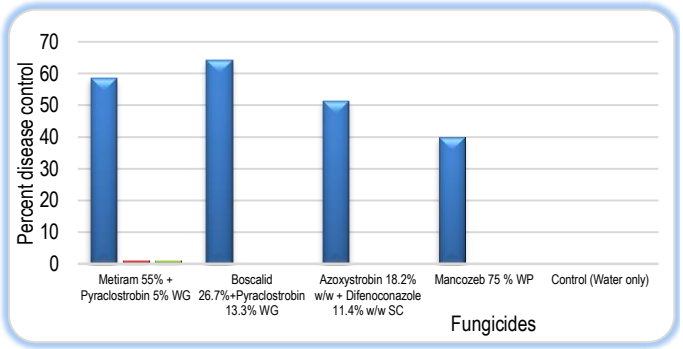

Fig-2 Influence of fungicides on Stemphylium blight disease control in onion

Depending on the prevailing weather conditions, maximum disease severity (34.12%) was recorded on plants in control. Among the treatments T_2: in Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water (12.18 %) exhibited minimum disease severity on plants followed by T_1: Metiram 55% + Pyraclostrobin 5% WG @ 1.0 g/litre of water (14.12 %), T_3: Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/litre of water (16.59%) and T_4: Mancozeb 75 % WP @ 2.5 g/litre of water (20.46 %) at 15 days after final spray. Results among these four treatments (T_1, T_2, T_3 & T_4) were found good efficacy against the disease over control.

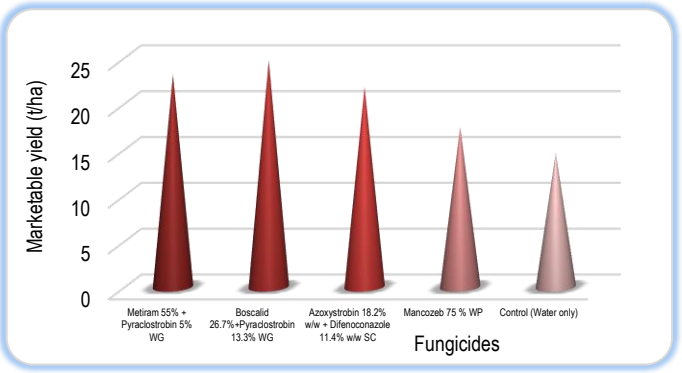

Fig-3 Effect of fungicides on marketable bulbs yield in onion

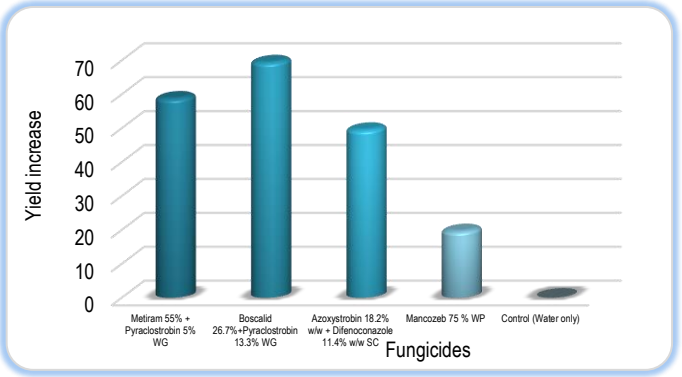

Fig-4 Influence of fungicides on marketable bulbs yield increase in onion

The per cent reduction in terminal PDI was also calculated over control [Table-2] and [Fig-2]. The data revealed that highest disease control was in T_2: in Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water (64.30 %) exhibited minimum disease severity on plants followed by T_1: Metiram 55% + Pyraclostrobin 5% WG @ 1.0 g/litre of water (58.62 %), T_3: Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/litre of water (51.38%) and T_4: Mancozeb 75 % WP @ 2.5 g/litre of water (40.04 %) at 15 days after final spray. All treatments controlled effectively the stemphylium blight disease in onion.

The yield data has been presented in [Table-3] and [Fig-3]. The results revealed that maximum yield was obtained from T_2: Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water (24.76 t/ha) followed by T_1: Metiram 55% + Pyraclostrobin 5% WG @ 1.0 g/litre of water (23.20 t/ha), T_3: Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/litre of water (21.85 t/ha) and T_4: Mancozeb 75 % WP @ 2.5 g/litre of water (17.48 t/ha). The lowest yield was recorded in control (14.62 t/ha).

Highest increase of marketable yield was recorded from T_2: in Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water (69.36 %) followed by T_1: Metiram 55% + Pyraclostrobin 5% WG @ 1.0 g/litre of water (58.69 %), T_3: Azoxystrobin 18.2% w/w + Difenoconazole 11.4% w/w SC @ 1.0 ml/litre of water (49.45%) and T_4: Mancozeb 75 % WP @ 2.5 g/litre of water (19.56%) presented in [Table-3] and [Fig-4].

Results of field trials showed that azoxystrobin + difenoconazole (Quadris top), fluopyram + pyremethanil (Luna Tranquility), difenoconazole (Inspire) were the most effective in reducing stemphylium leaf blight, which is supporting the findings of the present study [11]. Strobilurin fungicides are quinone outside inhibitors and are effective in inhibiting the germination of fungal spores. Triazole fungicides inhibit ergosterol biosynthesis in pathogenic fungi. Because spores already contain ergosterol, the triazole fungicides are generally not very effective in preventing spore germination. Triazole fungicides work best by inhibiting fungi's mycelial growth [12].

Conclusion

The findings of the present investigation are comparable with the findings of the previous researchers. Based on findings of the present study, it may be concluded that two times foliar spray with Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water at an interval of 15 days may be recommended to management of Stemphylium blight disease of onion in West Bengal condition.

Application of research: The fungicide Boscalid 26.7%+Pyraclostrobin 13.3% WG @ 1.0 g/litre of water will be very effective for management of Stemphylium blight disease of onion.

Research Category: Plant disease management by chemical fungicide.

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University: Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, 741252, West Bengal, India
Research project name or number: Research station study

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Author statement: Author read, reviewed, agreed and approved the final manuscript. Note-Author agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Regional Research Sub-Station (Red & Laterite Zone), Sekhampur, Birbhum, 731129

Cultivar / Variety / Breed name: Onion (*Allium cepa* L.) Sukhsagar

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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