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RESEARCH ARTICLE

Microthiol Disperss as Alternative Fungicide for Control of Powdery Mildew (*Leveillula taurica*) Disease on Tomato at Debre Zeit, Ethiopia

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ABSTRACT

Tomato powdery mildew (*Leveillula taurica*) is a common disease of tomato crops in Ethiopia. To control the disease, application of fungicide Microthiol Disperss (Sulfur 80%) was tested under natural field condition at Debre Zeit Agricultural Research Center and the standard check Thiovet Jet 80 WP (Sulfur) on Galiea tomato variety to assess the efficacy. The rate was 2–4 kg/ha diluted with 400 L of water/ha of land. Result of experiment showed that Microthiol Disperss (Sulfur 80%) effective Powdery Mildew tomato to get good fruit quantity and qualities with no significant difference Thiovet Jet 80 WP under natural field condition. Microthiol Disperss (Sulfur 80%) has gave 16.65 t/ha of yield at a rate of 2–4 kg/ha provided comparable yield as Thiovet Jet 80 WP (Sulfur) of 12.41 t/ha with no significance difference. Therefore, Microthiol Disperss at a rate of 2–4 kg/ha is diluted with 400 L/ha of water is recommended to be used as alternative fungicide for prevention and control of Powdery Mildew integrated with other environmentally safe powdery mildew management practices on tomato cultivated depending on disease pressure, agroecology, and susceptible variety. Moreover, it also used to as preventive fungicide for powdery mildew on tomato in early occurrence of the disease.

Key words: Tomato powdery mildew (*Leveillula taurica*), Microthiol disperss (sulphur 80%), Fruit yield

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) belongs to the solanaceae family along with other economically important crops such as pepper, eggplant, and potato. It is an excellent source of nutrients and secondary metabolites which are important for human health including minerals and vitamins (Naika *et al*., 2005). According to De Lannoy (2001), the average productivity of tomato in Africa ranged from 8 t ha^{-1} to 25 t ha^{-1}, the highest in South Africa and the least in Benin and Nigeria. Tomatoes in Ethiopia are produced mainly in northern and central rift valley areas. According to FAOSTAT (2014), commercial tomato production in Ethiopia has significantly expanded as the national agriculture strategies gave the highest priority for the production of high value cash crops.

Tomato offers better economic returns to many farmers in Ethiopia especially when it is grown during the wet season. According to CSA (2020/21), in Ethiopia for large scale farms and private holders, tomato was cultivated on 14010.79 hectares of land and above 1.06 million quintal of yield was harvested in both rain and irrigation seasons. The average yield per hectare was 7.58 ton.

Powdery mildew (*Leveillula taurica)* epidemics on tomatoes are often sporadic and unpredictable, making it difficult for researchers to determine the overall impact of the disease on tomato production. *L. taurica* is a major pathogen of tomato and several other crops that can cause substantial yield losses in favorable conditions for the fungus. Powdery mildews are obligate biotrophic fungi that cause

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extensive damage in a wide range of crops (Ridout, 2009). It causes that infections on tomato are caused by the fungal species *L. taurica* (Correll *et al*., 1987) which is primarily associated with the disease in open field and greenhouse cultivated tomatoes (Cerkauskas and Brown, 2015). Powdery mildew fungi have a wide host range within the solanaceae, alliaceous, and cucurbitaceous plant families, thus making them extremely destructive pathogens in number of vegetable crops (Whipps *et al*., 2002).

Warm, arid, and semiarid climatic conditions seem to promote infections by *L. taurica*, which under favorable conditions can have a significant impact on fruit production and quality. Yield reduction of tomato due to powdery mildew infestation ranges between 10% and 90% (Aegerter *et al*., 2014; Asfaw and Eshetu, 2015). The fungus mainly infects the leaves, where it enters through the stomata and grows predominately endophytically, penetrating deeply into the mesophyll of the leaf tissue (Palti, 1988). The current chemical practices to manage late blight include a mixture of fungicides designed to slow the disease progress (Gisi and Cohen, 1996). Systemic fungicides inhibit ribosomal RNA (rRNA) polymerases in fungi by reducing incorporation of uridine (Majid *et al*., 2008). Contact fungicides are effective against pathogen arrival to the plant and have not resulted in pathogen resistance after many years of use. They coat the leaves to prevent infection, but cannot stop infections once they occur. The aim of this research is to test the efficacy of Microthiol Disperss for prevention and control of powdery mildew on tomato.

MATERIALS AND METHODS

The experiment was conducted at Debre Zeit Agricultural Research Centre in 2020/21 using hybrid Galilea tomato variety. The test product was Microthiol Disperss (Sulphur 80%). The test product/Microthiol Disperss were applied 2 $kgha^{-1}$ diluted with 400 L of water/ha of land. Agronomic practices were applied as per the recommendation. Experimental plot was thoroughly plowed and leveled. The spacing between plants and rows was having 0.5 m and 0.7 m, respectively. Inorganic fertilizers as DAP and UREA were applied at a rate of 150 and 100 kg/ha kg^{-1}, respectively. DAP was applied a week after transplanting; while UREA was applied in two splits; the first at transplanting and the second 1 1/2 months after transplanting. Thiovet Jet 80 WP (Sulfur) was used as standard check at a rate of 2 kg/ha diluted by 400 l of water.

