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In – Vivo Evaluation of fungicides for the management of stemphylium blight disease of garlic



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ABSTRACT

Garlic commonly known as 'Lasan' is the 2nd important crop grown and used as a condiment, next to onion in India. Among the different fungal diseases of garlic, stemphylium blight has currently become one of the most important diseases of all garlic varieties. Diseases in the garlic is becoming the major limiting factor for its production and storage losses due to disease has been varying on different factors. Therefore, the present investigation is undertaken for the management of stemphylium blight disease in garlic. Combined fungicides were evaluated for their effectiveness under in vivo conditions. Field trial was conducted for two consecutive years during rabi season 2020-21 and 2021-22 on garlic variety Agrifound White. The experiment was conducted at Regional Research Station, National Horticultural Research and Development Foundation, Nashik, Maharashtra. The data were evident that treatment T₄ (Azoxystrobin + Cyproconazole @ 1.0ml/L at 45, 60 and 75DAP) performed superior with the lowest incidence (32.50 %) and intensity (5.05 %) of stemphylium blight as well as 58.77% disease control of stemphylium blight over untreated control at 75 DAP. The significantly highest gross yield (65.27q/ha) as well as marketable yield (62.82 q/ha) was also recorded in T₄.

Keywords: Garlic, Disease, Stemphylium blight, Fungicides, Incidence, Intensity, Treatment, Management, Control, Days after planting.

INTRODUCTION

Garlic (*Allium sativum*) is one of the important bulb crop and is used as a spice throughout the world. It is belonging to the family *Alliaceae* and is commonly termed as 'Lasan' as well as botanically known as *Allium sativum* (Linnaeus). It is mainly used for culinary purposes and a condiment for different food items. Garlic is widely used around the world for its pungent flavor as a seasoning or condiment ingredient. It is a major spice crop in India. India is the second largest producer of garlic. Garlic bulb is used for consumption (raw or cooked) or for medicinal purposes [1]. Several diseases caused by fungi, bacteria, nematodes, and viruses play a major role in reducing the yield per unit area. Among the diseases leaf blight is a major disease of garlic caused by different species of *Stemphylium* [14]. The severity of the disease is much more where the crop is

predisposed by thrips injury [4]. In favorable conditions, an epidemic may cause total failure of the crop caused by *Stemphylium* sp. Garlic yield was reduced by 30% on average, with up to 70% yield losses in some fields during the winter growing season. In view of this, the present study has planned to assess the effect of different fungicides as foliar sprays in controlling stemphylium blight disease of garlic.

MATERIAL AND METHODS

The experiment was piloted at the Research Farm of National Horticultural Research and Development Foundation (NHRDF), Regional Research Station (RRS) Nashik, Maharashtra for the two consecutive years during rabi season (2020-21 and 2021-22) on the Agrifound white variety of garlic. The raised bed 1.50m x 2.50m in size was made to plant the cloves at the space of 15.0cm x 10.0 cm. The trial was designed with Randomized Block Design with four replications. Three foliar sprays of fungicides were done, starting after 45 days of planting, 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 stemphylium blight before each spray. Scoring of the disease was done on a scale of 0-5, while Percent Disease Index (PDI) or disease intensity was

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recorded as described by Wheeler [13] as given below. The percent disease control (PDC) for the stemphylium blight was also recorded. After attaining maturity crop was harvested from all the treatments for further assessment of yield.

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of all disease ratings}}{\text{Total number of observed leaves} \times \text{Maximum rating value (5)}} \times 100$$

$$\text{Percent Disease Incidence} = \frac{\text{Infected plants}}{\text{Total no. of plants}} \times 100$$

Details of treatments

T₁: Spray of Mancozeb @ 2.5 g/L at 45 DAP + Iprodione @ 2.5g/L at 60 DAP + Azoxystrobin + Cyproconazole @ 1.0 ml/L at 75 DAP

T₂: Spray of Hexaconazole @ 2.0 g/L at 45 DAP + Tebuconazole + Trifloxystrobin @ 1.0g/L at 60 DAP + Fenamidone + Mancozeb @ 2.0ml/L at 75DAP

T₃: Spray of Mancozeb @ 2.5 g/L at 45DAP + Chlorothalonil @ 2.0g/L at 60 DAP + Pyraclostrobin 5% + Metiram 55% @ 1.0 g/L @ at 75DAP

