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Efficacy of New Fungicides against Turcicum Leaf Blight Disease of Maize

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ABSTRACT

Seven new fungicides were evaluated in vivo for two successive years of 2019-20 & 2020-21 during rabi against *Exserohilum turcicum* causing turcicum leaf blight of maize. The combination treatment of Azoxystrobin 18.2 w/w +Difenoconozole 11.4% w/w SC @ 0.10% as foliar spray at 3 days and 18 days after inoculation recorded the lowest percent disease index (PDI) in both the seasons together is 16.6 reducing the disease by 78.61% and also contributed for higher grain yield when compared with untreated control. The treatment which had a combination of Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.20% spray at 3 days and 18 days after inoculation was found to be the next best treatment in reducing the disease by 69.39 with PDI of 23.8. The treatments which were received a foliar spray at 3 days and 18 days after inoculation with systemic fungicides Pyraclostrobin 133g/l + Epoxiconazole 50g/l SE @ 0.15% and Kresoxim methyl 44.3%SC @ 0.10% found on par with each other in reducing the disease by 51.48% and 50.42% respectively.

Key words: *Fungicides, Turcicum leaf blight disease, Maize*

Introduction

Maize (*Zea mays* L.) is known as "King of crops" and "Miracle crop or Queen of cereals" in view of its several uses. It is being grown both for seed and fodder purpose. Maize has its significance as a source of a large number of industrial products besides its uses as human food and animal feed. Diversified uses of maize for corn starch industry, corn oil production, baby corns, popcorns, etc., and potential for exports has added to the demand of maize all over world besides other commercial avenues. It is grown in many parts of the world for its immense potentiality both for adoption and nutritive value but increase in area, production and productivity creates very favorable condition for several foliar and stalks rot diseases (Payak and Sharma, 1980). Maize can be raised during kharif and rabi in South India and Bihar but only during kharif season in most of the North Indian states (Singh *et al.,* 2012.).

In India, among the foliar diseases, Turcicum leaf blight (TLB) of maize caused by Exserohilum turcicum is a major constraint in large scale cultivation and production of the crop both in kharif and rabi season and the losses vary from 25 to 90 per cent depending upon the severity of the disease (Jha, 1993; Pant *et al.,* 2000). The infection of *E. turcicum* is evident on maize commencing from seedling till

harvesting. However, maximum severity was noticed during tasselling and six to eight weeks after silking which resulted in huge loss. The disease became well established before or at silking stage (Chenulu and Hora, 1962, Ullstrup, 1966). Therefore, an experiment was conducted to evaluate the efficacy of new fungicides against Exserohilum turcicum causing leaf blight disease of maize for two seasons during rabi.

Turcicum leaf blight (TLB) or Northern Corn Leaf Blight (NCLB) is a major foliar disease of corn (maize) caused by *Exserohilum turcicum*, the anamorph of the ascomycete *Setosphaeria*. Turcicum leaf blight is favored by mild temperature and high humidity (Ullstrup, 1966). Heavy dews, cool temperature and frequent rains create good environmental conditions for disease development (Jordan *et al.*, 1983). The TLB fungus survives through the winter on infected maize residue at the soil surface. As temperatures rise in the spring and early summer, the fungus produces spores on residue, and then the spores are splashed or wind-blown onto leaves of the new maize crop. Infection by germinating conidia occurs when free water is present on the leaf surface for 6-18 hours and the temperature is between 66 and 80°F (18- 27°C). Under favorable conditions, lesions develop and produced a new crop of spores within 7-12 days on susceptible cultivars, causing the disease to spread rapidly.

The characteristic symptom of turcicum leaf blight is one-to-six inch long cigar-shaped gray- to tan-colored lesions on the leaves. However, before lesions are fully developed, they first appear as small light-green to grayish spots approximately 1-2 weeks after infection. As the disease develops, the lesions spread to all leafy structures, including the husks, and produce dark gray spores, giving lesions as dirty appearance. The lesions may become so numerous that the leaves are eventually destroyed, causing major yield loss due to reduction in the available of carbohydrates to fill the grain. The leaves then become grayish-green and brittle, resembling leaves killed by frost.