Disease Assessments

For disease occurrence, natural infestation was allowed. Disease severity was assessed on 10 randomly selected and tagged plants. Powdery Mildew **(***L. taurica***)** was scored in 0–5 scales and converted to percentage severity index (PSI) by (Ullasa *et al*., 1981) of which: 0: R (no symptoms), (1) MR (10% affected), (2) MS (11–20% affected), (3) S (21–50% affected), (4) HS (51% or more affected), and (5) the entire plant defoliation. The analysis of disease severity was using the following formula: PSI: (sum of individual numerical rating)/ (total numbers of assessed maximum scoring scale). Average infection coefficient (AIC), terminal disease severity (TDS), and disease progress rate (DPR) were done for the disease progress data. The agronomic data were collected from 10 sample plants from each plot. Data such as diseased leaf count, fruit weight (g), fruit diameter (mm), and yield components such as marketable, unmarketable yield, and yield advantage collected. Yield data in respect to marketable fruits are those with average size.

Data Analysis

Average severity of 10 representative randomly selected plants per plot was used for statistical analysis. Data were analyzed using descriptive statistics. The data were collected on Microthiol Disperss, Thiovet Jet 80 WP (Sulfur) and control plot. Data on disease parameters such as TDS, AIC, DPR, and yield were subjected for analysis using simple statistics analysis.

Table 1: The Mean of agronomic and yield parameters evaluated from the treatments

Treatments	Diseased leaf number	Fruit Diameter (mm)	Fruit weight (g)
Control	50	32.58	85.49
Micrithiol Disperss	16.4	47.37	104.94
Thiovet Jet 80 WP (Sulfur)	17.2	49.3	135.40
CV (%)	7.63	2.8	25.16

Table 2: Yield and yield components on treatments

Treatment	Healthy fruit number	Diseased fruit	Marketable (t/ha)	Unmarketable (t/ha)
Control	29	51	4.39	8.5
Micrithiol Disperss	96	46	13.13	4.2
Thiovet Jet 80 WP (Sulfur)	86	41	10.04	2.9
CV	36.14	5	4.43	1.4

Table 3: Yield and yield advantage on fungicide treated tomato

Treatment	Yield (t/ha)	Yield advantage (t/ha)
Micrithiol Disperss	16.65	11
Thiovet Jet 80 WP (Sulfur)	12.41	6.76
Control	5.65	0
CV	5.55	–

RESULTS AND DISCUSSION

Yield and yield components

The result in revealed that statistical differences were observed among treatments healthy leaf number [Table 1]. Among the test fungicides; more diseased leaf number (50) were observed on control, conversely mean less/more healthy diseased leaves were plots treated with Thiovet Jet 80 WP (Sulfur) and Microthiol Disperss with value of 27.2 and 26.4. This implies that Microthiol Disperss appropriate fungicides for the management of powdery mildew on tomato no significance difference between compared to standard check Thiovet Jet 80 WP (Sulfur) and Microthiol Disperss [Table 1].

Fruit diameter is important parameter of yield components. Large fruit diameter (mm) 49.3 mm is obtained from the treatments at Thiovet Jet 80 WP (Sulfur). Smaller fruit diameter 32.58 mm is found on control. There are significant differences between treated and untreated plots; Thiovet Jet 80 WP (Sulfur) applied at a rate of 3.5 kg/ha has revealed 47.37 mm fruit diameter which does not have significance variation compared to Microthiol Disperss [Table 1]. This indicates that fruit diameter is increased by application of fungicides when for tomato production. Regarding, fruit weight is important characters and factors.[1,2] Heavy fruit; 135.40 g and 104.94 g; was found on plots treated Thiovet Jet 80 WP (Sulfur) and Micrithiol Disperss, respectively. Less fruit heaviness was found on control (85.49 g). There were no significant differences that were obtained from between Thiovet Jet 80 WP (Sulfur) and Microthiol Disperss on fruit weight.

Poor quality is always leads for yield loss. Comparable lower yield loss 2.9 and 4.2 t/ha is obtained on Thiovet Jet 80 WP (Sulfur) and Micrithiol Disperss; respectively; while highest unmarketable yield 8.5 (t/ha) is obtained on control. There were no significance differences between Thiovet Jet 80 WP (Sulfur) and Microthiol Disperss by comparison of unmarketable yield (kg). Standard check Thiovet Jet 80 WP (Sulfur) revealed 2.9 t/ha of unmarketable yield (kg).

Marketable yield provides for yield advantage. Good yield 13.13 t/ha is obtained on Micrithiol Disperss; conversely lower yield 4.39 t/ha is obtained from control. There was significant difference between control and treated, but there were no differences between Thiovet Jet 80 WP (Sulfur) and Microthiol Disperss [Table 2].

