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Management of leaf blight of wheat (*Triticum aestivum* L) with botanicals and fungicides

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Abstract

Leaf blight (*Alternaria triticina*) is major disease in irrigated areas of MP. Given the significance of wheat leaf blight, a field investigation was done employing various fungicides and plant extracts to study their comparative efficacy in controlling foliar blight and yield of wheat in the field. Seven different solo fungicides viz. Propiconazole, Pyraclostrobin, Azoxystrobin, Difenconazole, Propineb, Thiophanate methyl, Trifloxystrobin and seven different combinations fungicides viz., Luna (Fluopyran + Tebuconazole), Sofia (Hexaconazole + Carbendazim), Azoxy super (Azoxystrobin + Tebuconazole), Azoxy top (Azoxystrobin + Difenconazole), Vitavex power (Carboxin + Thiaram), Nativo (Tebuconazole + Trifloxystrobin) were evaluated as a foliar spray under field conditions., Propiconazole @ 1 ml/L and combination of Tebuconazole + Trifloxystrobin @ 1 g/L was found most effective against *Alternaria* leaf blight. Further, thirteen solo and combination plant extracts viz. Garlic, Neem, Ashwagandha, Datura, Ginger, Tulsi, Giloy and Ginger + Garlic, Tulsi + Garlic, Neem + Ashwagandha, Ashwagandha + Garlic, Ginger + Neem, Neem + Tulsi along with control were evaluated at the rate of 5% against *Alternaria triticina*. Garlic clove extract @ 50 gram/L and combination of Ginger + Garlic @ 25 gram/L + 25 gram / L was found most effective against *Alternaria* blight under *in-vivo* condition.

Keywords: *Alternaria triticina*, fungicide, leaf blight, plant extracts, wheat

Introduction

Wheat is an essential component of the human diet, accounting for around 20% of daily protein and calories, and it is the second most important food crop in developing countries behind rice in terms of food security. Wheat (*Triticum* spp L.) is one of India's most important Rabi cereal crops. Wheat is a member of the Poaceae family and belongs to the genus *Triticum*. Wheat grain is essential for growth and survival since it contains carbs, proteins, vitamins, and minerals. Wheat production is influenced by many factors, ranging from planting to storage. Diseases are the most significant of these stressors. Wheat is attacked by a number of fungi, bacteria, viruses, and insect pests, all of which considerably impair output. The three rusts, black, brown/orange, and yellow, produced by *Puccinia graminis tritici*, *Puccinia triticina*, and *Puccinia striiformis*, are the most serious foliar diseases affecting wheat output. Leaf blight is caused by *Alternaria triticina*, *Helminthosporium* spp., *Curvularia* spp., and other pathogens, although *Alternaria triticina* is especially common in wheat-growing areas in Eastern and South-Central India (Joshi *et al.*, 1978) [6]. Wheat leaf blight caused by *Alternaria triticina* is one of the most important wheat diseases, inflicting significant losses in Rajasthan on high yielding Mexican types. According to Prabhu and Prasada (1966) [11], as the disease proceeds, the irregularly distributed necrotic patches combine and cover huge areas, resulting in the loss of the entire leaf. In extreme cases, symptoms may emerge on the leaf sheath, seed, and wild host in the soil. Wheat leaf blight caused by *Alternaria triticina* is a damaging disease in several parts of India, including Kanpur, Orissa, Maharashtra, Bihar, and West Bengal (Prabhu and Prasada, 1966) [11]. This disease has become widespread in Madhya Pradesh in recent years, resulting in significant yield losses. Given the significance of the wheat crop and its pathogen, a comprehensive investigation was carried out with the goals in mind to develop control techniques utilising botanicals and fungicides.

Materials and Methods

Evaluation of plant extracts: A field experiment was conducted during Rabi 2020-21 in Wheat Improvement Project, Department of Plant Breeding and Genetics, Jawahar Lal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP).

Thirteen different plant extracts *viz.* Garlic, Neem, Ashwagandha, Datura, Ginger, Tulsi, Giloy and combination plant extracts *viz.* Ginger + Garlic, Tulsi + Garlic, Neem + Ashwagandha, Ashwagandha + Garlic, Ginger + Neem, Neem + Tulsi along with control were evaluated at the rate of 5% against *Alternaria triticina* to study their comparative efficacy in controlling foliar blight and yield of wheat in the field. The experiment was set up in a randomised block design with a plot size of 6.0 m.02 m and three replications on the variety HI 8759 (Pusa Tejas). Fresh plant leaves (Neem, Datura, Tulsi), clove (Garlic), and rhizome (Ginger) were collected, washed with tap water followed by sterile water, and then crushed in mortar with pestle @ 1 g leaf and 1ml water, i.e., 1:1 ratio of leaf and water (w/v), filtered with two layers of muslin cloth. The resulting extract was diluted in 1 L of water for each plot before being sprayed on the crop. Two consecutive 5% sprays were given at 15-day intervals between 07/02/2022 and 21/02/2022.