Materials and Method

In order to identify a suitable control measure for tucicum leaf blight a field experiment was carried out at Agriculture Research station, Peddapuram during *rabi* season of two successive years 2019-20 and 2020-21. The maize cultivar pioneer 3396 was sown in a randomized block design with a spacing of 60 × 20 cm with four replications.

Preparation of Inoculum

Conidia of the fungus was collected from actively growing 12 days old culture. The spores were harvested by adding sterilized distilled water into petriplates and scraped gently with camel hair brush. The spore suspension was transferred in to a beaker and the concentration of spore suspension was adjusted to 5×10^4 spores ml^{-1} .

Pathogen Inoculation

Artificial inoculation of the pathogen *E. turcicum* was done on 30 days old maize plants and further field was inoculated thrice at 2 day interval. To create high disease pressure the spore suspension was sprayed with an automizer in the late evening. To maintain high relative humidity the plots were irrigated frequently.

Imposition of Treatments

All the treatments were imposed 3 days after inoculation in 38 - 40 day old plants. The second spray of treatment was done 15 days later i.e., at 18 days after inoculation. The data on per cent disease index was calculated 15 days after the second spray using the diseases scale given by Payak and Sharma (1983).

An experiment was conducted to test different new fungicides against turcicum leaf blight in

Table 1

Treatments	Fungicides	Active ingredients	Concentrations%
T1	Kresoxim methyl	44.3%SC	0.1
T2	Zineb75% WP	75% WP	0.2
T3	Thiram	75% WS	0.2
T4	Azoxystrobin +Difenoconozole	18.2 w/w+11.4% w/w SC	0.1
T5	Azoxystrobin + Cyproconazole	18.2 w/w+7.3% w/w SC	0.2
T6	Pyraclostrobin + Epoxiconazole	133g/l+50g/l SE	0.15
T7	Mancozeb	75%WP	0.2

maize. All the treatments (Table 1) applied as foliar spray at 3 days and 18 days after inoculation on maize genotype except T3 which is only seed treatment.. The final observations recorded at dough stage on percent disease index and grain yield are presented in Table 2.

Results and Discussion

Various foliar fungicides are available to help control or suppress TLB development. Though fungicides are routinely used by growers to protect against several common leaf diseases, TLB may not always be controlled as completely as some other diseases. This is because of the more rapid life cycle of TLB, which may be as short as one week under favorable conditions. Because TLB sporulates so rapidly, it is more difficult to time a single fungicide application (Dan Singh Jakhar *et al.*, 2017).

The results indicated significant differences between treatments with respect to percent disease index and grain yield among fungicides. The treatment which received a foliar spray of Azoxystrobin 18.2 w/w +Difenoconozole 11.4% w/w SC 1.0 ml /l of water at 3 days and 18 days after inoculation (T4) recorded significantly lowest disease score in both the seasons with percent disease index of 23.2 and 10 (PDI=16.6) reducing the disease by 69.1% and 87.5% respectively and highest grain yield of 78.2 Q/ha compared to other treatments and untreated check. Among other products which received a foliar spray Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 2.0 ml /l (T5) recorded significantly lowest disease index of 23.8 with disease reduction by 69.5% and highest grain yield of 57.8 Q/ha compared to others and significant over untreated check.

This was followed by a foliar spray

Table 2.

