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Comparative Effect of Selected Chemicals with *Pseudomonas* sp. on Leaf Blight (*Alternaria triticina*) of Wheat

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A B S T R A C T

The present investigation was carried out in crop season of Rabi 2013 with the wheat variety of Pusa 402. Leaf blight of wheat is an important disease of wheat in northern and eastern region of India. Use of Fungicide and bioagent can be minimized by the integrated approach towards the management of plant diseases. Treatment of foliar spray with propiconazole @500 ml/ha was found best for reduce disease intensity, higher shoot length, root length, root weight, shoot weight, number of tiller, yield/ha. Observation recorded on 50 DAS pertaining to mean plant fresh shoot weight was highest in Propiconazole followed by *Pseudomonas* sp (9.86g-T_5), Captan (7.86g-T_2,) + Ergon (7.17gt1) + Hexaconazole (5.61g t3), Control (4.53g-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_1, T_2,) and (T_3) (T_5) (T_4) was statistically significant over other treatments but there is significant increase in plant shoot weight in treatments over control. However, foliar spray of Propiconazole@ 500 ml/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C.@ 1000 ml/ha Observation recorded on 100 DAS (Table 4.1) pertaining to mean plant fresh shoot weight was highest in Propiconazole (18.46g-T_4), followed by *Pseudomonas* sp (16.26g-T_5), Captan (12.85g-T_2), Ergon (10.90-T_1), Hexaconazole (9.34g-T_3), Control (7.16g-T_0). All the treatments were foun statistically significant over control treatment. However, foliar spray of Propiconazole@ 500 ml/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C. @ 1000 ml/ha.

Introduction

Wheat is the main cereal crop in India. The total area under the crop is about 29.8 million hectares in the country. The production of wheat in the country has increased significantly from 75.81 million MT in 2006-07 to an all time record high of 94.88 million MT in 2011-12. The productivity of wheat which was 2602 kg/ha in 2004-05 has increased to 3140 kg/hectare in 2011-12. Wheat (*Triticum aestivum* L.) is an important

cereal crop in the world. This cereal as the axiom comes true that "necessity is the mother of invention" in the way that this cereal converted the ancient food gatherers and hunters into the modern, well organized and civilized human beings in the course of evolution. India is the second largest producer of wheat next to China. Wheat crop in India, owing to its diverse climatic conditions prevailing throughout the country, suffers more or less due to all three rusts. The entire country offers the congenial climatic conditions for the occurrence and spread of the leaf rust, every year during rabi season (Kalappanavar *et al.*, 2008). Wheat *(Triticum acstivum* L.) is one of the most important winter crops in eastern terai. In 2001/2002 there was wheat in 6670,077 ha all over in the Nepal with the total production of 1258045 tons.

In the same year it was cultivated in 123,479 ha in the Eastern Development Region with total production of 242579 tons. In eastern terai it was cultivated in 89,334 ha with production of 188,240 tons and average productivity was 2107 kg (Chaurasia *et al.*, 2006). Wheat (*Triticum aestivum* L.) is the world's most extensively grown crop and important staple food. There are several constraints limiting the potential yield of wheat. Among them foliar blight has recently emerged as major concern throughout the world (Dubin and Van, 1991). 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 far and wide in our country causing 2.72 to 36.24% yield losses under different agroclimatic zones (Parashar *et al.*, 1995). In India, foliar blights of wheat are considered as one complex, which includes leaf blight caused by *Alternaria triticina* Prasada and Prabhu and spot blotch caused by *Bipolaris sorokiniana* (Sacc) Shoemaker (Syn. *Helminthosporium sativum* Pammel, King and Bakke). In the Indogangetic plains, covering the entire north-western and north-eastern plains, rice-wheat rotation is the dominant cropping sequence. It has been commonly observed that the intensity of foliar blights has considerably increased in the rice-wheat system (Saari and Wilcoxson, 1974; Nagarajan and Kumar, 1998). During last decade multilocational surveys for determining incidence of foliar blights of wheat have been conducted in eastern U.P., Bihar, Haryana, Punjab, Delhi, Gujrat and Rajasthan (Goel *et al.*, 1999; Singh *et al.*, 2004; Saharan *et al.*, 2008). In view of the growing concern about foliar blight of wheat, it was considered desirable to study the incidence of the disease and the causal organisms in Allahabad region where wheat (*Triticum aestivum*) is main fod crop.(Singh *et al.*, 2012) In Maharashtra state wheat is grown in 7.53 lakh ha and contributes 10.56 lakh tonnes of wheat grains. In Vidarbha region of Maharashtra, wheat occupies an area about 1.90 lakh ha and production about 2.41 lakh tonnes with an average yield 1280 kg per ha (Anonymous, 1996).

