

In Vivo Evaluation of Fungicides for the Management of Late Blight of Tomato

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Abstract

Tomato (*Lycopersicon esculentum* Mill.) is an important vegetable having culinary, medicinal and economic significance. It belongs to family "Solanaceae" and is vulnerable to many biotic and abiotic factors. Among the biotic stresses, late blight disease is the most destructive disease causing huge losses and posing a great threat to successful tomato production. The present experimentation was carried out to test the efficacy of ten fungicides viz. Mentor 50% EC, Symbol 76% EC, Fossil 32.5% SC, Cruze 32.5% EC, Falter 70% WP, Cosmos 80% WP, Wilson 69% WDG, Clone 72% WP, Puslan 72% WP and Ridomil 72% WP against tomato late blight to find out the most effective one. Randomized Complete Block Design (RCBD) was followed with three replications. The means were compared with the help of Least Significant Difference (LSD) test.

Keywords: Tomato; Late blight; *Phytophthora infestans*; Fungicides

Introduction

Tomato (*L. esculentum* Mill.) belongs to family "Solanaceae". It was originated from west coast highlands of South America where it was locally called "Tomati" [1]. Etymologically, the word "tomato" was originated from Nauthl language word "tomatl". In Indo-Pak subcontinent, tomato was introduced about 200 years ago [2]. Worldwide production of tomato is over 120 million metric tons [3]. Countries where tomato is extensively grown are Brazil, China, Egypt, India, Iran, Italy, Mexico, Russia, Turkey, United States of America and Uzbekistan [4]. It is an important vegetable in the cuisines of Pakistan. Pakistan is ranked 35th among tomato producing nations. In Pakistan, it is grown on an area of 52,300 hectares with an annual production of 5,29,900 tons [5]. Tomato is cultivated in all provinces but Sindh and Punjab are the major ones where tomato is largely cultivated. Tomato is vulnerable to different diseases caused by bacteria, fungi, nematodes, viruses and abiotic factors which are threat to decreased production. Late blight of tomato caused by fungus *Phytophthora infestans* (Mont.) De Bary is one of the important diseases of tomato and potato which contributes to high yield losses. This pathogen is responsible for the Irish Potato famine in 1845-46 [6,7]. On tomato, it was first reported in France in 1847 [8]. In Pakistan, this disease was first reported in Faisalabad and since its appearance it has become danger to successful tomato productivity [9]. Late blight may kill the foliage and stems of tomato plants during the growing period and drastically reduces its quality and quantity [10]. Leaf, fruits, petioles, stems and seed of tomato are affected by late blight pathogen [11]. This disease is characterized by formation of water soaked spots usually at the edges of lower leaves which then changed to brown, dried surrounded by a yellow tissue. In the presence of moist weather, a whitish growth forms on margins of the lesions on the underside of leaf. Infected stem also become dark brown to black. Chemical application is an effective and curative method for the management of late blight under proper forecasting. Two major fungicide groups are frequently used for the chemical control including protectants like Chlorothalonil and Dithiocarbamate which are usually applied before the onset of disease and systemic fungicides like Phenyl amides (metalaxyl/mefoexam) and Morpholine fungicides which are usually applied after the symptom appearance on plant as curative measure. Metalaxyl inhibits rRNA polymerase in fungi reducing uridine combination [12]. So, proper application of fungicides on the on-set of disease is effective in the management of late blight. The current research work was focused on the chemical management of late blight of tomato under field conditions.

Materials and Methods

Collection of diseased plant specimens

The diseased tomato leaves were collected from different areas of Faisalabad region.

Isolation and identification of pathogen

The diseased plant specimens were brought into the laboratory and infected portion of leaves was along with healthy one and disinfected/sterilized in distilled water and sodium hypochlorite (NaOCl) solution in equal proportions. The isolated diseased leaf portions were then dried by placing them on a filter paper. After drying the isolated diseased leaf portions were placed in PARP medium and incubated at 20°C. After 5 days, a creamy flowery growth of *P. infestans* appeared in petri plates.

