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Management of Spot Blotch Disease of Wheat in Eastern Uttar Pradesh

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A B S T R A C T

The spot blotch disease caused by *Bipolaris sorokiniana* (Sacc.) Shoem is one of the most important wheat leaf diseases all over world, it appears in almost all wheat growing areas and causes severe yield loss every year. For the management of spot blotch disease of wheat two bio-agent and four fungicides were used. Plant disease intensity decreased with the application of different treatment over untreated control. Minimum plant disease intensity was recorded (25.83 per cent) under T5 (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole@ 0.1 %, first at boot leaf Stage second after 20 days), Which has highly significant compared to all the treatments. Maximum AUDPC was recorded (732.1) under T0 (Untreated/control). However, Minimum AUDPC was recorded (237.2) under T5 (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole @ 0.1 %, first at boot leaf Stage second after 20 days).

Introduction

Wheat (*Triticum aestivum* L.) is very important cereal crop after rice in India and major staple food of South Asian countries. Wheat crop in eastern Uttar Pradesh suffers from a number of fungal diseases. Spot blotch caused *Bipolaris sorokiniana*is more severe than other diseases. It attacks at all the growth stages of the crop starting from the seedling to spikes, that's why it was thought desirable to work on management of spot blotch disease.

Wheat (*Triticum aestivum* L.) crop belongs to family Poaceae (Graminae). It is the most important cereal crop after rice in India and major staple food of South Asian region countries. Generally, wheat is a self-pollinated and hexaploid plant. Three species, namely *Triticum astivum* L. (Bread wheat), *Triticum durum* Desf. (Macroni or durum wheat), and *Triticum dicoccum* Schrank. (Emmer wheat), are commonly cultivated at present. India is the world's second largest wheat producer, behind china and ahead USA. It has revealed from the archaeological records that wheat was cultivated in Mohenjo-Daro and Harappa nearly 5000 year back (Pal, 1996). The important of wheat as a food of South Asia is well known. It is utilized for bread, cakes, cookies, noodles, pestri-products, chapatti & morconi etc. Wheat is the staple cereal food, it is eaten in the form of chapattis. The stable cereal food wheat eaten in the form of 'puris'

or in the form of 'upmo' (Cocked form suji or rawa). In addition to this wheat is also consumed in various other preparations such 'dalia', 'halwa', 'Sweet meals' etc. In most of the urban areas in the country the use of backed leavened bread, flakes, cakes, biscuits etc. is increasing at a fast rate. Beside staple food for human being, wheat straw is a good source of feed for a large population of cattle in our country. Wheat grain contains 60-68% starch, 8.0 to 15% protein, 1.5 to 2.0 fat, 2.0-2.5 cellulose and 1.5 to 2.0% minerals (Rathore, 2001).

Spot blotch or Helminthosporium leaf blight caused by *Bipolaris sorokiniana* (Sacc.) Shoem. is a most important disease of wheat in north eastern plains zone (NEPZ) representing warm and humid climate in India as well as in other South Asian countries. It is also increasing in North western plains zone (NWPZ) due to climatic change and causing losses in susceptible varieties (Singh, 2014). In India, foliar blight of wheat had been noticed as early as 1924 (Kulkarni, 1924), but it was not of much consequence till recently. In the recent past, with the change in cropping system, foliar blight has now become a major disease and wide in our country causing 2.72 to 36.24% yield losses under different agro-climatic zones (Parashar *et al.,* 1995).

Bipolaris sorokiniana (Sacc.) Shoemaker is a seed and soil borne pathogen, causes head blight, seedling blight, foliar blight/ spot blotch, common root rot and black point of wheat, barley and other small cereal grains and grasses (Wiese, 1998). Symptoms mainly develop in the form of dark brown necrotic spots (boat shaped) occur on the coleoptiles, leaves, crowns, stems, and roots with or without yellow halo around these. Darkening of the sub crown internode is a characteristic symptom. Lesions on the leaves start as a few mm that extend as elongated dark brown spots greater than 1-2 cm (Chand *et al.,* 2002). In the humid subtropics of South Asia, there is evidence of stress conditions, which favor foliar blight (Dubin and Bimb, 1994). Sharma-Poudyal *et al.,* (2005) has reported that seed treatment with Vitavax 200B and Carbendazine improves early plant establishment in heavy soil predominating areas where wheat is cultivated after rice.