Results and Discussion

Evaluation of fungicides

All the fungicides proved effective and reduced the intensity of leaf blight disease and increased yield when compared with control. Spraying propiconazole (1 ml/l) proved to be most effective treatment in which least disease score (03) was recorded. The second least disease score plot was difenoconazole (05) and followed by pyraclostrobin (13), trifloxystrobin (14) (Table-1; Figure -1). The disease score recorded in azoxystrobin, thiophenate methyl and propineb were respectively, 16, 19 and 27. Maximum disease score recorded in control plot (33). All the treatments enhanced the grain yield in contrast to unprotected plot. The highest grain yield was obtained from the same treatment propiconazole (65.1 q/ha) followed by difenoconazole (61.3 q/ha). The remaining fungicides showed various levels of yield ranged from 50.4-58 q/ha. The plant height was ranged from 87.8 cm to 84.9 cm. The yield and plant height recorded in control were 50.4 q/ha and 84.8 cm. Ansari *et al.* (2017) [1] and Somani *et al.*, (2019) [16] also reported that triazole fungicides (e.g., Propiconazole and Tebuconazole) found effective against *Alternaria* blight. Propiconazole was effective for controlling leaf blight of wheat because of the reason it inhibits the synthesis of sterols, which are building blocks of the membranes of fungal cells. This makes them ideal

chemicals for the management of leaf blight of wheat. These findings are also in accordance with the finding of various workers like Zamal (2007) [20], Rahman *et al.* (2013) [12], Kumar *et al.* (2014) [8], Kakraliya *et al.* (2017) [7], Wei *et al.* (2021) [19].

All the combination fungicides proved effective and reduced the intensity of leaf blight disease and increased yield when compared with control. Spraying (Tebuconazole + Trifloxystrobin) proved to be most effective treatment in which least disease score (01) was recorded. It was followed by (Azoxystrobin + Tebuconazole) (03), (Carbendazim + Mancozeb) (10), (Fluopyran + Tebuconazole) (13), (Tebuconazole + Sulphur) (14), (Azoxystrobin + Difenoconazole) (16), and highest disease score was recorded in (Carboxin + Thiram) (22). The disease score recorded in control was 34 (Table-2, Figure-2). All the treatments enhanced the grain yield in contrast to unprotected plot. The highest grain yield was also obtained from the same treatment (Tebuconazole + Trifloxystrobin) to the tune of (69.2 q/ha) followed by (Azoxystrobin + Tebuconazole) to the tune of 64.8 q/ha. The yield recorded in remaining fungicides *viz.*, (Carbendazim + Mancozeb), (Fluopyran + Tebuconazole), (Azoxystrobin + Difenoconazole), (Tebuconazole + Sulphur) and (Carboxin + Thiram) were respectively, 61.5, 57.4, 55.4, 54.3 and 52.6 q/ha. The plant height was ranged from 90.1 cm to 84.5 cm. The yield and plant height recorded in control were 50.3 q/ha and 83.2 cm. Tebuconazole and Trifloxystrobin is new combination fungicide containing systemic broad- spectrum fungicide with protective and curative action which offers not only a disease control but also improves quality and yield of crop. Tebuconazole is dimethylase inhibitor (DMI) -interferes in process of building the structure of fungal cell wall. Finally, it inhibits the reproduction and further growth of fungus. Trifloxystrobin interferes with respiration in plant pathogenic fungi. This work is proved by the evidence given by workers Kumar *et al.* (2014) [8] and Shahbaz *et al.* (2018) [15]. The reason may be that combination fungicides may show additive effect of both the protectant and systemic fungicides over solo application and in the absence of host resistance, combination formulation should be preferred over solo application of systemic single site fungicides to avoid resistance and it gives better yield and result.