T₄: Spray of Azoxystrobin + Cyproconazole @ 1.0ml/L at 45, 60 and 75DAP

T₅: Spray of Mancozeb @ 2.5 g/L at 45, 60 and 75DAP

RESULTS AND DISCUSSION

Rabi 2020-21

The data presented in Table-1 revealed that stemphylium blight disease has appeared after 60 days of planting. The incidence of stemphylium blight ranged from 25.0% to 55.0% and intensity varied from 1.60% to 11.0% during the cropping period. The significantly lowest stemphylium blight incidence (25.0%) as well as intensity (1.60%), was recorded in treatment T₄ (Sprays of Azoxystrobin + Cyproconazole @ 1.0 ml/L at 45, 60 and 75 DAP) at 60 DAP. The disease progresses as per the advancement of the crop stage. Further, data revealed that, the significant lowest incidence (27.50%) as well as intensity (4.30%) was recorded in same treatment T₄ at 75 DAP. The highest stemphylium blight incidence (55.0%) and intensity (11.0%) was recorded in T₆ (Untreated control) at 75 DAP. The highest percent disease control (PDC) of stemphylium blight was recorded in treatment T₄ (60.91%) followed by T₃ (50.0%) and T₂ (38.18%) over untreated control. The significantly highest gross yield (35.33 q/ha) as well as marketable yield (32.80 q/ha) was recorded in T₄ which was found at par with all the treatments except untreated control. The lowest gross yield (27.20 q/ha) and marketable yield (24.06 q/ha) were recorded in T₆ (Untreated control).

Table-1 In Vivo Evaluation of fungicides for the management of foliar diseases of garlic during Rabi, 2020-21

Treatments	Stemphylium blight								#PDC	Gross Yield (q/ha)	Marketable Yield (q/ha)
	At 60 DAP				At 75 DAP						
	*Incidence (%)		Intensity (%)		*Incidence (%)		Intensity (%)				
T1	32.50	(34.72)	2.90	(1.84)	45.00	(42.12)	8.00	(2.91)	27.27	34.00	31.60
T2	30.00	(33.05)	2.50	(1.72)	40.00	(39.17)	6.80	(2.70)	38.18	34.07	31.83
T3	30.00	(33.05)	2.20	(1.64)	35.00	(36.22)	5.50	(2.45)	50.00	34.20	32.60
T4	25.00	(29.89)	1.60	(1.45)	27.50	(31.55)	4.30	(2.19)	60.91	35.33	32.80
T5	35.00	(36.22)	3.40	(1.97)	52.50	(46.44)	9.70	(3.19)	11.82	33.20	29.56
T6	42.50	(40.67)	4.40	(2.21)	55.00	(47.88)	11.00	(3.39)	-	27.20	24.06
S.Em±	-	2.08	-	0.08	-	2.24	-	0.11	-	2.17	2.65
CD at 5%	-	4.43	-	0.17	-	4.77	-	0.23	-	4.63	5.65
CV %	-	8.49	-	6.58	-	7.83	-	5.39	-	9.32	12.31

Note- Data in the parenthesis shows *arcsine/square root transformed values

Percent Disease Control

Rabi 2021-22

The data presented in Table-2 revealed that stemphylium blight disease has appeared after 60 days of planting. The incidence of stemphylium blight ranged from 15.0% to 67.50% and intensity varied from 1.20% to 13.50% during the cropping period. The significantly lowest stemphylium blight incidence (15.0%) as well as intensity (1.20%), was recorded in treatment T₄ (Spray of Azoxystrobin + Cyproconazole @ 1.0 ml/L at 45, 60, and 75 DAP) at 60 DAP. The disease progresses as per the advancement of the crop stage. Further, data revealed that, the significantly lowest incidence (37.50%) as well as intensity (5.80%) was recorded in the same treatment T₄ at 75 DAP. The highest stemphylium blight incidence (67.50%) and intensity (13.50%) was recorded in T₆ (Untreated Control) at 75 DAP. The highest percent disease control of stemphylium blight was recorded in treatment T₄ (57.04%) followed by T₃ (47.41%) and T₂ (37.78%) over T₆ (Control). The significantly highest gross yield (95.21 q/ha) as well as marketable yield (92.85 q/ha), was recorded in T₄. However, the gross yield was found at par with T₂ (Spray of Hexaconazole @ 2.0 ml/L at 45 DAP, Tebuconazole + Trifloxystrobin @ 1.0 g/L at 60 DAP, Fenamidone + Mancozeb 2.0 g/L at 75 DAP) and T₃, whereas, the marketable yield was found at par with T₃.