The pathogen

The fungus spot blotch is caused by *Bipolaris sorokiniana* (Sacc.) Shoem. Syn. *Drechslerasorokiniana (Sacc.) [Syn. Helminthosporium sativum,* teleomorph *Cochliobolus sativus]* Subram and Jain, *Cochliobolus sativus, Drechslera*ex Dastur [anamorph *Bipolaris sorokiniana* (Sacc.) Shoem.] and several synonyms of the anamorph have been used like *Helminthosporium sorokinianum, Drechslera sorokiniana* and *Helminthosporium sativum* (Maraite *et al.,* 1998). *Bipolaris sorokiniana*is characterized by thick-walled, elliptical conidia (60-120 µm ×12-20µm) with 5-9 cells. In axenic culture, the mycelium is composed of hyphae interwoven as a loose cottony mass and appears as white or light to darkgrey depending on the isolates (Kumar *et al.,* 2002).

The disease

Spot blotch caused by *Bipolaris sorokiniana* (Sacc. in Sorok.) Shoem. is an important disease of wheat. In India, foliar blight of wheat had been noticed as early as 1924 (Kulkarni, 1924), but it was not of much consequence till recently. It has been observed in several other countries (Dickson, 1956). Spot blotch caused by *Helminthosporium sativum* (*Bipolaris sorokiniana*) was wide spread in six states of India, namely Madhya Pradesh, Uttar Pradesh, Himanchal Pradesh, West Bengal, Punjab and Haryana (Neema and Joshi 1973).

Symptomatology

Symptoms mainly develop on sub-crown internodes, stem, leaves, awns, glumes and seeds. The main symptom caused by the pathogen is spot blotch, which is nothing but the disease of leaves. The early lesions on leaves are 1-2 mm long, small and dark brown in colour. The dark brown necrotic spots (boat shaped) occur on the coleoptiles, leaves, crowns, stems, and roots with or without yellow halo around these. Darkening of the sub crown internode is a characteristic symptom.

Management of spot blotch disease of wheat using Bio-agents and Fungicides

Singh *et al.,* (2017) results showed that the seed treatment with vitavax power @ 3 g kg of seed followed by two spray of propiconazole @ 0.1% at the time of disease initiation on flag -1 leaf and at soft dough stage were best and per cent disease intensity (39.03%) was minimum. Yadav *et al.,* (2015) reported the effect of recommended dose of fungicides (Propiconazole, Carbendazim and Hexaconazole), bio-agents and botanicals on incidence and severity of spot blotch disease and seed yield of wheat. Two sprays of Carbendazim at 0.1% at tillering and boot leaf stage resulted in the maximum reduction in spot blotch incidence and severity followed by two applications of Propiconazole at tillering and boot leaf stage.

Singh *et al.,* (2017) reported effect of seed treatment and foliar spray with fungicides and *T. viride* on disease intensity of spot blotch and yield contributing characters like ear length, number of grains/ ear, thousand grain weight, yield and avoidable yield losses were studied. Yadav *et al.,* (2015) reported Triazole group Propiconazole especially have proven to be very effective against spot blotch disease. Singh *et al.,* (2017) showed that the seed treatment with vitavax power @ 3 g/kg of seed followed by two sprays of propiconazole @ 0.1% at the time of disease initiation on flag -1 leaf and at soft dough stage were best in managing the spot blotch disease. Yadav *et al.,* (2015) reported Triazole group Propiconazole especially have proven to be very effective against spot blotch disease. Singh *et al.,* (2014) reported seed treatment with Vitavax Power @0.25% and two sprays of Tilt @0.1%, highest average grain yields (42.78 q/ha) and thousand grain weight were in case of in NEPZ, and 57.30 q/ha at Karnal (NWPZ) with gain of 25.7% and 10.6%, respectively, over untreated.

Singh D.P. (2014) reported the disease appeared at flag leaf visible stage on lower leaves and moved upward in NEPZ whereas it appeared relatively late at boot swollen stage in NWPZ. The first spray was given at boot leaf stage in majority of cases and second after 15 days of it. The lowest spot blotch score (35) was in case of Vitavax power @ 2.5 g/kg of seed and two sprays of propiconazole (Tilt) @0.1%.Yadav *et al.,* (2015) reported Triazole group Propiconazole especially have proven to be very effective against spot blotch disease.