Leaf blight caused by *Alternaria triticina* isthe major disease in irrigated wheat in Vidarbha region of Maharashtra. *Alternaria* leaf blight was first reported from Maharashtra in 1924 (Kulkarni, 1924). The disease initially appears as small and irregularly scattered chlorotic lesions on the leaves in last week of December. As the disease progresses, several spots coalesce and cover the whole or part of the leaf giving it a blighted' appearance. Heavily infected fields show a burnt appearance (Sokhi and Joshi, 1972). The normal sown as well as late sown irrigated wheat varieties were found heavily infected with *Alternaria* leaf blight during January and February in Vidarbha region, causing

considerable losses in the grain yield of irrigated wheat. Therefore, this trial was formulated to estimate the losses caused due to leaf blight disease (Shivankar *et al.,* 2000). The application of two irrigations reduced the severity of foliar blight as compared to no irrigation (Shrestha *et al.,* 1998). Ruckstuhl (1998) reported that low or imbalance soil nutrient levels predispose plants to more severe leaf blight attack. Singh *et al.,* (1998) found low incidence of disease when wheat crop was sown on 30th Nov. as compared 20th Dec.

Materials and Methods

The present investigation were carried out 2012-13 Rabi season and the Department of Plant Protection central Research field, Allahabad Agricultural Institute, Deemed-University, Allahabad, situated at 25.28ºN latitude and 81.55ºE longitude, located at an altitude of 98m amsl, during July, 2010.Experiment conducted in the field conditions by adopting Randomized Block design (R.B.D.) with six treatments and each treatments were replicate four times.

Symptoms

Early lesions are characterized by small, dark brown lesions 1 to 2 mm long without chlorotic margin. These lesions extend very quickly in oval to elongated blotches, light brown to dark brown in colour. They may reach several centimetres before coalescing and inducing the death of the leaf. Fruiting structures develop readily under humid conditions and are generally easily observed on old lesions. If spikelets are affected, it can result in shrivelled grain and black point, a dark staining of the embryo end of the seed. The small dark brown spots on the leaves contrast with the larger, light brown spots or blotches produced by tan spot and septoria avenae blotch.

Microscopic characteristics of pathogen (*Alterneria triticina*)

The mycelium of this fungus is hyaline. But later on it becomes alive buff in appearance.

The conidiophores are septate usually unbranched, erect, single or in groups emerging out through the stomata.

Detail of observation recorded

Shoot weight at 50 and 100 DAS, Root weight at 50 and 100 DAS, Shoot length at 50 and 100 DAS, Root length at 50 and 100 DAS, Number of tillers at 45 DAS, Disease intensity percent at 45 and 90 days after germination, Yield q/ha

Observation of disease Intensity % calculated by following formula at 45 and 90 days after germination

$$\text{Disease intensity \%} = \frac{\text{Sum of all disease rating}}{\text{Total no. of rating X Maximum disease grade}} \times 100$$

(Singh, 2009)

Observation of cost benefit ratio

Cost benefit ratio

Cost benefit ratio is the ratio of gross return to cost of cultivation which can also be expressed as return per rupees invested. This index provides an estimate of the benefit a former derives from the expenditure he insure in adopting a particular cropping system.

Any value is 2.0 is considered safe as the former gets Rs. 2 for every rupees invested. The benefit cost ratio was calculated following formula (Reddy *et al.,* 2010).

