Original Research Article

EVALUATION OF FUNGICIDES AGAINST *TURCIUM LEAF BLIGHT* OF MAIZE CAUSED BY *EXSEROHILUM TURCICUM*

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Abstract *Northern Leaf Blight of Maize (NLBM) is a serious disease of Maize crop in Pakistan. The disease causes heavy losses in maize crop every year. To avoid this loss, a research experiment was conducted to check the efficacy of four fungicides and one control against Turcicum Leaf Blight of maize. The experiment was tested against the maize variety Malka-2016. The trial was conducted at Research Area of Plant Pathology Research Institute, Faisalabad, from 2021 to 22. The result of experiment showed that DithaneM-45 (Mancozeb), Tilt 25%EC (propiconazole), Score 25% EC (Difenaconazole), and Topsin-M70%WP (Thiophenate Methyl) significantly reduced the northern leaf blight disease of Maize and increase the yield. Dithane M45(Mancozeb) controlled the disease by 86% over control ,followed by Tilt (Propiconazole) by 79%, Score (Difenaconazole) by 71 %, and the least effective fungicide was Topsin-M 70% WP (Thiophenate Methyal) which control the disease by 68%.*

Keywords: Northern leaf blight, Maize, Fungicides*, Exserohilum turcicum,* Disease, Mancozeb, Tilt

Introduction

Maize is the world's most important cereal crop (Khalid et al., 2021). It stands in third position after wheat and rice (Aaliya et al., 2016; Ahsan et al., 2013; Alam et al., 2021). Different fungal, viral and bacterial diseases attack this crop. It is also called the queen of cereals because of its higher yield (Ali et al., 2013; Ali et al., 2014ab; Khalid & Amjad, 2018). It is used as animal and human feed. Maize is important in ethanol production, food processing, dairy and poultry industries. The Maize production for 2022 is estimated at 9.4 million tons from an area of 1.61 million hectares (Ali et al., 2016; Ali et al., 2017; Khalid & Amjad, 2022). High humidity and mild temperature favored the disease. Cool temperature, heavy dews and frequent rains are favorable conditions for spreading this disease (Ali et al., 2015; Subedi et al., 2019) was the first who reported this disease. The disease is considered one of the most dangerous due to its incidence and occurrence. This disease reduces yield by 28% to 91% (Debela et al., 2017; Iqbal et al., 2017; Mazhar et al., 2020). It is a foliar disease of corn. The cigar-shaped lesions appear on leaves about six inches long (Fig-1). The shape of spore under Microscope is shown in (Fig-2) It is very important to manage this disease through various methods. Among the methods, the most efficient and fast method is through fungicides rather than biological, Cultural and mechanical methods.

To mitigate the impact of turcium leaf blight disease on maize, Kumar et al. (2022) suggests applying three sparsely spaced propiconazole applications. After evaluating seven fungicides, (Tesema et al., 2022) determined that capatafol and mancozeb were the most efficient at preventing maize northern leaf blight. In their study, Reddy et al. (2014) examined the impact of administering six applications of Mancozeb (0.2%) ten days apart, thirty days after planting, and inoculation, on the management of turcium leaf blight in maize. The researchers observed a reduction in infection rates. Vieira et al., (2012) report that five fungicides effectively target the turcium disease in susceptible maize cultivars. Each fungicide was effective in mitigating the

disease. It was discovered that mancozeb and thiophanate methyl were to blame. Thatcher et al. (2023) conducted an in vitro evaluation of twenty-three (23) fungicides against turcium leaf blight of maize. Mancozeb (0.25%) inhibited pathogen development entirely. Carboxychlor powder (0.1%) and propiconazole (0.1%) exhibited the highest efficacy as fungicides. The incidence of turmeric leaf blight was reduced by mancozeb (0.25% plus titanium dioxide (0.4%), monopotassium phosphate (1%), and potassium silicate (1%), according to (Kotze, 2020). Mayada et al. (2016) state that mancozab and zinceb are efficacious fungicides that concurrently avert pathogenicity and augment crop productivity. Twelve fungicides, including non-systemic ones, were evaluated by (Fowler, 2015) against maize Turicum leaf disease. Each of the fungicides effectively inhibited the mycelial proliferation of the test pathogen in comparison to the untreated control. It has been demonstrated that propiconazole is the most effective systemic fungicide at inhibiting the development of pathogen mycelia. After administering two foliar applications of a systemic fungicide, such as Propiconazole 25 EC 0.1 percent, the disease intensity was diminished to 6.11 percent. The control group experienced a reduction in illness intensity from 20.45% to 5.69 percent when administered Mancozeb 75WP, 0.25 percent. The required and recommended dose of fungicides should be sprayed. If recommended dose is not applied, then side and residual effects of fungicide spray occurred. So, the management of this disease by fungicide is effective. A Present study was undertaken to manage Turcium leaf blight of maize through various fungicides and found out which fungicides are most effective against the *turcium leaf blight* of maize. The fungicides used in the experiment are given in (**Table No.1**)

