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Effective Management of Tomato Early Blight (Alternaria solani) Using Fungicide Applications

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ABSTRACT:
The present investigation was conducted to evaluate the efficiency of five fungicides against the tomato disease, Alternaria leaf blight caused by Alternaria solani. All fungicides were tested under field conditions against the early blight and late blight. The results revealed that all the fungicides were significantly effective against early blight of tomato. Among the fungicides Difenconazole and Carboxin were most effective against early blight.

KEYWORDS: Fungicide, Tomato, Management, Evaluation.

I. INTRODUCTION

Tomato (Solanum lycopersicum L.) is a member of the Solanaceae family and one of the most extensively produced vegetables worldwide. Based on its nutritional value, antioxidant molecules like lycopene, ascorbic acid, vitamin E, and phenol components like flavonoids, it is typically regarded as "Protective food" (Sepat et al., 2013).It is an important commercial crop grown in India over an area of 8.41 million hectare with a production of 20.336 million tonnes (Anonymous, 2022).

Numerous diseases,caused by fungi, bacteria, viruses, and nematodes, can affect tomatoes grown in both protected and natural environments. However, fungus pathogens are primarily responsible for significant losses in plant stand and harvested fruit in both situations. One of the major leaf diseases, early blight caused by Alternaria solani, is responsible for 80–86% of production losses (Pandey et al., 2003). For every 1% rise in disease severity, there is a loss in yield about 0.76 t/ha (Saha and Das, 2012)

Chemical fungicides, lengthy crop rotations, and steam or fumigant pasteurization of the seedbed have been the main methods used to manage early blight disease (Jones et al., 1991). However, this disease is very difficult to control (Pasche et al., 2004). Failure to control this disease can cause reduction in yield (Malik et al., 2014). It needs to develop new effective fungicide and bioagents with mode of action which will be helpful for increase in quality and quantity of tomato production (Sahu et al., 2013). However, the present investigation was conducted to evaluate the efficacy of five fungicides against the disease.

II. Materials and Methods

Isolation of pathogen

The pathogen Alternaria alternata was isolated from naturally infested leaves of tomato plants collected from the farmer's field. The agar plate method was used for the isolation of fungus (Horn, 2005). The diseased leaves samples were washed and the small bits (2.5 mm) of infected portion of leaves were cut with sterilized blade and disinfected with 0.1% aqueous solution of mercuric chloride (HgCl2) for two minutes. These surface sterilized bits were washed by giving three changes of sterile distilled water to remove traces of mercuric chloride then blot dried and inoculated on the solidified and cooled PDA (Potato dextrose agar) medium in petri plates under aseptic condition. These plates were then incubated at 25± 2 °C temperature for seven days. The well-developed mycelial growth free from any contaminant was obtained and transformed to agar slant by hyphal tip method. Through frequent sub-culturing pathogen was purified and maintained on agar slants for further studies.

In vivo evaluation of fungicides and bio agents against Alternaraiasolani

The field experiment was conducted on the Rainfed Chemical Agriculture Research farm Narayan Bagh, Jhansi, during Rabi, 2023-24, to evaluate the efficacy of fungicide.Randomized Block Design (RBD) with 3 replications was used. Thirty days old healthy seedlings of tomato cultivar(Arka Vikas) were transplanted at 75-90cm x 45-60 cm (R xP) and the crop was raised as per recommended package of practices and drip irrigation was given as and when required.

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Treatment Details

	Treatment Details	
T1	Control	-
T2	Zineb 75% WP	0.2%
T3	Thiram 75% DS	0.02%
T4	Mancozeb 75% WP	0.02%
T5	Propiconazole 25% EC	0.05%
T6	Azoxystrobin 23% S	0.05%
T7	Difenconazole 25% EC	0.20%
T8	Carboxin 75% WP	0.20%
T9	Dithane- M 45	0.05%

OBSERVATION RECORDED FOR EFFICACY

Five fungicides were tested for effectiveness at predetermined concentrations and their results were compared to an untreated control. The first observation was recorded on the same day of appearance of disease and subsequent two observations were recorded at an interval of 15 days. The final (4th) observation was recorded 15 days after 3rd spraying.

Five plants per treatment per replication were selected randomly and three leaves (bottle, middle and top) from main branch on each plant were selected for recording the observations. As regard of disease intensity, three branches of each plant, one from top, one from middle and on from bottom were tagged for recording observations. From each branch six leaves were examined individually, and their intensity of disease was recorded separately. Observations on foliage was early blight disease incidence and intensity were recorded at 15 days after last spraying. The observations were graded into 0-9 scale as described by Mayee and Datar (1986)

Percent Disease Intensity (PDI) was calculated by using the following formula given by (Pandey et al., 2002).

PDI = Sumofnumerical value× Number of leaves observed

100

Maximum disease rating value

STATISTICAL ANALYSIS

The data obtained in all experiments were statistically analysed by R-software (Ri386 2.15.3). The percentage values are transformed into arcsine values. The standard error (SE) and critical difference (CD) at 5% level of significance were worked out and results obtained were compared statistically.

III. Results and Discussion

In vivo management of early blight of tomato

Data on disease severity revealed that all fungicides tested reduced the disease intensity significantly compared to control. The results depicted in Table 1 revealed that in all the treatments, there was increases in disease index from 60 to 90 DAT. However, the rate of increase in PDI was slow in case of fungicides treated plots compared to control.