C.B.R. = Gross return (Rs/ha)/ Total cost of cultivation (Rs/ha)

Gross return

The total monetary value of economic produce and by products obtained from the crop raised in the cropping system was calculated based on the local market price.

Cost of cultivation

Cost of cultivation is the total expenditure incurred for raising crops in a cropping system.

The cost included for this purpose consists of own is hired human labour, value of seed manure fertilizer, pesticides and herbicide and irrigation charges.

Net returns

Net return is of trained by subtracting cost of cultivation from gross return. It is good indicator of suitability of a cropping system since this represent the actual income to the former (Reddy *et al.*, 2010).

Statistical analysis

In the experiment Randomized Block (RBD Design) adopted. The analysis of variance (ANOVA) technique was applied for drawing conclusion from data.

The calculated values were compared with tabulated values at 5% level of probability (Fisher and Yates, 1968) for the appropriate degree of freedom.

The skeleton was of analysis at variance table is as follows

Results and Discussion

Observation were recorded at Shoot length, root length, shoot weight, root weight, number of tillers, disease intensity and yield.

Comparative effect of selected chemicals with *Pseudomonas* sp on shoot weight (g.) of wheat at different days of intervals

Shoot weight at 50, days after sowing

Observation recorded on 50 DAS (Table 1) pertaining to mean plant fresh shoot weight was highest in Propiconazole (11.40g-T4) followed by *Pseudomonas* sp (9.86g-T_5), Captan (7.86g-T_2,) + Ergon (7.17gt1) + Hexaconazole (5.61g t3), Control (4.53g-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_1, T_2,) and (T_3) (T_5) (T_4) was statistically significant over other treatments but there is significant increase in plant shoot weight in treatments over control.

However, foliar spray of Propiconazole@ 500 ml/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C.@ 1000 ml/ha.

Shoot weight at 100, days after sowing

Observation recorded on 100 DAS (Table 1) pertaining to mean plant fresh shoot weight was highest in Propiconazole (18.46g-T_4), followed by *Pseudomonas* sp (16.26g-T_5), Captan (12.85g-T_2), Ergon (10.90-T_1), Hexaconazole (9.34g-T_3), Control (7.16g-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_3, T_1), (T_1, T_3,) (T_3,) and (T_5) (T_4) was statistically significant over other treatments but there is significant increase in plant weight in treatments over control. However, foliar spray of Propiconazole@ 500 ml/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C.@ 1000 ml/ha.

Comparative effect of selected chemicals with *Pseudomonas* sp on root weight (g.) of wheat at different days of intervals

Observation recorded on 50 DAS (Table 2) pertaining to mean plant fresh root weight was highest in Propiconazole (2.84g-T_4), followed by *Pseudomonas* sp (2.30g-T_5), Captan (1.73g-T_2), Hexaconazole (1.60g-T_3), Ergon (1.51g-T_1), Control (1.02g-T_0).

All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_1, T_3, T_2) (T_2) and (T_5), (T_4) was statistically significant over other treatments but there is significant increase in plant weight in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Ergon @ 2500g/h.

Root weight at 100 days after sowing

Observation recorded on 100 DAS (Table 2) pertaining to mean plant fresh root weight was highest in Propiconazole (4.17g-T_4), followed by *Pseudomonas* (3.22g-T_5), Captan (2.50g-T_2), Ergon (2.26g-T_1), Hexaconazole (2.02g-T_3), Control (1.50g-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_3, T_1, T_2) (T_2) (T_5), (T_4) was statistically significant over other treatments but there is significant increase in plant weight in treatments over control.

However, foliar spray of propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Ergon @2500 g/ha.