Table 1: Evaluation of fungicides against *Alternaria* blight of wheat under *in vivo* condition

S. No	Chemical Name	Concentration (Per litre)	Disease Score	Yield (q/ha)	Plant Height (Cm)
T ₁	Propiconazole	1 ml	03	65.1	87.8
T ₂	Pyraclostrobin	1 ml	13	58.0	86.5
T ₃	Azoxystrobin	1 ml	16	56.6	86.1
T ₄	Difenoconazole	1 ml	05	61.3	87.4
T ₅	Propineb	3 g	27	51.6	84.9
T ₆	Thiophanate methyl	1 g	19	53.9	85.1
T ₇	Trifloxystrobin	1 g	14	57.4	86.3
T ₈	Control		33	50.4	84.8
	C.D.			1.28	1.46
	SE(m)			0.44	0.50
	C.V.			2.35	1.77

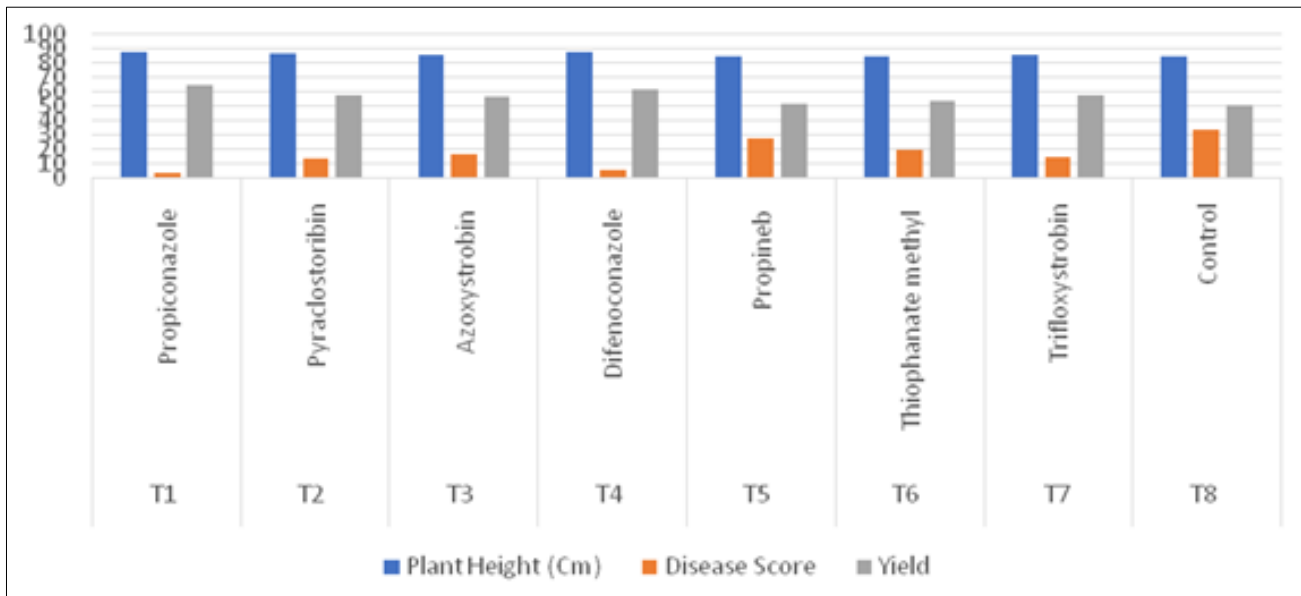


Fig 1: Evaluation of fungicides against leaf blight of wheat

Evaluation of plant extracts

Spraying garlic (5%) proved to be most effective treatment in which least disease score recorded (12) followed by Ginger (16). The disease score recorded in neem, tulsi, Ashwagandha, giloy and datura were respectively, 20, 21, 24, 26 and 29. Maximum disease score recorded in control (34). All the treatments enhanced the grain yield in contrast to unprotected plot. The highest grain yield was obtained from the same treatment garlic @ 5% (66.3 q/ha) followed by ginger (62.3 q/ha). The remaining plant extracts showed various levels of yield ranged from 51.3-57.8 q/ha. The plant height was ranged from 87.3 cm to 84.7 cm. The yield and plant height recorded in control were 50 q/ha and 84 cm (Table-3, Figure -3).