This experiment was conducted at laboratory of Student instructional farm of Plant Pathology, Narendra Deva University of Agriculture and Technology. The experimental details are given below.

Treatments-13
Variety: Raj 4015
Plot size: 2 x 2 m^2
Design: RBD
Replications: 4

Observations to be recorded

Disease incidence and severity
1000 seed wt. (g.)
Yield (q/ha)

Disease intensity was recorded on first appearance of symptoms after 07 days of 1st and 2nd spray. Observations on flag leaf and flag -1 leaf of 10 randomly selected plants from each treatment of each replication.

The per cent disease intensity (PDI) was calculated by using the formula:

Per cent disease intensity

It was calculated according to Mc Kinney (1975) formula

$$\text{Disease intensity (\%)} = \frac{\text{Sum of all disease rating}}{\text{Total number of rating X maximum}} \times 100$$

Area under disease progress curve (A-value)

It was calculated by the following formula (Dubin *et al.,* 1998).

$$AUDPC = \Sigma_{i=1}^{n}\left[(Yi + 1 + Yi) \times 0.5\right]\left[Ti + 1 - Ti\right]$$

Where,

Yi= Severity/ intensity (%) at the i^{th} observation.

Ti= Time (days) of i^{th} observation

n= Total number of observation

First observation on disease intensity was recorded before first spraying using (Kumar *et al.,* 1998). Subsequent observations were recorded before each spray and finally disease intensity was recorded 20 days after spray. Yield (q/ha), plant disease control and per cent increase in yield were also calculated.

$$\text{Per cent increase in yield} = \frac{\text{Yield in treated plot - Yield in check plot}}{\text{Yield in check plot}} \times 100$$

$$\text{Plant disease control (PDC)} = \frac{\text{PDI in check-PDI in treatments}}{\text{PDI in check}} \times 100$$

Management of spot blotch disease of wheat using bio-agents and fungicides

For the management of spot blotch disease of wheat two bio-agent and four fungicides were used. Among these bio-agents such as *Trichoderma viride*@ 6 gm/kg seed (T_3) and *Pseudomonas fluorescence*@ 6 gm/kg seed (T_4) and fungicides vitavax 75 WP @ 2.5 gm /kg, Thiram 75 WDP @ 3 gm/kg seed used as seed dressers. Whereas, propiconazole @ 0.1%, first at boot leaf stage second after at 20 days as foliar spray and Nativo (trifloxysytrobin 25% + tebuconazole 50%) @ 0.4 gm/lit, first at boot leaf stage second after at 20 days as foliar spray.

Per cent disease intensity (PDI)

The data on plant disease intensity (PDI) was recorded after second spray on wheat crop have been presented in table 16 clearly recoded that plant disease intensity decreased with the application of different treatment over untreated control. Minimum plant disease intensity was recorded (25.83per cent) under T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole@ 0.1 %, first at boot leaf Stage second after 20 days). Which has highly significant with all the treatments. Hence, maximum plant disease intensity (PDI) was recorded under untreated control.

AUDPC (Area under disease progressive curve)

The data on AUDPC was recorded after second spray on wheat crop have been presented in table 16 clearly recoded that plant disease intensity decreased with the application of different treatment over untreated control.

Table.1 Management of spot blotch disease of wheat using bio-agents and fungicides

S. No.	Treatments
T_0	Untreated control (unsprayed)
T_1	Seed treatment with vitavax 75 WP @ 2.5 gm /kg
T_2	Seed treatment with Thiram 75 WDP @ 3 gm/kg
T_3	Seed treatment with *Trichoderma viride* @ 6gm/kg of seed
T_4	Seed treatment with *Pseudomonas fluorescence* @ 6gm/kg
T_5	Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1% (first at boot leaf Stage and second after 20 days)
T_6	Seed treatment with Thiram 75 WDP @ 3 gm/kg + 2 foliar sprays of propiconazole@ 0.1% (first at boot leaf Stage and second after 20 days)
T_7	Seed treatment with *Trichoderma viride* @ 6gm/kg of seed + 2 foliar sprays of propiconazole@ 0.1%(first at boot leaf Stage second after 20 days)
T_8	Seed treatment with *Pseudomonas fluorescence* @ 6gm/kg + 2 foliar sprays of propiconazole@ 0.1%(first at boot leaf Stage second after 20 days)
T_9	Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of Nativo (trifloxysytrobin 25% +tebuconazole 50%)@ 0.4 gm/lit, (first at boot leaf stage second after at 20 days)
T_{10}	Seed treatment with Thiram 75 WDP @ 3 gm/kg +2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @0.4 gm/lit, (first at boot leaf stage second after at 20 days)
T_{11}	Seed treatment with *Trichoderma viride* @ 6gm/kg of seed + 2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @0.4 gm/lit, (first at boot leaf stage second after at 20 days)
T_{12}	Seed treatment with *Pseudomonas fluorescence* @ 6gm/kg + 2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @0.4 gm/lit, (first at boot leaf stage second after at 20 days)