Fig: 01

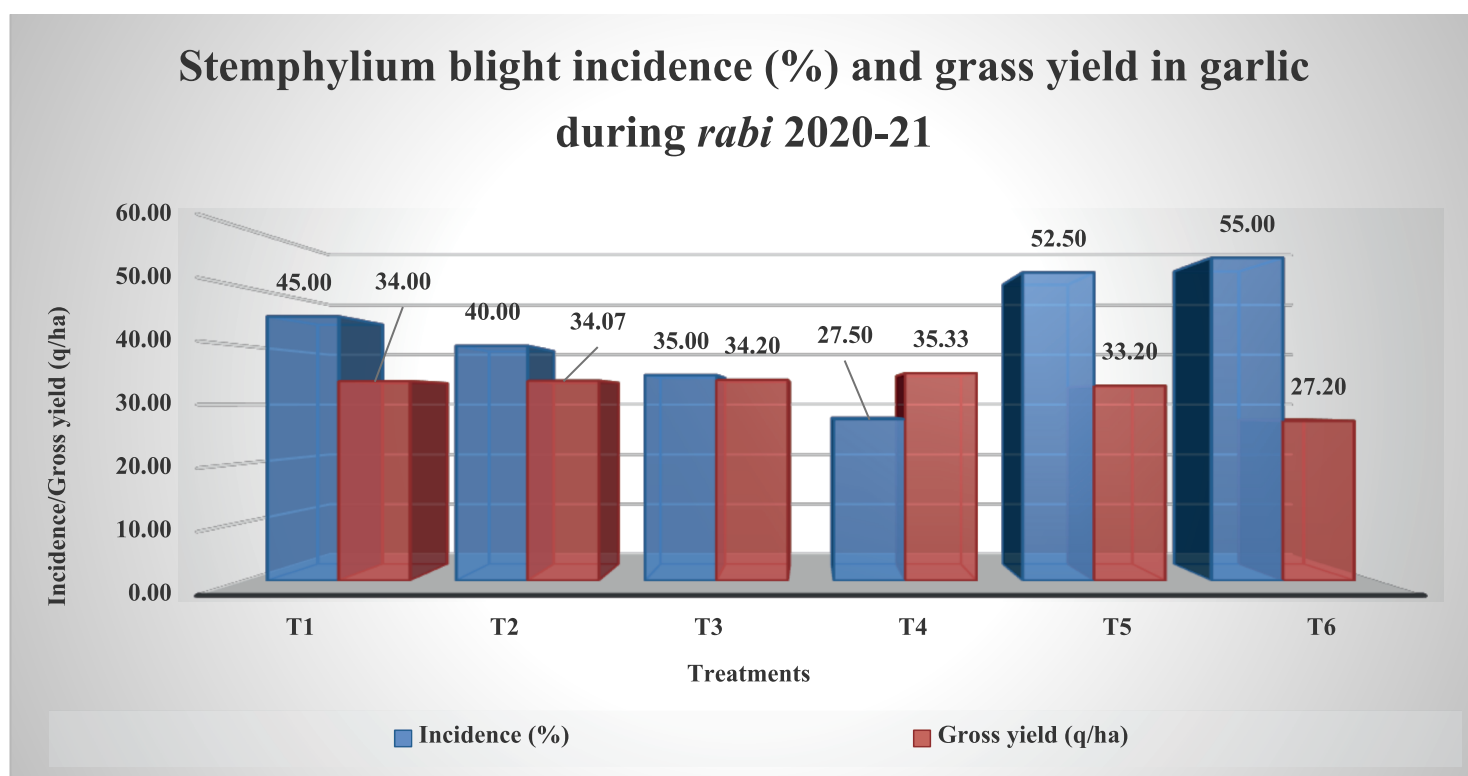


Table-2 In-Vivo evaluation of fungicides for the management of foliar diseases of garlic during rabi, 2021-22