Comparative effect of selected chemicals with *Pseudomonas* sp on leaf blight (*Alterneria triticina*) disease intensity %at different days of interval after germination

At 45 days after germination

Observation recorded on 45 days after germination (Table 3) pertaining to mean was lowest in Propiconazole (19.033%-T_4), followed by *Pseudomonas* sp (24.95%g-T_5), captan (28.81%-T_2), Ergon (30.44%-T_1), Hexaconazole (38.14-T_3), Control (51.62%-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_5), (T_2 T_1), (T_1) and (T_3,) (T_4) was statistically significantly over other treatments but there is significant decrease disease intensity % in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

At 90 days after germination

Observation recorded on 90 days after germination (Table 3) pertaining to mean was lowest in Propiconazole (26.44%-T_4), followed by pseudomonas sp (33.22%-T_5), captan (34.74%-T_2), Ergon (36.81%-T_1),, Hexaconazole (42.62%-T_3), Control (60.51%-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_5, T_2), (T_2, T_1) (T_1) but there is significant decrease disease intensity % in treatments over control. However, foliar spray of propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

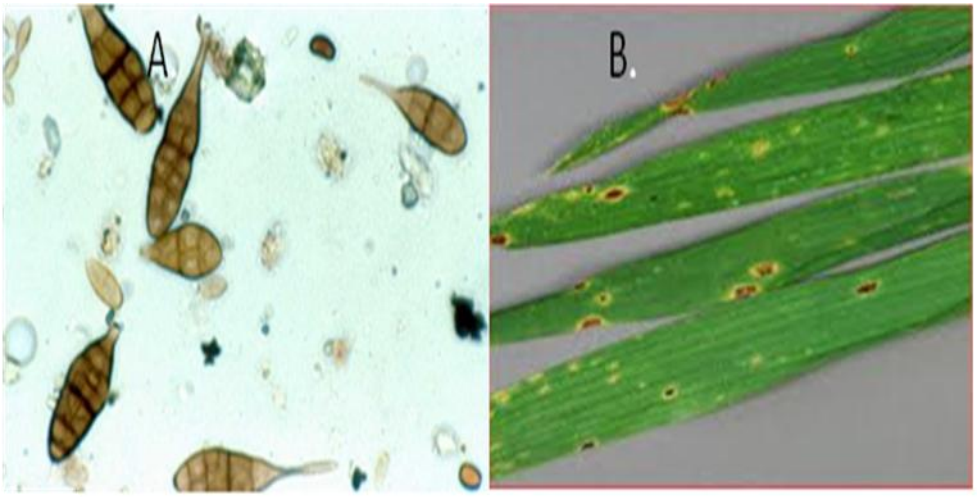

Fig. A) Microscopic characteristics of Pathogen (*Alterneria triticina*) B) leaf blight symptoms in wheat leaf

Details of treatment (Foliar spray)

Symbol	Treatment Name	Dose	Refrence
T_1	Ergon	0.2%	Pawar *et al.*, (2013)
T_2	Captan	0.1%	Singh *et al.*, (2005)
T_3	Hexaconazole	0.1%	Kalappanavar *et al.*, (2008)
T_4	Propiconazole	0.1%	Brahma *et al.*, (1991)
T_5	*Pseudomonas* sp.	0.5%	Flaishman *et al.*, (1996)
T_0	Control		

Comparative effect of selected chemicals with *Pseudomonas* sp leaf blight (*Alterneria triticina*) on shoot length (cm) at different days of interval

Shoot length at 30 days after sowing

Observation recorded on 30 DAS (Table 5) pertaining to mean plant shoot lenght was highest in Propiconazole (36.8cm-T_4), followed by *Pseudomonas* sp, (34.1-T_5), Captan (31.0cm-T_2), Ergon (30.0cm-T_1), Hexaconazole (28.4cm T_3) control (26.3 cm-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_3, T_1), (T_1, T_2) and (T_5), (T_4) was statistically significantly over other treatments but there is significant increase in plant length in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Shoot length at 60 days after sowing

Observation recorded on 60 DAS (Table 5) pertaining to mean plant shoot length was highest in Propiconazole (60.1cm-T_4), followed by *Pseudomonas* sp (57.4cm-T_5), Captan (52.9cm-T_2), Ergon (51.2cm-T_1), Hexaconazole (47.2cm-T_3), Control (42.8cm-T_0). All the treatments were found statistically

significant over control and among the treatments non-significant result were found in the treatments (T_3, (T_1, T_2), (T_2), (T_5), (T_5, T_4) but there is significant increase in plant length in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Shoot length at 90 days after sowing