Yield advantage increases profitability of producer and reduces yield loss. Good yield advantage 11 t/ha is obtained from Micrithiol Disperss next to this Thiovet Jet 80 WP (Sulfur) has revealed 6.76 t/ha. No significance difference by yield advantage between Microthiol Disperss and Thiovet Jet 80 WP (Sulfur). The result implies that prevention and control of powdery mildew on tomato by fungicides are useful and increase yield and yield advantage. Microthiol Disperss is good fungicide for the management of powdery mildew on tomato production during offseason/by irrigation. The treatments applied with fungicide showed slow disease development and low damage of the crop.[3-12]

Powdery mildew progress over time

For appropriate disease development, suitable agroecology is important. The severity in the field tomatoes ranged from light to severe up to 40% [Figure 1]. There were different powdery mildew progress on treated and control plot of tomato. High progress was observed on control, while lower was obtained on treated plots by Thiovet Jet 80 WP

Table 4: Comparison of Microthiol Disperss and Thiovet Jet 80 WP (Sulfur)

Treatments	Terminal disease severity		Disease progress rate (%)	Average infection coefficient (%)
	Severity	Reaction		
Micrithiol Disperss 80%	5	R	0.63	17.6
Thiovet Jet 80 WP (Sulfur)	5	R	0.54	16.21
Control	40	S	0.85	38.8

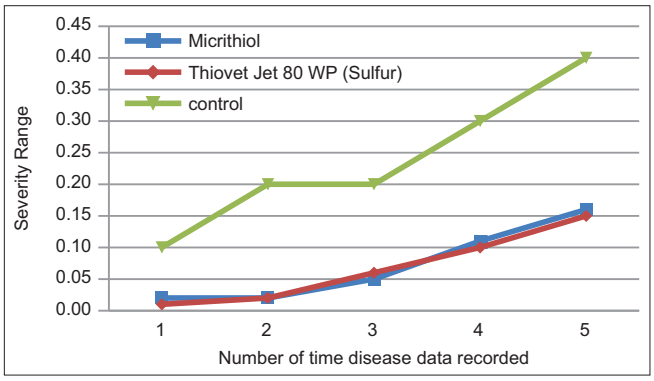

Figure 1: Powdery mildew progress on over treatments

(Sulfur) and Microthiol Disperss shown as in the Figure below.

AIC

Infection coefficient is important indicator for the occurrence of powdery mildew on tomato. The result indicated that higher AIC 38.8% was on untreated control. The lowest AIC was found on standard check Thiovet Jet 80 WP (Sulfur) about 16.21%. In similar fashion, Microthiol Disperss has revealed about 17.60% of AIC which is equally managed powdery mildew on the tested tomato [Table 3]. The result indicates that uses of appropriate fungicides for appropriate fungus at appropriate season can effectively reduce the disease.

TDS

The treatments applied with fungicide showed slow disease development and low damage of the crop. Higher TDS (40 S) has been obtained on control, while lowest TDS (5R and 5R) was obtained from Thiovet Jet 80 WP (Sulfur) and Micrithiol Disperss. Microthiol Disperss has shown optimum TDS as standard checks with no difference with the value of 5.00% and 5.00% at the center and farm, respectively [Table 4]. At the last records, both fungicides have reduced the disease by half and more. Low TDS indicates high reduction of the powdery mildew progress and the severity. So that it is important to use Microthiol Disperss as control and prevention of powdery mildew on tomato.

DPR

Logistic model was used to describing the rate of tomato powdery mildew infection. The maximum mean DPR (Infection rate = 0.85) was observed on the control. The slowest powdery mildew progress rate on tomato was found on Thiovet Jet 80 WP (Sulfur) at a rate of 3.25 kg/ha revealed (DPR = 0.54); while Microthiol Disperss has showed disease progress of (DPR = 0.63). Variation in powdery mildew infection rate due to the prevention level of the treatment was clearly showed [Table 4].

CONCLUSION AND RECOMMENDATION

Based on the result of the study obtained test product, Microthiol Disperss has showed better and effective for disease management as of Thiovet Jet 80 WP (Sulfur). Microthiol Disperss has showed effective disease management, high marketable yield, good fruit quantity, and qualities on fruit of tomato with no significant difference to that of standard check Thiovet Jet 80 WP (Sulfur) by preventing and control of Powdery Mildew (*L. taurica*) on tomato under natural field condition. Microthiol Disperss (Sulphur 80%) has gave 12.41 t/ha of yield at a rate of 2 kg/ha provided comparable yield as Thiovet Jet 80 WP (Sulfur) 16.65 t/ha with no significance difference. Microthiol Disperss has given 11 t/ha yields advantage as of Thiovet Jet 80 WP (Sulfur) is 6.67 t/ha. Therefore, Microthiol Disperss at a rate of 2 kg/ha is diluted with 400 L/ha of water is recommended to be used as alternative fungicide for prevention and control of Powdery Mildew (*L. taurica*) integrated with other environmentally safe powdery mildew management practices on tomato cultivated under

natural field condition depending disease pressure, agroecology, and susceptible variety. At early occurrence, Microthiol Disperss is the appropriate fungicide used to preventive fungicide for powdery mildew on tomato.

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