Seven combination plant extracts viz, Ginger + Garlic, Tulsi + Garlic, Neem + Ashwagandha, Ashwagandha + Garlic, Ginger + Neem, Neem + Tusli and Tulsi + Ginger along with control were evaluated to study their comparative efficacy in controlling leaf blight and yield of wheat in the field. Spraying (Ginger + Garlic) @ 5 percent proved to be most effective treatment in which least disease score (10), highest plant height (88.1 cm) and highest grain yield (66.6 q/ha) were recorded. It was followed Tulsi + Garlic (13), Ginger + Neem (14), Tulsi + Ginger (15), Ashwagandha + Garlic (16),

Neem + Tusli (25) and highest disease score was recorded in Neem + Ashwagandha (29) (Table-4; Figure-4). All the treatments enhanced the grain yield in contrast to unprotected plot. The highest grain yield was also obtained from the combination treatment of Ginger + Garlic (66.6 q/ha) followed by Tulsi + Garlic (63.5 q/ha). The yield recorded in remaining plant extracts ranged from 53.6 to 60.3 q/ha. The plant height was ranged from 88.1 cm to 84.7 cm. The yield and plant height recorded in control were 50.4q/h and 84.1 cm. The evidence of botanicals in field conditions showed that botanicals successfully decreased illness when compared to the control plot. The yield and plant height were also higher in botanically treated plots than in untreated ones. It was clearly noticed that garlic has antifungal effect against the fungus that may attributed to presence of various sulphur compounds like alien, allicin, ajoene, allylpropyl-diallyltrisulfide, sallylcysteine, vinylidithiines, S-allylmercaptocystein, and others. Besides sulfur compounds garlic contains 17 amino acids and their glycosides, arginine and others. Minerals such as selenium and enzymes like allinase, peroxidases, myrosinase, and others are also present. Similar effect of garlic has been reported by several workers like Kakraliya *et al.* (2017) [7], Naz Rabia *et al.* (2018) [10], Magar *et al.* (2020) [9] and Tiwari, Singh (2021) [17].

Table 2: Evaluation of fungicides against Alternaria blight of wheat under *in vivo* condition

S. No	Chemical Name	Concentration (Per litter)	Disease score	Yield (q/ha)	Plant height (cm)
T ₁	Fluopyran + Tebuconazole	1 ml	13	57.4	86.2
T ₂	Carbendazim + Mancozeb	1 ml	10	61.5	87.2
T ₃	Azoxystrobin + Tebuconazole	1 ml	03	64.8	88.5
T ₄	Azoxystrobin + Difenoconazole	1 ml	16	55.4	85.5
T ₅	Carboxin +Thiram	3 gm	22	52.6	84.5
T ₆	Tebuconazole + Trifloxystrobin	1 gm	01	69.2	90.1
T ₇	Tebuconazole + Sulphur	2 g	14	54.3	85.9
T ₈	Control		34	50.3	83.2
	C.D.			1.08	1.16
	SE(m)			0.37	0.40
	C.V.			1.93	1.39