Fungicide testing

Ten fungicides were used during the chemical treatment which were Mentor 50% EC, Symbol 76% EC, Fossil 32.5% SC, Cruze 32.5% EC, Falter 70% WP, Cosmos 80% WP, Wilson 69% WDG, Clone 72% WP, Puslan 72% WP and Ridomil 72% WP. The fungicides were sprayed at recommended doses at an interval of ten days with three replications following RCB design at the appearance of disease (Figures 1 and 2).

Data recording

Data were recorded based on two parameters:

1. Disease Incidence (%)

Disease Incidence (%) = No. of infected plants / Total number of plants × 100

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Received February 05, 2017; Accepted February 23, 2017; Published February 27, 2017

Citation: Humza M, Iqbal B, Nasir M, Atiq M, Rana MF, et al. (2017) In Vivo Evaluation of Fungicides for the Management of Late Blight of Tomato. J Plant Pathol Microbiol 8: 400. doi: 10.4172/2157-7471.1000400

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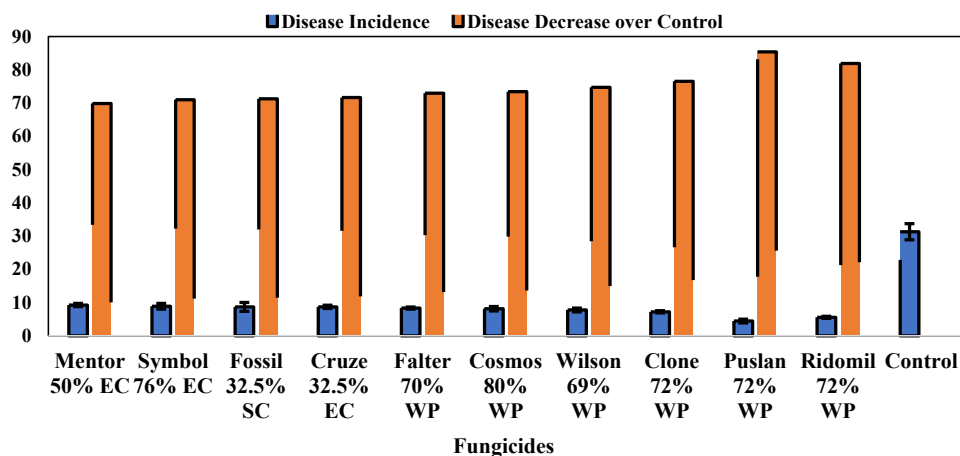


Figure 1: Evaluation of fungicides against late blight of tomato after 1st spray under field conditions.

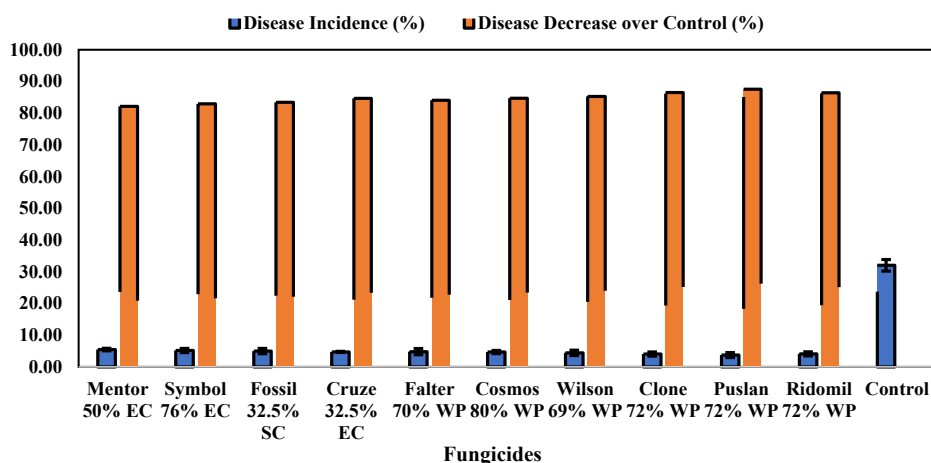


Figure 2: Evaluation of fungicides against late blight of tomato after 2nd spray under field conditions.