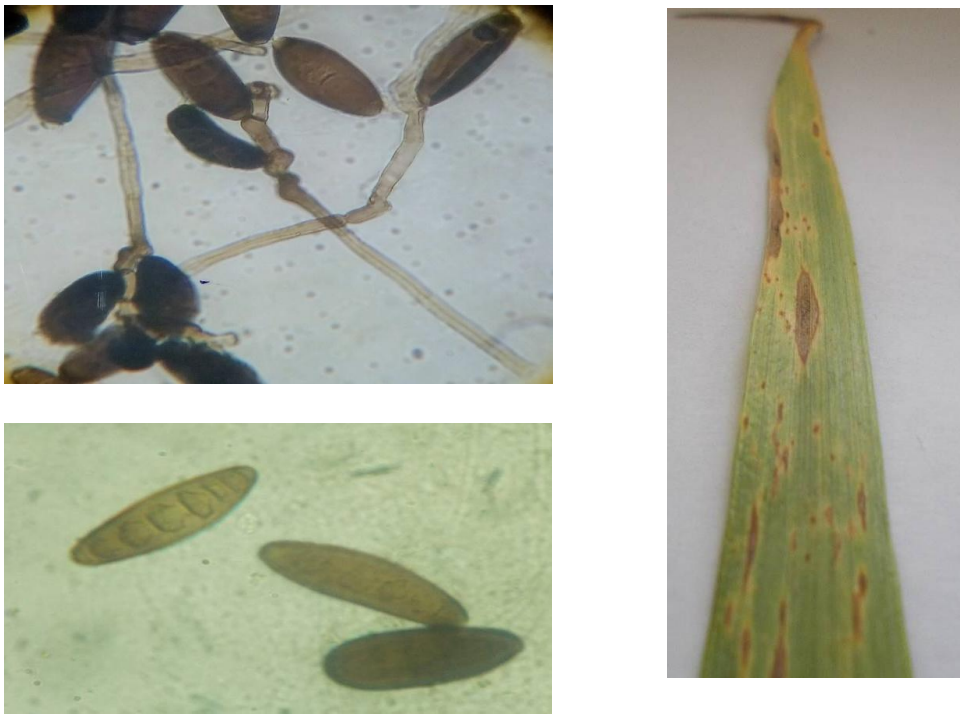
Table.2 Effect of per cent disease intensity and AUDPC of spot blotch disease of Wheat