S. No	Treatments	Percent Disease Index (PDI)			Percent Disease Control (PDC)			Grain yield (Q/ha)			Cost of cultivation	B:C ratio
		2019	2020	Pooled	2019	2020	Pooled	2019	2020	Pooled		
1	T1: Kresoxim methyl 44.3%SC @ 0.10% spray at 3 days and 18 days after inoculation	23.0	42.5	33.2	56.67	44.16	50.42	62.1	50.1	56.1	70098	1.44
2	T2: Zineb75% WP @ 0.20% spray at 3 days and 18 days after inoculation	46.4	65.0	55.7	38.29	48.75	28.22	38.1	35.1	36.6	65290	1.01
3	T3: Thiram 75% WS only seed treatment @ 0.20%	51.1	70.0	60.6	32.05	12.50	21.97	36.2	30.2	33.2	66934	0.90
4	T4: Azoxystrobin 18.2 w/w + Difenoconozole11.4% w/w SC@ 0.10% spray at 3 days and 18 days after inoculation	23.2	10.0	16.6	69.14	87.50	78.61	66.2	90.1	78.2	68310	2.06
5	T5 :Azoxystrobin 18.2% w/w + Cyproconazole 7.3% w/w SC @ 0.20% spray at 3 days and 18 days after inoculation	27.5	20.0	23.8	63.43	75.00	69.39	54.6	61.0	57.8	68460	1.52
6	T6: Pyraclostrobin 133g/l + Epoxiconazole 50g/l SE @ 0.15% at 3 days and 18 days after inoculation	35.3	40.0	37.7	53.05	50.00	51.48	50.1	60.2	55.2	69154	1.44
7	T7:Protected check Mancozeb 75%WP @ 0.20% spray at 3 days and 18 days after inoculation)	37.8	45.0	41.4	49.73	43.75	46.65	49.2	45.0	47.1	64706	1.31
8	T8:Untreated Control (Water spray)	75.2	80.0	77.6	—	—	—	28.1	25.1	26.6	63910	0.74
	S.Em±	3.3	3.5	3.4	—	—	—	3.8	2.9	3.4	—	—
	CD @5%	10.2	10.7	10.5	—	—	—	11.8	8.9	10.3	—	—
	CV%	13.5	12.9	13.2	—	—	—	13.5	10.2	11.8	—	—

of Pyraclostrobin 133g/l + Epoxiconazole 50g/l SE @ 1.5 ml/l of water (T6) and Kresoxim methyl 44.3%SC @ 1.0 ml/l of water (T1) found on par with each other with disease index of 37.7 and 33.2 and grain yield of 55.2 Q/ha and 56.1 Q/ha respectively. Mancozeb 75%WP @ 2.0 g/litre of water (T7) showed best next to these treatments with percent disease index of 41.4 reduction in disease by 46.5% and grain yield of 47.1 Q/ha .

Lowest disease reduction found in (T3) Thiram 75% WS seed treatment 2.0g/kg of seed and Zineb75% WP 2.0 g/l of water spray at 3 days and 18 days after inoculation (T7) reported disease reduction by 21.9 and 28.2 respectively over the control.

These results are compared with E. Jagadeesh *et al.* (2020) reported that among combi products, Azoxystrobin 18.2% + Difenoconazole 11.4% SC as foliar spray @ 0.250 ml/l of water recorded significantly lowest disease score (8%) and highest grain yield of 5913 kg/ha compared to other treatments.

Similar observations were made by Veerabhadraswamy et *al.* (2014) to see the efficacy of Strobilurin group of fungicides against Turcicum leaf blight and found that mixture of Trifloxystrobin 50 WG + Tebuconazole 250 EC @ 0.7 g/l i.e., native and mixture of Azoxystrobin 25 SC + Difenoconazole 25 EC @ 2.5 ml/l were found effective in the management of TLB with more significant increase in the yield.

Anand *et al.* (2013) reported the efficacy of trifloxystrobin 25% + tebuconazole 50% (Nativo 75 WG) against *Exserohilum turcicum* and opined that it reduced the incidence of leaf blight with no phytotoxic effect on plant when it is used at different concentrations. Even the Grain yield was recorded maximum at trifloxistrobin 25% + tebuconazole 50% @ 87.5+175g a.i. ha-1 being, 29.08 q ha^{-1} and found at par with its dose of 75+150 g a.i. ha^{-1}.

Zanatta (2013) also reports that when the triazole (Cyproconazole) only treatment and strobilurin (Trifloxystrobin) only treatment were used, no reduction was found in the AUDPC. This result reflects the low reduction capacity of *E. turcicum* using treatments with isolated fungicides. In addition, the best alternative to reduce AUDPC was using mixed treatments. This result agrees with the findings by Cota *et al.* (2010), who demonstrated that the fungicide mixture was efficient in controlling NCLB in sorghum, representing the best control alternative.

Vilela *et al.* (2012) showed that the application of the fungicides pyraclostrobin + epoxiconazole and azoxystrobin + cyproconazole in maize was efficient in the control of foliar diseases, as evidenced by the lower incidence rates of the disease.

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