Treatments	Stemphylium blight								#PDC	Gross yield (q/ha)	Market-able yield (q/ha)
	At 60 DAP				At 75 DAP						
	*Incidence (%)		Intensity (%)		*Incidence (%)		Intensity (%)				
T1	35.00	(36.22)	2.70	(1.79)	55.00	(47.88)	9.70	(3.19)	28.15	79.80	75.49
T2	25.00	(29.89)	1.80	(1.52)	50.00	(45.00)	8.40	(2.98)	37.78	84.65	77.08
T3	20.00	(26.57)	1.60	(1.45)	45.00	(42.12)	7.10	(2.75)	47.41	85.76	82.57
T4	15.00	(22.50)	1.20	(1.30)	37.50	(37.73)	5.80	(2.51)	57.04	95.21	92.85
T5	30.00	(33.21)	2.30	(1.67)	62.50	(52.27)	11.30	(3.43)	16.30	79.23	73.33
T6	47.50	(43.56)	7.50	(2.82)	67.50	(55.28)	13.50	(3.74)	-	72.08	68.05
S.Em±	-	1.96	-	0.09	-	2.18	-	0.09	-	5.61	6.72
CD at 5%	-	4.18	-	0.19	-	4.65	-	0.19	-	11.96	14.32
CV %	-	8.66	-	7.38	-	6.60	-	3.96	-	9.59	12.14

Note- Data in the parenthesis shows *arcsine/square root transformed values
Percent Disease Control

Combined data (2020-21 & 2021-22)

The combined data from two years of trials are presented in Table-3 revealed that stemphylium blight disease was appeared after 60 days of planting. The incidence of stemphylium blight ranged from 20.0% to 61.25% and intensity varied from 1.40% to 12.25% during the cropping period. The significantly lowest stemphylium blight incidence (20.0%) as well as intensity (1.40%), was recorded in treatment T₄ at 60 DAP. The disease progresses as increasing the crop age. Further, data revealed that, the significantly lowest incidence (32.50%) as well as intensity (5.05%) was recorded in same treatment T₄ at 75 DAP and the incidence was found at par with T₃. The highest stemphylium blight incidence (61.25%) and intensity (12.25%) were recorded in T₆ (Untreated Control) at 75 DAP. The highest percent disease control of stemphylium blight was recorded in treatment T₄ (58.78%) followed by T₃ (48.57%) and T₂ (37.96%) over T₆ (Control). The yield data shows non-significant variations, however, the highest gross yield (65.27 q/ha) as well as marketable yield (62.83 q/ha) were recorded in T₄. The highest benefit-cost ratio (8.28:1) was recorded in T₃ followed by T₄ (5.89:1). Similar study has been done by Chaurasia et. al. (2007) who reported that two to three spray of Dithane M-45 @ 0.3% and

Bavistin @ 0.3% was effective against purple blotch disease of garlic as well as increased yield [3]. According to Gupta and Sharma (2017), soil application of *Ps. fluorescens* and foliar spray of Pyraclostrobin + Metiram was most effective for control of stemphylium blight in garlic [5]. Tebuconazole and procymidone have been reported to provide effective control of stemphylium leaf blight in garlic [2]. Singh et al. (2021) reported that some bio-agents and botanicals were found most effective against foliar diseases of garlic [11]. Gupta et al. (1996) reported that *Stemphylium vesicarium* is one of the major destructive diseases of onion crops grown in the state of Maharashtra [6]. Bio-efficacy of eight fungicides was evaluated *in vitro* against *Stemphylium vesicarium*. All the fungicides tested were found fungicidal against the pathogen and inhibited mycelial growth of the pathogen over untreated control. Srivastava et al., reported that Chlorothalonil 75 WP, Difenconazole 25 EC, thiophanate methyl 70 WP, Penconazole 10 EC. and Hexaconazole 5 EC were promising for effective management of Stemphylium leaf blight of garlic [12]. Jakhar et al. (1996) reported that fungicide Mancozeb and Copper oxychloride have been the most effective and economical fungicides against stemphylium blight and purple blotch disease *in vitro* as well as under *in vivo* conditions [7]. Pandey et al. (2022, 2023a and 2023b) reported that combined fungicides and the alternative spray of bio-agents as well as fungicides are more effective against stemphylium blight of onion and increased the bulb yield [8] [9] [10].