S. No.	Treatments	Plant disease intensity(PDI)			AUDPC
		Before spray	After First spray	After Second spray	
T_0	Untreated control (unsprayed	15.56 (23.19)	57.50 (49.31)	78.61 (62.44)	732.1
T_1	Seed treatment with vitavax 75 WP @ 2.5 gm /kg	2.78 (2.98)	35.00 (36.27)	56.39 (48.42)	452.1
T_2	Seed treatment with Thiram @ 3 gm/kg	3.89 (3.58)	45.83 (42.59)	65.83 (55.37)	564.9
T_3	Seed treatment with *Trichoderma viride* @ 4gm/kg of seed	4.50 (3.89)	47.50 (43.57)	67.78 (49.06)	585.5
T_4	Seed treatment with *Pseudomonas fluorescence* @ 4gm/kg	3.33 (3.26)	39.72 (39.06)	58.06 (30.53)	492.9
T_5	Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1 %	1.39 (2.07)	20.28 (26.71)	25.83 (30.53)	237.2
T_6	Seed treatment with Thiram @ 3 gm/kg + 2 foliar sprays of propiconazole@ 0.1%	3.06 (3.14)	23.89 (29.27)	35.56 (36.57)	302.4
T_7	Seed treatment with *Trichodermaviride* @ 4gm/kg of seed + 2 foliar sprays of propiconazole@ 0.1%	4.44 (3.53)	25.83 (30.53)	36.67 (37.29)	324.7
T_8	Seed treatment with *Pseudomonas fluorescence* @ 4gm/kg + 2 foliar sprays of propiconazole@ 0.1%	3.61 (3.61)	25.83 (30.53)	35.56 (36.57)	317.9
T_9	Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @ 0.4 gm/lit	2.22 (2.62)	26.39 (30.83)	45.83 (42.59)	352.9
T_{10}	Seed treatment with Thiram @ 3 gm/kg +2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @0.4 gm/lit	3.89 (3.53)	36.67 (37.29)	47.50 (43.57)	436.5
T_{11}	Seed treatment with *Trichodermaviride* @ 4gm/kg of seed +2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @0.4 gm/lit	4.72 (3.92)	45.56 (42.48)	57.22 (49.14)	535.7
T_{12}	Seed treatment with *Pseudomonas fluorescence* @ 4gm/kg +2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @0.4 gm/lit	4.44 (3.53)	40.83 (39.70)	56.67 (48.72)	499.7
SEm±		**0.44**	**3.07**	**0.58**	
CD		**1.27**	**9.15**	**1.67**	

Table.3 Evaluation of thousand seed weight (g.), seed yield q/ha and percent increase yield against spot blotch disease of wheat

Treatments	Thousand seed weight (g.)	Seed Yield (q/ha)	Per cent increase yield
T_0	36.19 (36.94)	31.28 (33.95)	0.00
T_1	38.56 (38.35)	36.31 (37.05)	16.08
T_2	37.62 (37.82)	35.38 (36.45)	13.11
T_3	36.86 (37.35)	34.56 (35.97)	10.49
T_4	36.21 (36.99)	33.44 (35.30)	6.91
T_5	41.49 (40.05)	38.69 (38.41)	23.69
T_6	39.66 (39.00)	37.12 (37.58)	18.67
T_7	39.99 (39.17)	36.63 (37.23)	17.10
T_8	39.22 (38.76)	36.25 (36.99)	15.89
T_9	40.55 (39.52)	37.06 (37.47)	18.48
T_{10}	39.04 (38.65)	36.44 (37.11)	16.50
T_{11}	38.11 (38.12)	35.06 (36.27)	12.08
T_{12}	38.75 (38.47)	35.56 (36.57)	13.68
SEm±	0.45	**1.19**	
CD	**1.28**	**3.63**	

Fig.1 (a) Conidia with conidiophore of *B. sorokiniana* of wheat (b) Conidia of *B. sorokiniana* and (c) Spot of *B. sorokiniana* of wheat