Fig-1   **Symptoms of** *turcicum l*eaf blight of maize:

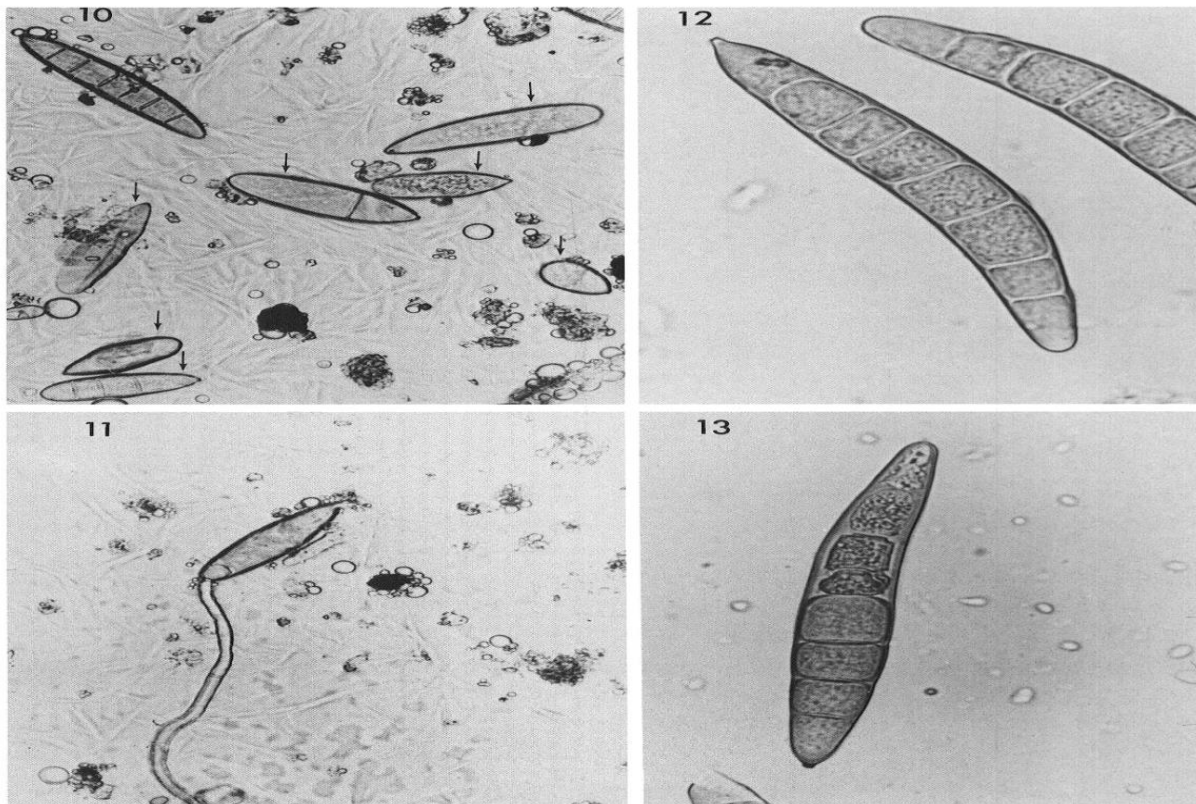**Fig 2 Spores** *of turcicum leaf blight* **under microscope**

Table 1: Fungicides used in the research experiment

S. No.	Trade Name	Common name	Active Ingredients (%)	Formulation
1.	Dithane M-45	Mancozeb	75	WP
2.	Tilt	Propiconazole	25	EC
3	Score	Difenaconzale	25	EC
4	Topsin-M	Thiophenate Methyl	70	WP

Material and Methods

Isolation and purification of *Turcium Leaf Blight*

The plant showing disease symptoms of northern leaf blight of maize were brought to the laboratory of Plant Pathology Research Institute Faisalabad during 2021-22. The infected portion was washed with water and kept in the refrigerator to avoid dryness and contamination. Samples were cut into small pieces about 2-3 mm. These small pieces were put in 0.1 percent mercuric chloride solution for 30 seconds and then washed with sterilized water. These tiny pieces were kept in Potato Dextrose Agar (PDA) slants with the help of inoculating needles. Seven days after inoculation, the germinating pathogen was shifted to fresh slants. After the development of the pathogen, the fungus was identified under the microscope. The pure fungus was kept in the refrigerator. The pure culture of *turcium leaf Blight* was ready for spray.