Fig: 02

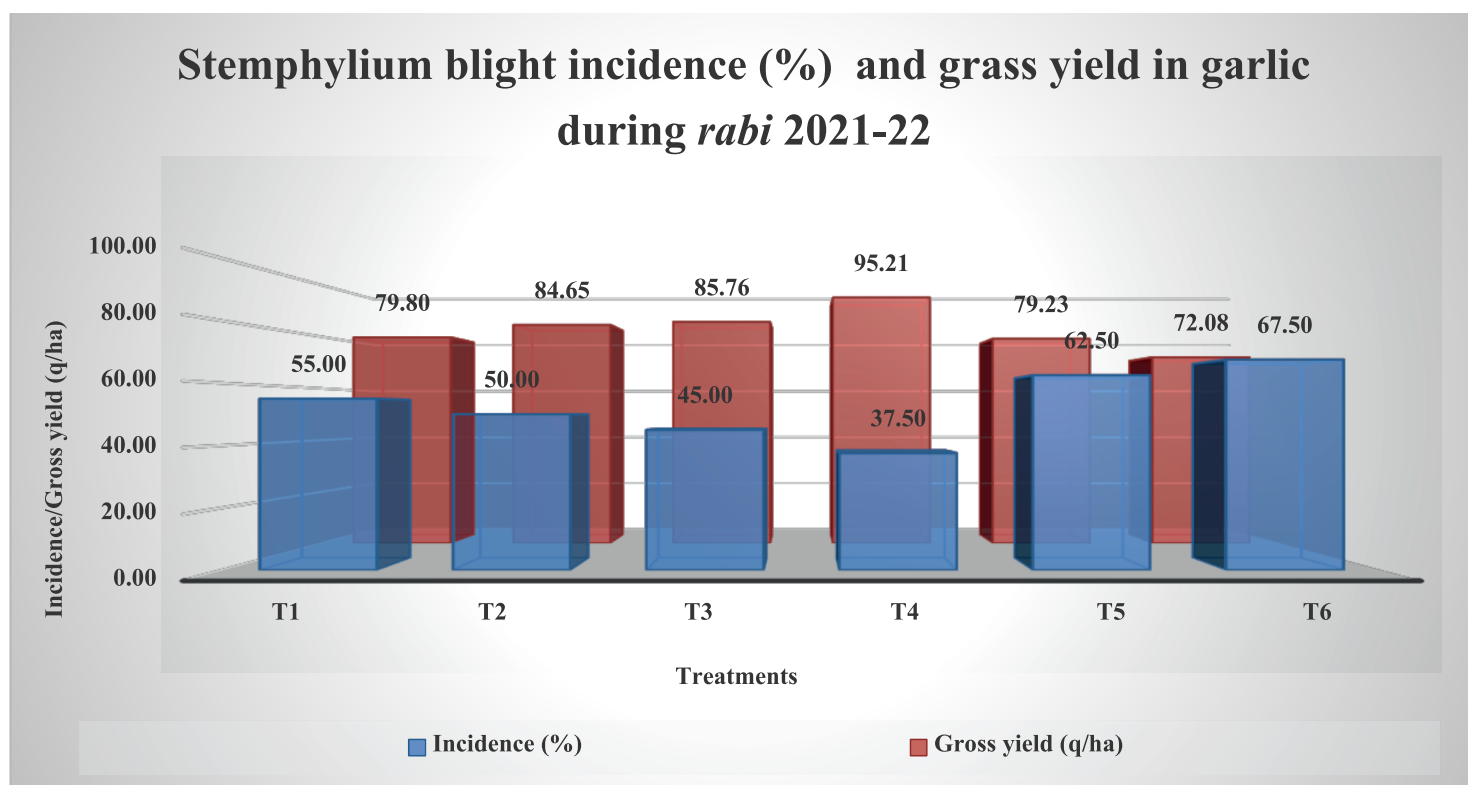
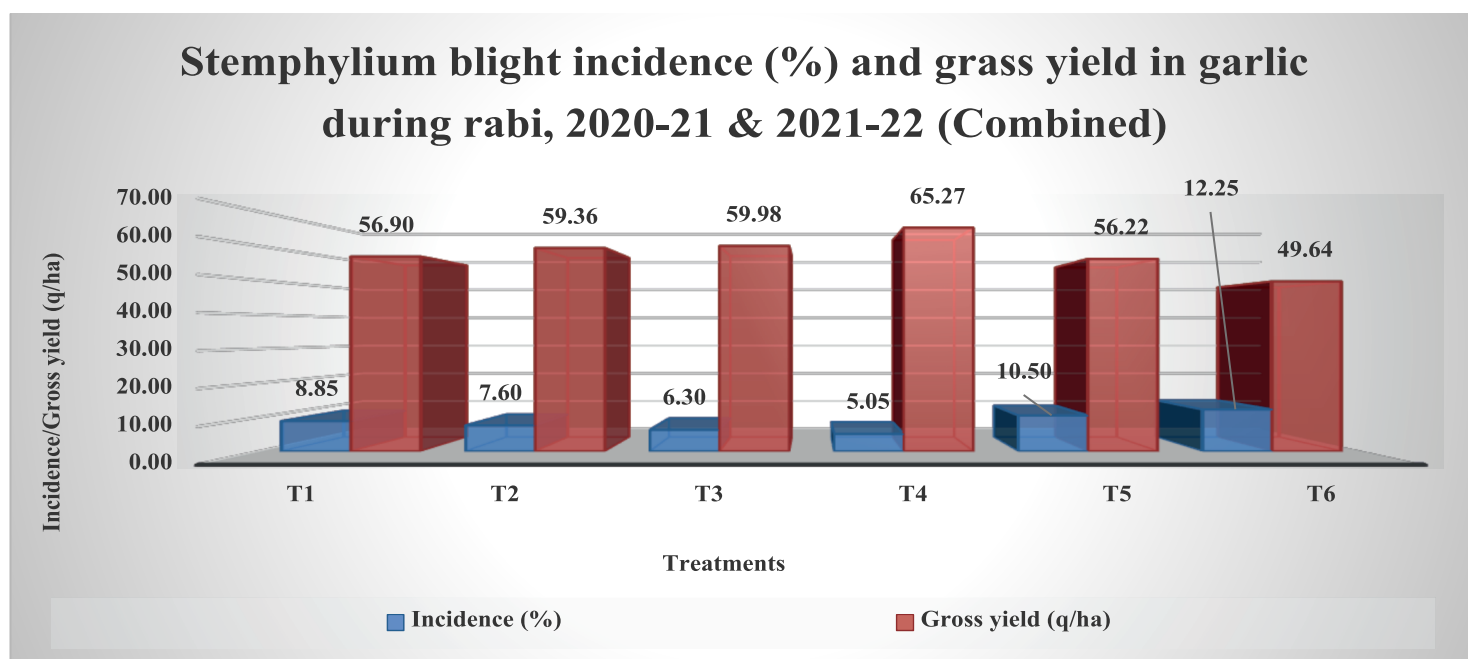