Grade	Disease Incidence (%)	Level of Resistance/Susceptibility
0	0.0%	No disease
1	10%	Small lesions on the inoculated point with the lesion area less than 10% of the whole leaflet
3	10% and 20%	Lesion area between 10% and 20% of the whole leaflet
5	20% and 30%	Lesion area between 20% and 30% of the whole leaflet
7	30% and 60%	Lesion area between 30% and 60%
9	Over 60%	Lesion area over 60% of the whole leaflet

Table 1: Disease rating scale for assessment of late blight disease on tomato.

Fungicides	Disease Incidence (%)	Disease Decrease over Control (%)
Mentor 50% EC	9.256667b	69.85
Symbol 76% EC	8.89b	70.97
Fossil 32.5% SC	8.703333b	71.25
Cruze 32.5% EC	8.703333b	71.65
Falter 70% WP	8.333333bc	72.93
Cosmos 80% WP	8.146667bc	73.42
Wilson 69% WP	7.776667bc	74.7
Clone 72% WP	7.223333bcd	76.52
Puslan 72% WP	4.443333d	85.38
Ridomil 72% WP	5.566667cd	81.91
Control	31.29333a	0.00
LSD	2.8244	

Table 2: Evaluation of fungicides against late blight of tomato after 1st spray under field conditions.

Fungicides	Disease Incidence (%)	Disease Decrease over Control (%)
Mentor 50% EC	5.48b	82.14
Symbol 76% EC	5.19b	82.93
Fossil 32.5% SC	5.00b	83.44
Cruze 32.5% EC	4.74b	84.68
Falter 70% WP	4.81b	84.05
Cosmos 80% WP	4.70b	84.7
Wilson 69% WP	4.45b	85.26
Clone 72% WP	4.07b	86.52
Puslan 72% WP	3.74b	87.56
Ridomil 72% WP	4.11b	86.42
Control	32.04a	0
LSD	2.3846	

Table 3: Evaluation of fungicides against late blight of tomato after 2nd spray under field conditions.

1. Disease Decrease over Control (%)

Disease Decrease over Control

$$= \frac{(\text{Disease Incidence in Control} - \text{Disease Incidence in treatment})}{(\text{Disease Incidence in Control})} \times 100$$

For the assessment of disease, a disease rating scale formulated by Shutong et al. [13] was followed (Table 1).

Statistical analysis

The collected data were statistically analyzed by employing analysis of variance (ANOVA) and treatment means were compared with the help of least significance difference (LSD) at 5% probability level [14].

Results and Discussion

For the management of late blight of tomato, 10 fungicides were evaluated. After 1st spray, Puslan 72% WP (85.38%) and Ridomil Gold 72% (81.91%) showed best results in controlling late blight of tomato while Mentor 50% EC (69.85%) was least effective (Table 2). The data recorded after 2nd spray reveals that all fungicides were statistically at par in controlling late blight of tomato. Results showed that two sprays of fungicides are necessary for the best management of late blight of tomato (Table 3). The results which are deduced from this experiment are in close conformity with Dhanbir et al. [15] in which 5 fungicides were evaluated and Ridomil 72% WP (8% Metalaxyl+64% Mencozeb) was most effective in controlling late blight disease. Trehan et al. also

found that combined application of Metalaxyl and Mencozeb showed excellent results in reducing late blight incidence.

Conclusion

Two fungicides namely Puslan 72% WP (85.38%) and Ridomil Gold 72% (81.91%) are most effective against late blight of tomato and could be recommended to farmers for its chemical management.

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