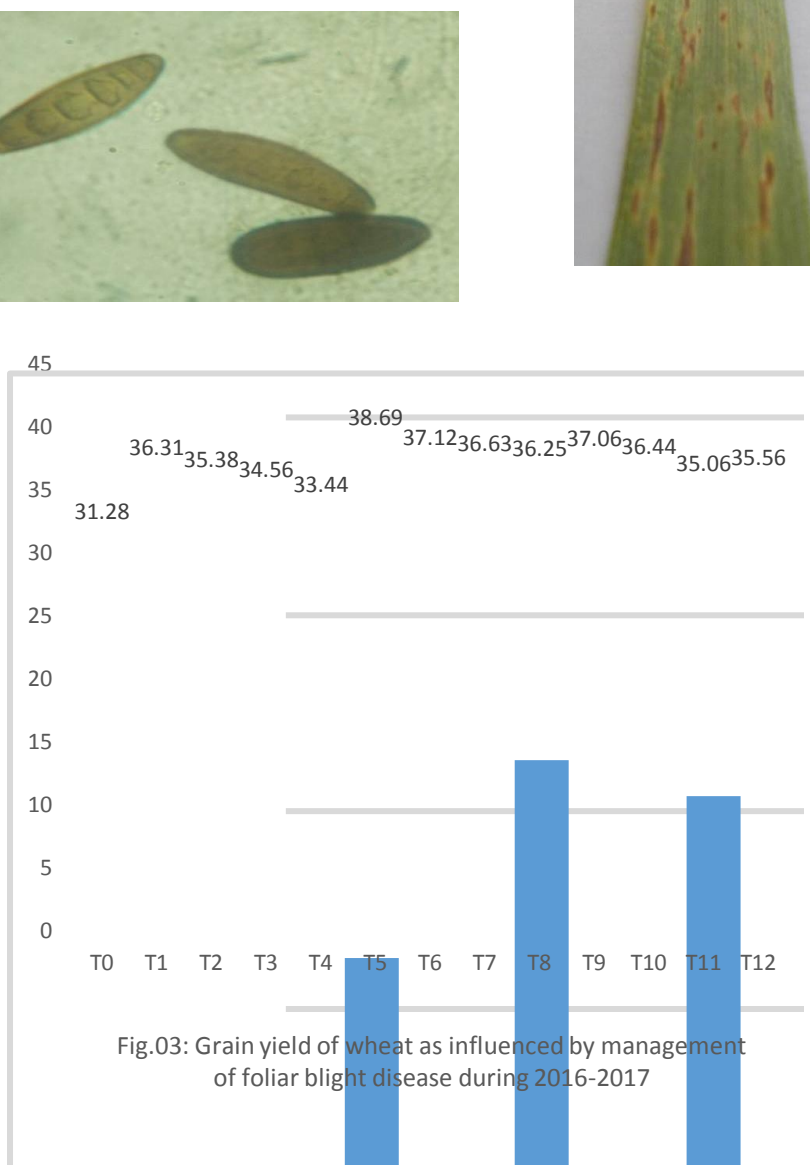


Fig.03: Grain yield of wheat as influenced by management of foliar blight disease during 2016-2017

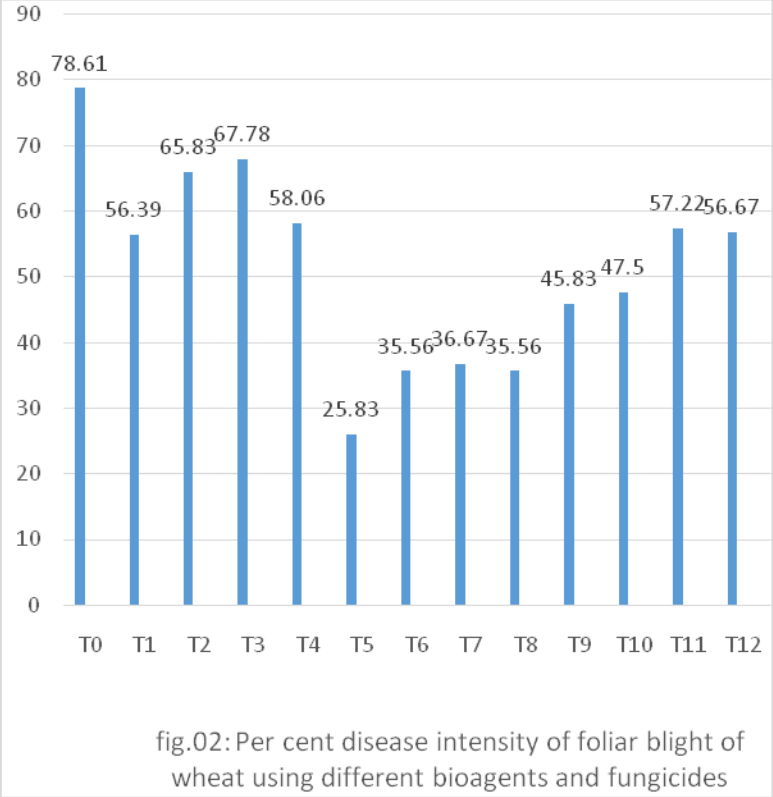


fig.02: Per cent disease intensity of foliar blight of wheat using different bioagents and fungicides

Maximum AUDPC was recorded (732.1) under T_0 (Untreated/control). Hence, Minimum AUDPC was recorded (237.2) under T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole @ 0.1 %, first at boot leaf Stage second after 20 days).Which has highly significant with all the treatment.

Thousand seed weight (g.)