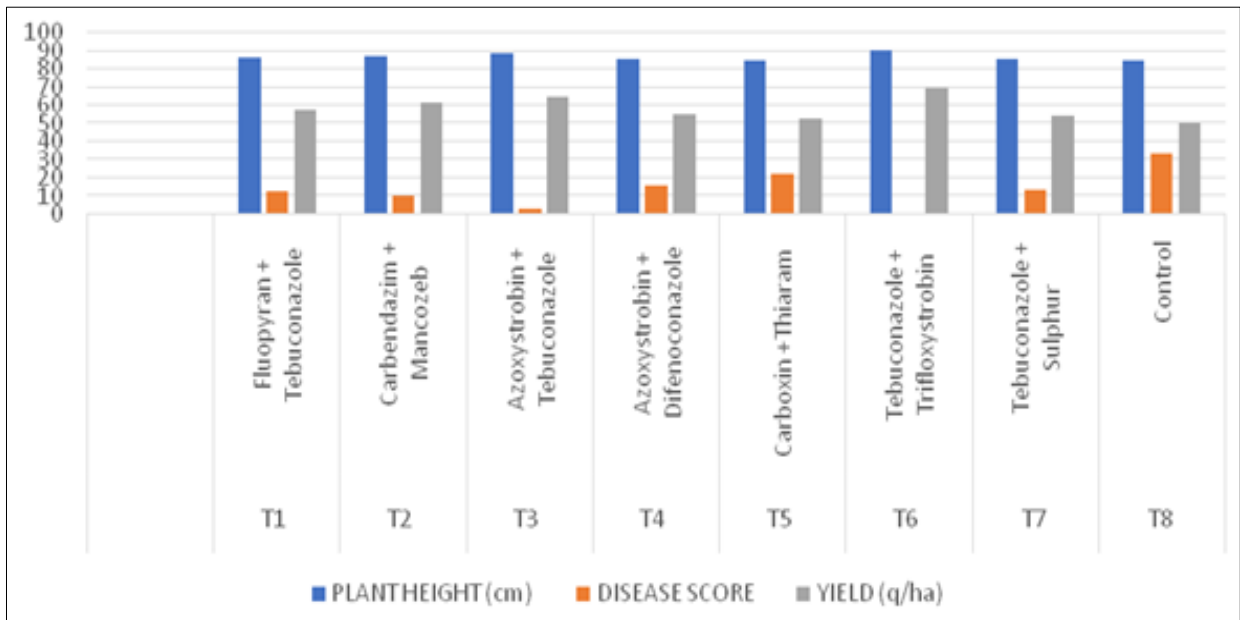


Fig 2: Evaluation of combination fungicides against leaf blight of wheat

Table 3: Evaluation of plant extracts against leaf blight of wheat under field condition

S. No.	Treatment	Plant part used	Concentration (g/l)	Disease score	Yield (q/ha)	Plant height (cm)
T ₁	Garlic	Cloves	50	12	66.3	87.3
T ₂	Neem	Leaves	50	20	57.8	86.4
T ₃	Ashwagandha	Leaves	50	24	53.0	85.1
T ₄	Giloy	Leaves	50	26	52.8	84.2
T ₅	Datura	Leaves	50	29	51.3	84.7
T ₆	Ginger	Rhizome	50	16	62.3	87.2
T ₇	Tulsi	Leaves	50	21	55.8	86.2
T ₈	Control			34	50	84.0
	C.D.				1.42	1.21
	SE(m)				0.49	0.42
	C.V.				2.64	1.48

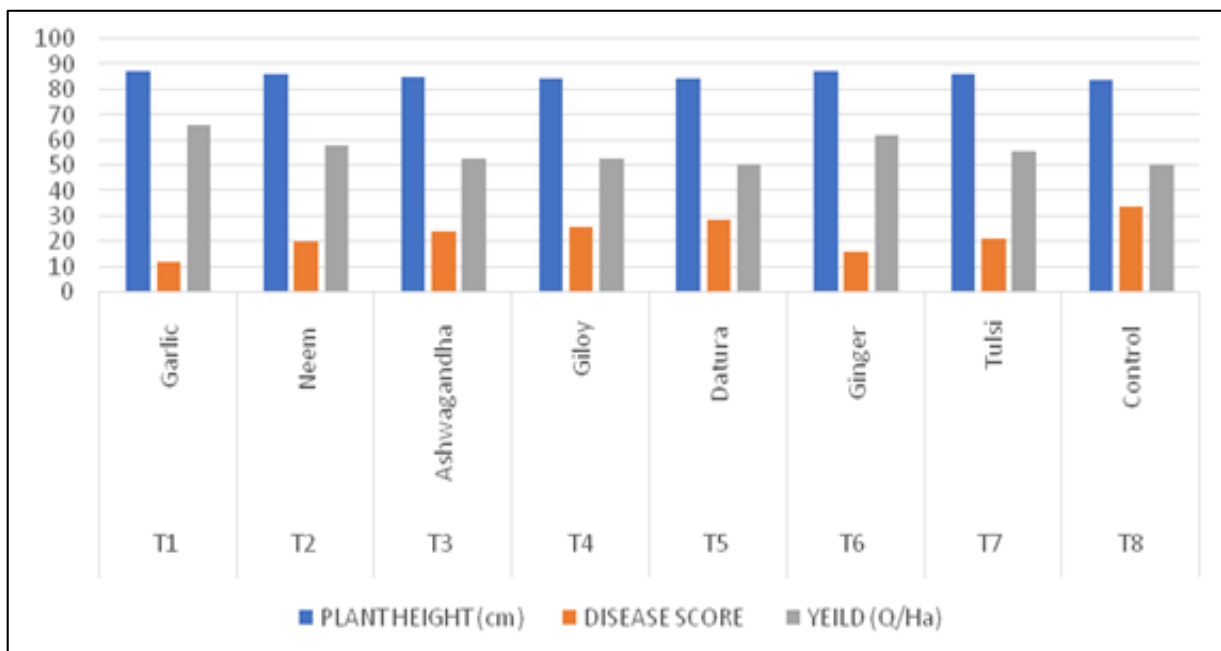
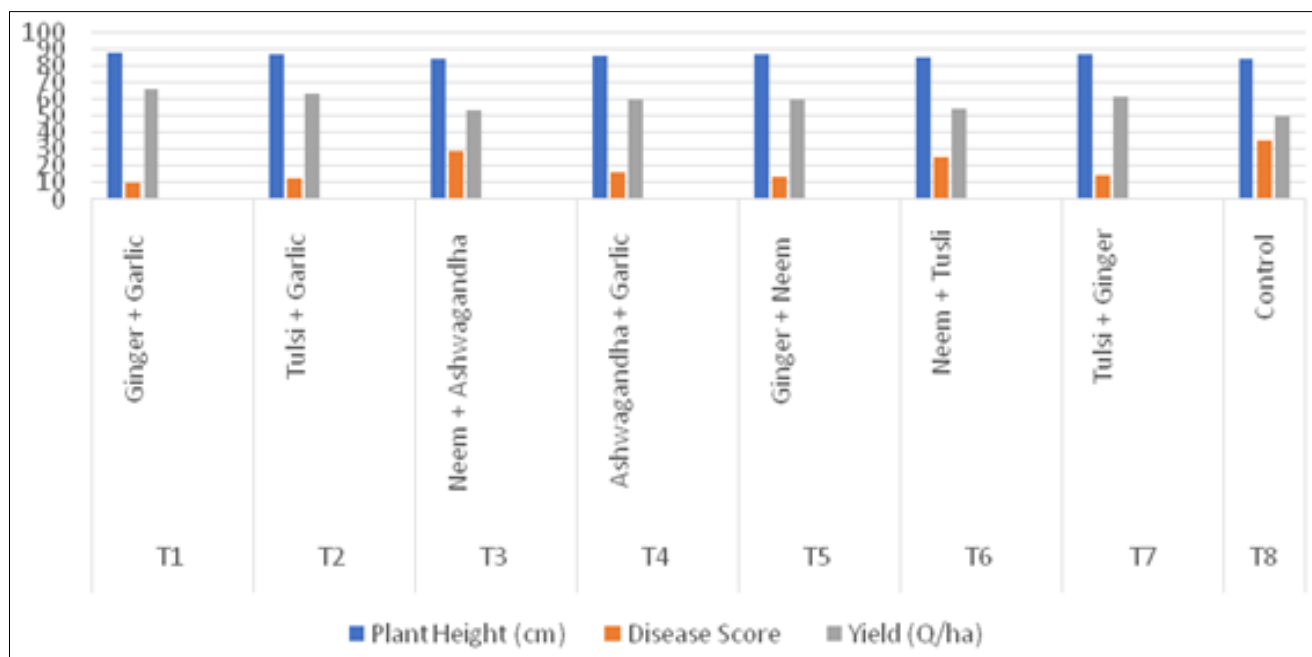