Inoculation of fungus *Turcium Leaf Blight*

The culture of *Turcium leaf Blight* of maize was picked from slants and shifted to Petri plates having potato dextrose agar medium. The Petri Plates were placed in the refrigerator for 20-25 cᵒ. Thirty Petri dishes of culture were macerated with the blinder's help for 15-20 seconds. This culture was mixed with sterilized water and then passed through muslin cloth to make four to five liters of suspension. The pure culture was brought to the field and put in a compressed air sprayer @ 1 liter / 2 liters of water. The fungus suspension should be inoculated twice a week when the plants attain a height of 40cm. 100 Petri dishes of culture is sufficient for 1000 plants. The spray of fungicide was sprayed on the appearance of disease symptoms. The second spray was sprayed after 15 days interval.

Efficacy of fungicides against *Turicum Leaf Blight* in field condition

The research, which utilized an RCBD design with five measures, three replications, and one control, was conducted in the Research Area of the Plant Pathology Research Institute in Faisalabad throughout the Kharif season of 2021-2022. As an indicator, the Malka-2016 tick was utilized. Four rows comprised the 3.0-metre plot. A sterile suspension of the pathogen was applied via aerosol on to each replication to induce illness. Twenty-five days separated the applications of two distinct fungicides on the plots. A random selection of five plants was made for each treatment. Data was collected using the disease severity scale (0–5, Jakhar et al., 2017), and the disease incidence was computed utilizing the subsequent formula.

Disease incidence (%) = No. of diseased plants X 100

                                                    Total no. of plants

Table No. 2. Scale used for recording the disease data of Northern leaf Blight

Disease symptoms	Scale	Responsive	Reaction of Disease
No or nil symptoms	0	0	Without Symptoms
Slight to very Slight infection	1	Few or one Two, scattered lesions on lower leaves.	Highly resistant (HR)
Light infection	2	Moderate number of lesions on lower Leaves only or Light infection	Resistant (R)
Moderate infection	3	Few lesions on lower leaves or abundant lesions on middle leaves	Moderately resistant (MR)
Heavy infection	4	Abundant lesions on lower, middle leaves, extending to upper leaves	Susceptible (S)
Very heavy infections	5	Abundant lesions on all leaves of plants prematurely dry or killed by the disease.	Highly susceptible (HS)

Result and Discussion

In the experiment, four fungicides and one control were tested against *Exserohilum turcicum leaf blight* of maize. These fungicides significantly reduced the northern leaf blight of maize and increased the yield. Dithane M-45 (Mancozeb) controlled the disease by 86% over control ,followed by Tilt (Propiconazole) by 79%, Score (Difenaconazole) by 71%. The least effective fungicide was Topsin-M 70 %WP (Thiophenate Methyl) controlled the disease by 68%

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(**Table No.3**). The whole experiment was shown in the shape of a graph (**Fig No.3).** The effectiveness of fungicides like Carboxin, Propiconazole, and Mancozeb were tested against northern leaf Blight of Maize by (Beshir, 2015). The results of this study are consistent with the findings from (Badu-Apraku et al., 2017), which investigated the effects of seven fungicides on E. turcium, the pathogen responsible for maize leaf blight. The investigation revealed that 0.25 percent mancozeb reduced illness by 72.1 and 73.1 percent, respectively. Additionally, he asserted that carbendazim and mancozeb 0.25% combination therapy alleviated the symptoms of the disease. The next-best medication, Cabrio top (0.3%) (Metiram + Pyraclostrobin), achieved a disease control rate of 61.5%. Tebuconazole 0.1% was the most efficacious medication, following carbendazim 0.1%, reducing symptoms of illness by 28.9%. Based on the obtained data, it is suggested that the carbendazim and mancoze (0.25%) combination be utilized to prevent northern leaf blight in maize, as it exhibited superior performance compared to the other interventions.

Moreover, he asserted that implementing effective management techniques could readily contain the rapid dissemination and epidemic-causing nature of foliar diseases. This experiment aimed to assess the efficacy of various fungicides in comprehensively addressing northern leaf blight in maize. In addition, he provided evidence that all of the interventions reduced maize turcicum leaf blight by a significant margin compared to the control.