It is evident from table 17 that application of different fungicides has impact on Thousand seed weight in current study. Treatment T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1% (first at boot leaf Stage and second after 20 days) and T_9 (Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @ 0.4 gm/lit, first at boot leaf stage second after at 20 days) were found significantly superior amongst all the treatment as highest seed weight *i.e.* 41.49gm and 40.55gm, respectively. Were recorded with these treatment and treatment T_6, T_7, T_8 and T_{10} were second performer in cash of thousand seed weight which gave 39.66gm, 39.99gm, 39.22gm, 39.04gm thousand seed weight, respectively. Least seed weight were recorded with treatment T_0 (31.19 gm) which was at par with T_3 (36.86 gm.) and T_4 (36.21 gm).

Seed yield (q/ha)

Highest yield (38.69 q/ha) was recorded with T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1per cent). This treatment was found significantly superior in cash ofyield q/ha followed by T_6 andT_9 which gave the 37.12 q/ha and 37.06 q/ha, respectively.

Per cent increase yield

It is presented in table 17 clearly recoded that was maximum per cent increase yield (23.69)

was recorded under T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole @ 0.1 %, first at boot leaf Stage second after 20 days)followed by T_6(18.67) and T_9 (18.48), respectively. However, Minimum was recorded (0.0) under T_0 (control).

For the management of spot blotch disease of wheat two bio-agent and four fungicides were used.Plant disease intensity decreased with the application of different treatment over untreated control. Minimum plant disease intensity was recorded (25.83 per cent) under T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole@ 0.1 %, first at boot leaf stage second after 20 days)**,** Which has highly significant compared to all thetreatments. Maximum AUDPC was recorded (732.1) under T_0 **(**Untreated/control)**.** However**,** Minimum AUDPCwas recorded (237.2) under T_5 **(**Seed treatment with vitavax 75 WP @ 2.5 gm/kg seed + 2 foliar sprays of propiconazole @ 0.1 %, first at boot leaf Stage second after 20 days).

All the fungicides gave significant impact on thousand seed weight over untreated control. Treatment T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1%, first at boot leaf Stage and second after 20 days) and T_9 (Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @ 0.4 gm/lit, first at boot leaf stage second after at 20 days) were found significantly superior amongst all the treatment as thousand seed weight *i.e.* 41.49gm. and 40.55gm., respectively. Highest yield (38.69 q/ha) was recorded with T_5 (Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1per cent). This treatment was found significantly superior in cash ofyield q/ha followed by T_6 andT_9which gave the yield 37.12 q/ha and 37.06 q/ha, respectively. Maximum Per cent increase yield (23.69per cent) was recorded under T_5 followed by T_6 (18.67per cent) and T_9 (18.48per cent), respectively. However, Minimum was recorded (0.0) under T_0 (control). Seed treatment with *Trichoderma viride* and *Pseudomonas fluorescence* were not found effective alone because they have more disease intensity and lower yield compared the systemic fungicides such as propiconazole and Nativo (trifloxysytrobin 25% + tebuconazole 50%), which were used as foliar spray with combination of seed treatment with vitavax 75 WP and Thiram.

All the fungicides gave significant impact on thousand seed weight over untreated control. Treatment T_5 **(**Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1%, first at boot leaf Stage and second after 20 days) and T_9**(**Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of Nativo (trifloxysytrobin 25% + tebuconazole 50%) @ 0.4 gm/lit, first at boot leaf stage second after at 20 days**)** were found significantly superior amongst all the treatment as thousand seed weight *i.e.* 41.49gm and 40.55gm, respectively. Highest yield (38.69 q/ha) was recorded with T_5 **(**Seed treatment with vitavax 75 WP @ 2.5 gm /kg + 2 foliar sprays of propiconazole@ 0.1per cent). This treatment was found significantly superior in cash of yield q/ha followed by $T_6$and T_9which gave the yield 37.12 q/ha and 37.06 q/ha, respectively. Maximum Per cent increase yield (23.69per cent) was recorded under T_5 followed by T_6 (18.67per cent) and T_9 (18.48per cent), respectively.

References

Anonymous (2016). Project Directorate report (IIW & BR), Karnal.

Anonymous (2016). United states Department of Agriculture (USDA), Circular Series WAP, 8-16.

Chand, R., Singh, H.V., Joshi, A.K. and Duveiller, E. (2002). Physiological and morphological aspects of *Bipolaris sorokiniana* conidia surviving on Wheat straw. *Journalof Plant Pathology* 18: 328-332.

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Dickson, J.G. (1956). Diseases of field Crops. Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. pp. 517.