Fig 3: Evaluation of plant extracts against leaf blight of wheat

Table 4: Evaluation of combination plant extract against *Alternaria* blight of wheat under *in-vivo* condition

S. No	Treatment	Plant Part Used	Concentration (g/l)	Disease score	Yield (q/ha)	Plant height (cm)	Plant height (cm)
T ₁	Ginger + Garlic	Rhizome + Cloves	25 + 25	10	66.6	88.1	88.1
T ₂	Tulsi + Garlic	Leaves + Cloves	25 + 25	13	63.5	87.7	87.7
T ₃	Neem + Ashwagandha	Leaves + Leaves	25 + 25	29	53.6	84.7	84.7
T ₄	Ashwagandha + Garlic	Leaves + Cloves	25 + 25	16	59.6	86.1	86.1
T ₅	Ginger + Neem	Rhizome + Leaves	25 + 25	14	60.3	86.9	86.9
T ₆	Neem + Tulsi	Leaves + Leaves	25 + 25	25	54.3	85.6	85.6
T ₇	Tulsi + Ginger	Leaves + Rhizome	25 + 25	15	60	86.5	86.5
T ₈	Control			35	50.4	84.1	84.1
	C.D.				1.30	1.41	1.41
	SE(m)				0.45	0.49	0.49
	C.V.				2.31	1.71	1.71

**Fig 4:** Effect of combination plant extracts against leaf blight of wheat

Conclusion

Leaf blight (*Alternaria tritricina*) is a major disease in MP. A field investigation was done employing various fungicides and plant extracts to study their comparative efficacy in controlling foliar blight and yield of wheat in the field. Propiconazole @ 1 ml/L and combination of Tebuconazole + Trifloxystrobin @ 1 g/L was found most effective against *Alternaria* leaf blight. Among plant extract, garlic clove extract and combination of ginger + garlic @ 5% was found most effective against *Alternaria* blight under *in-vivo* condition.

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