The percent disease severity in different treatments at 90 days after transplanting (DAT) reported that minimum disease severity (26.10%) was observed in T4 followed by T5, T3, T2, T6, T9, T7 and T8 with severity of 28.14%, 28.54%, 30.86%, 30.95%, 34.87%, 36.20%, and 37.61%, respectively as compared to control (42.72%).

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Table 1: Efficacy of Fungicides on Disease Severity of Early Blight

	Treatments	Dose	Disease Severity (%)		
			60 DAT	75 DAT	90 DAT
T1	control	-	21.30	30.18	42.62
T3	Thiram 75% DS	0.02%	16.58	25.48	28.54
T4	Mancozeb 75% WP	0.02%	17.07	23.84	26.10
T5	Propiconazole 25% EC ozeb 75% WP	0.05%	17.65	25.76	28.14
T6	Azoxystrobin 23% SC	0.05%	18.73	25.74	30.95
T7	Difenconazole 25% EC	0.20%	l16.19	28.19	36.20
T8	Carboxin 75% WP	0.20%	14.40	27.29	37.61
T9	Dithane- M 45	0.05%	15.25	24.99	34.87
	SE(m)±	--	**0.443**	**0.792**	**0.364**
	CD(P= 0.05)	--	**1.33**	**2.394**	**1.100**

Effect of fungicides on Fruit Yield

The data on fruit yield per ha have been presented in Table 2 revealed that there was significant increase in fruit yield in fungicide treated plots over control. Maximum yield (38.35t/ha) was obtained in plots sprayed with 0.02 % Difenconazole 25% EC, followed by 0.20%Carboxin 75% WP(36.81 t/ha). Least yield was obtained by0.2%Zineb 75% WP (19.10 t/hac)followed by 0.02%Thiram 75% DS (21.90t/ha). Control plot recorded a fruit yield of only 12.83 t/ha and the other treatments were statistically on par with each other.

Table 2: Evaluation of Fungicides against Disease

	Treatment Name	Dose	PDI	PDC	Fruit Yield
T1	Control	-	54.75	-	12.83
T 2	Zineb 75% WP	0.2%	47.18	12.45	19.10
T3	Thiram 75% DS	0.02%	44.35	19.01	21.90
T4	Mancozeb75% WP	0.02%	37.41	37.49	31.54
T5	Propiconazole 25% EC	0.05%	39.49	27.70	25.42

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T6	Azoxystrobin 23% SC	0.05%	32.96	39.77	33.81
T7	Difenconazole 25% EC	0.20%	29.38	46.35	48.35
T8	Carboxin 75% WP	0.20%	32.55	35.08	36.81
T9	Dithane	0.05%	30.55	33.10	34.36

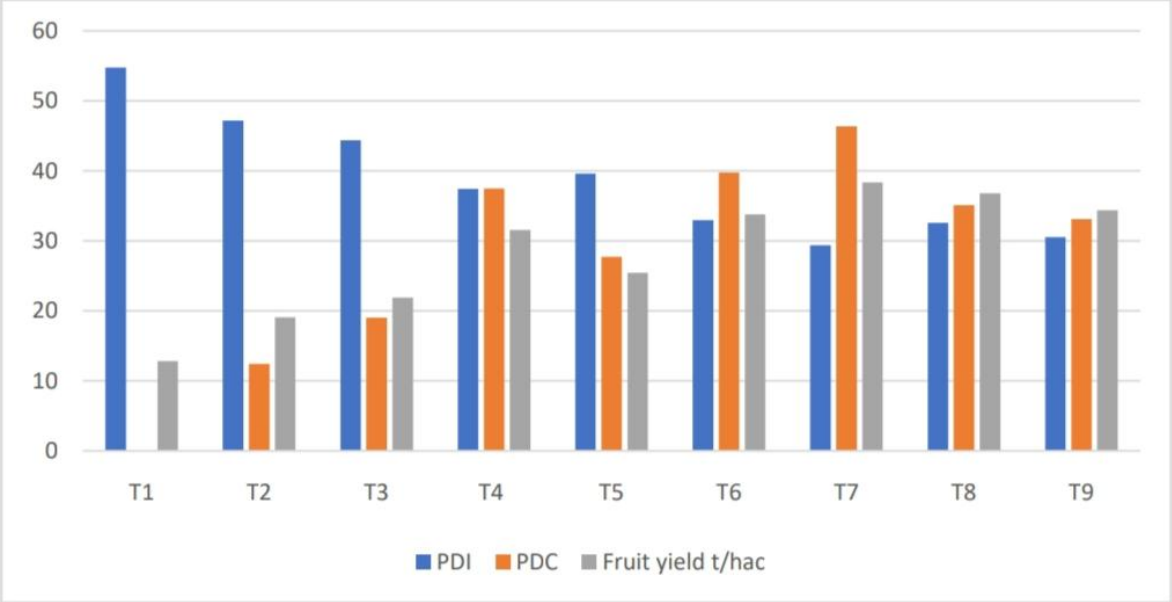

Fig 1: *In vivo* evaluation of efficacy of fungicide on fruit yield

IV. CONCLUSION

All fungicides show effective control for disease but among them .02 % Difenconazole 25% EC, followed by 0.20% Carboxin 75% WP (36.81 t/ha) shows highly suppression of disease under field condition.

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