Dubin, H.J. and Duveiller, E. (2000). *Helminthosporium* leaf blights of wheat: integrated control and prospects for the future. In: *proc. Int. conf. integrated Plant Disease Management for Sustainable Agriculture.*, New Delhi, 10-15 Nov. 1997, vol. (1): 575-579.

Kulkarni, G.S. (1924). Report of the work done in plant pathology section during the year 1922-23. *Ann. Rept. Deptt of Agric*., Bombay Presidency: 167- 171.

Kumar, J., Schafer, P., Huckelhoven, R., Lungen, G., Baltruslhat, H., Stain, E., Nagarajan, S. and Kugel, K.H. (2002). *Bipolaris sorokiniana*, a cereal pathogen of global concern: cytological and molecular approaches towards better control. *Molecular Plant Pathology*, 3(4): 185-195.

Kumar, J., Singh, G. and Nagarajan, S. (1998). A field scale of leaf blight recording. *Indian Wheat News Newsletter*, 5(2): pp 3-4.

Maraite, H., Zinno, T.D.I., Longree, H., Daumerie, V. and Duveiller, E. (1998). Fungi association with foliar blight of wheat areas. In: *Helminthosporium* blights of wheat: Spot blotch and Tan spot (Duveiller E, Dubin HJ, Reeves J, McNab A, eds.) Mexico. D.F., Mexico: CIMMYT, 293-300.

Nema, K.G. and Johsi, L.M. (1973). Spot blotch disease of Wheat in relation to host temperature and moisture. *Indian Phytopath.*, 26: 41-48.

Parashar, M., Nagarajan, S., Goel, L.B. and Kumar, J. (1995). Report of co-ordinated experiments 1994-95. Crop Protection, AICWIP. Directorate of Wheat Research, Karnal: 206.

Parashar, M., Nagarajan, S., Goel, L.B. and Kumar, J. (1995). Report of co-ordinated experiments 1994-95. Crop Protection, AICWIP. Directorate of Wheat Research, Karnal: 206.

Rathore, P.S. (2001). Techniques & management of field crop production, 1sted^{n}. Agrobios (India) Jodhpur, 96-120.

Sharma-Poudyal D, Duveiller E, Sharma RC (2005) Effects of seed treatment and foliar fungicides on *Helminthosporium* Leaf Blight and performance of wheat in warmer growing conditions. *J. Phytopatho.* 153: 401-408.

Singh D.P., Kumar A., Solanki I. S., Singh S. P., Verma J., Mahapatra Sunita, Vaish S. S, Mukhopadhyay S.K. and. Dutta, S. (2014). Management of spot blotch of wheat caused by *Bipolaris sorokiniana* in wheat using fungicides. Directorate of Wheat Research, Karnal, Haryana, India, 1-3.

Singh, R., Sengar, R.M.S. and Singh, S. (2012). Incidence of foliar blight pathogens of wheat *(Triticum aestivum L.*) In Agra Region, Department of Botany, *Indian J. L. Sci.* 1(2): pp 39-41.

Singh, R.N. and Singh, A.K. (2006). Spot type Net blotch of barley caused by *Pyrenophorateres f.* spp. *maculata* in India and its management presented in National Symposium on "Biodiversity and Biotechnology: Research and Development needs in edible Mushrooms and crop disease

management held at Department of Plant Pathology, G.B. Pant University of Agriculture & Technology, Pantnagar-263145 on November, 9-11, pp. 16

Singh, R.V., Singh, A.K. and Singh, S.P. (1998). Distribution of pathogens causing foliar blight of Wheat in India and neighbouring countries In: Dueiller, E. Dubin, H.J., Reeves, J. and Mc Nab, (Eds.). *Helminthosporium Blight of Wheat: Spot Blotch and Tan Spot* pp. 59-62. Mexico, D.F. CIMMYT.

Wiese, M.V. (1998). Compendium of wheat diseases (3rd Ed). St. Paul, USA: APS Press, 112.

Wilson, V.E. and Murphy, H.C. (1964). Morphology and physiology of *H. victoria* and related species. *Phytopathology* 54: 147-150.

Yadav, B.; Singh, R. and Kumar, A. (2015). Management of spot blotch of wheat using Fungicides, Bio-agents and Botanicals, Department of Plant Pathology, *Afri. J. Agril. Rese*. 10(25), 2494-2500.

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