Observation recorded on 90 DAS (Table 5) pertaining to mean plant shoot length was highest in Propiconazole (68.9cm-T_4), followed by *Pseudomonas* sp (66.6cm-T_5), captan (61.0cm-T_2), Ergon (59.3cm-T_1), Hexaconazole (56.0cm-T_3), Control (53.5cm-T_0). All the treatments were found statistically significant over control and each other there is significant increase in shoot length over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Comparative effect of selected chemicals with *Pseudomonas* sp leaf blight (*Alterneria triticina*) on root length (cm) at different days of interval

Root length at 30 days after sowing

Observation recorded on 30 DAS (Table 6) pertaining to mean plant root length was highest in Propiconazole (6.1cm-T_4), followed by *Pseudomonas* sp (5.5cm-T_5), Captan (4.6cm-T_2), Ergon (4.2cm-T_1), Hexaconazole (3.7cm), Control (3.3cm-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_0, T_3), (T_3, T_1) (T_1, T_2,) (T_5, T_4), but there is significant increase in plant weight in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Root length at 60 days after sowing

Observation recorded on 60 DAS (Table 6) pertaining to mean plant root length was highest in Propiconazole (11.0cm-T_4), followed by *Pseudomonas* sp (10.4cm-T_5), Captan (9.2cm-T_2), Ergon (8.4cm-T_1), Hexaconazole (6.7cm), Control (5.8cm-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_0, T_3), (T_3), (T_1), (T_1, T_2), (T_2), (T_5 T_4) but there is significant increase in plant weight in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Root length at 90 days after sowing

Observation recorded on 90 DAS (Table 6) pertaining to mean plant root length was highest in Propiconazole (14.1cm-T_4), followed by *Pseudomonas* sp (13.0cm-T_5), Captan (11.7cm-T_2), Ergon (10.8cm-T_1), Hexaconazole (9.3cm-T3), Control (7.6cm-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_3) (T_1) (T_1, T_2) (T_2, (T_5) and (T_4) was statistically significantly over other treatments but there is significant

increase in plant weight in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Comparative effect of selected chemicals with *Pseudomonas* sp leaf blight (*Alterneria triticina*) on number of tillers at different days of interval

Number of tillers at 45 days after sowing

Observation recorded on 45 DAS (Table 7) pertaining to mean number of tillers was highest in Propiconazole (8.8-T_4), followed by *Pseudomonas* sp (7.6-T_5), Ergon (5.5-T_1), Captan (5.1-T_2), Hexaconazole (3.8-T_3), Control (2.5-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_3), (T_2, T_1) and (T_4) was statistically significantly over other treatments but there is significant increase in plant weight in treatments over control. However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Number of tillers at 60 days after sowing:

Observation recorded on 45 DAS (Table 7) pertaining to mean number of tillers was highest in Propiconazole (9.1-T_4), followed by *Pseudomonas* sp (8.6-T_5), Captan (5.8-T_2), Ergon (5.7-T_1), Hexaconazole (5.3T_3), Control (3.6-T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_0, T_3,) (T_3, T_1, T_2) (T_5, T_4) but there is significant increase number of tiller in treatments over control. However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the leaf blight and least significant was found with Hexaconazole 25% E.C @ 1000 ml/ha.

Comparative effect of selected chemicals with *Pseudomonas* sp leaf blight (*Alterneria triticina*) disease on wheat grain yield q/ha

Observation recorded on (Table 10) pertaining to mean wheat grain yield q/ha was highest in Propiconazole (30.46 q/ha-T_4), followed by *Pseudomonas* sp (29.74 q/ha -T_5),), Captan (26.66 q/ha -T_2), Ergon (19.81 q/ha -T_1)), Hexaconazole (17.44 q/ha T_3), Control (16.47q/ha -T_0). All the treatments were found statistically significant over control and among the treatments non-significant result were found in the treatments (T_0, T_3,) (T_1) (T_2), (T_5, T_4) but there is significant increase number of tiller in treatments over control.

However, foliar spray of Propiconazole 1500g/ha was found superior among all the treatments in managing the yield q/h and least significant was found with *Pseudomonas* sp @ 1500g/h.

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