(Ahmadi et al.) recorded that the maximum inhibition of mycelial growth (100%) was recorded in systemic fungicides like mancozeb 0.25% (100), and the next was carboxin power 0.1% (99.16%), propiconazole 0.1% (99.1%) and zineb 0.25% (99.16%). dos Santos et al., (2022) noted that topsin-M (Thiophanate Methyl), which inhibited the growth by (70.35%) at 500 ppm concentration, was found to be the least effective. The same type of result was recorded at 100 and 250 ppm concentrations. In-vitro conditions when non-systemic fungicides were applied, then mancozeb fungicide gave the best result and inhibited the mycelia growth of fungus by 100%. At 1500 ppm concentration, Captan (35.5%) was found to be the least effective fungicide. When two foliar sprays of Mancozeb 75%WP at 0.25% were sprayed against Turcicum leaf blight, disease was reduced from 20.40%.

According to a study (D. dos Santos Junior et al., 2022), the maize genotype CM-202 was used to evaluate various systemic fungicides. These fungicides included propiconzole, Azoxystrobin, Difenoconazole, Mancozeb, Trifloxystrobin, and Tebuconazole. Foliar spray experiments were also carried out on combination products containing 25% Trifloxystrobin + 50% Tebuconazole 50% -75 WG, and 18.2% Azoxystrobin + 11.4% Difenoconazole SC. The researchers made final observations about the disease's severity during the dough stage. These systemic fungicide treatments significantly varied crop production and disease severity. Compared to the untreated control group and other treatments, Tebuconazle 250 EC at a concentration of 1.4 ml/liter of water resulted in a substantially lower sickness score of 23.7%. The combination products sprayed with a foliar solution containing 11.4% SC at 0.25 ml/liter and 18.2% Azoxystrobin and Difenoconazole had the lowest disease score (8%), significantly lower than the untreated control and other treatments.

Systemic fungicides and combination treatments were employed to treat the illness at a rate ranging from 77.0% to 8%. Compared to the untreated control, each therapy considerably improved and reduced the severity of Turingium leaf Blight in maize.

Conclusion

It is concluded from the experiment that Dithane-M45 (Mancozeb) controlled the disease by 86% over control, followed by Tilt 25%((Propiconazole) controlled the disease by 79%, Score 25% EC (Difenaconzole) by 71%. The least effective fungicide was Topsin-M 70%WP (Thiophenate Methyal) control the disease by 68%.
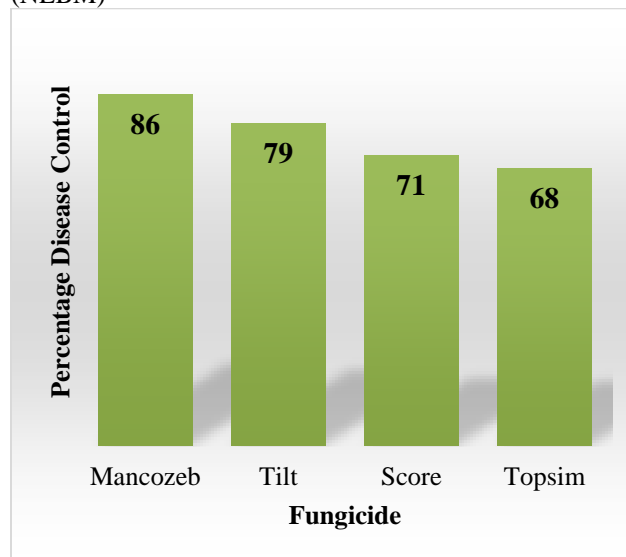
Table No.3. **Disease data was recorded after the application of fungicides**

Sr. No.	Name of Fungicide	R1 Disease %age	R2 Disease %age	R3 Disease %age	Mean Disease %age	%Disease over control
1	Dithane M-45 (Mancozeb)	20	10	10	13.33	86 a
2	Tilt (Propiconazole)	30	10	20	20.00	79b
3	Score (Difenaconazole)	30	20	30	27.00	71c
4	Topsin-M (Thiophenate Methyl)	30	20	40	30.00	68.00cd
5	Control	80	90	80	83.33	-

CV16.10, 0.05 Standard Error for Comparison 3.89

Fig No.3. Graphic Picture of efficacy of fungicides to control the *Northern Leaf Blight* of Maize (NLBM)

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Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

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Conflict of Interest

Regarding conflicts of interest, the authors state that their research was carried out independently without any affiliations or financial ties that could raise concerns about biases.

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