Table-3 In-Vivo evaluation of fungicides for the management of foliar diseases of garlic (Combined rabi, 2020-21 & 2021-22)

Treatments	Stemphylium blight								#PDC	Gross yield (q/ha)	Market-able yield (q/ha)	B:C ratio
	At 60 DAP				At 75 DAP							
	*Incidence (%)	Intensity (%)	*Incidence (%)	Intensity (%)	*Incidence (%)	Intensity (%)	*Incidence (%)	Intensity (%)				
T1	33.75	(35.51)	2.80	(1.82)	50.00	(45.00)	8.85	(3.05)	27.76	56.90	53.54	2.75:1
T2	27.50	(31.61)	2.15	(1.62)	45.00	(42.12)	7.60	(2.84)	37.96	59.36	54.46	3.21:1
T3	25.00	(29.89)	1.90	(1.55)	40.00	(39.20)	6.30	(2.60)	48.57	59.98	57.58	8.28:1
T4	20.00	(26.39)	1.40	(1.38)	32.50	(34.69)	5.05	(2.35)	58.78	65.27	62.82	5.89:1
T5	32.50	(34.74)	2.85	(1.82)	57.50	(49.34)	10.50	(3.31)	14.29	56.22	51.44	5.52:1
T6	45.00	(42.13)	5.95	(2.52)	61.25	(51.56)	12.25	(3.57)	-	49.64	46.06	-
S.Em±	-	2.86	-	0.12	-	3.13	-	0.14	-	6.02	7.22	-
CD at 5%	-	7.35	-	0.31	-	8.05	-	0.36	-	NS	NS	-

Note- Data in the parenthesis shows *arcsine/square root transformed values
Percent Disease Control

Fig: 03



CONCLUSION

The combined data of two years trial conducted during *rabi*, 2020-21 and 2021-22 on garlic variety Agrifound White revealed that foliar spray of Azoxystrobin + Cyproconazole @ 1.0 ml/L at 45, 60 and 75 days after planting performed superior for the management of foliar diseases with 58.78% disease control of stemphylium blight over untreated control with benefit cost ratio of 5.89:1 in this treatment. Farmers are suggested to use of Azoxystrobin + Cyproconazole fungicide @ 1.0 ml/L at 45, 60 and 75 days after planting for improved their yield and quality of garlic. Resistancy developed in the garlic against different diseases is due to the continuous spray of the same chemicals repeatedly and there is strong probability that if there is alternative use of chemicals on a schedule basis will help in minimizing the disease incidence as well as intensity and this scheduling must be analyzed in the field using different combinations and schedules for recommendation to the farmers.

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