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EVALUATION OF MASCOT (METALAXYL 8% + MANCOZEB 64% WP) FOR THE PREVENTION AND CONTROL OF POWDERY MILDEW (*LEVEILLULA TAURICA*) ON TOMATO

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ABSTRACT

Tomato (*Lycopersicon esculentum Mill*) belongs to the solanaceae which is one of commercial crop produced mainly in northern and central rift valley areas of Ethiopia. It is affected by many biotic and abiotic factors especially fungal diseases mainly powdery mildew is the main challenging factor on tomato production in irrigated agriculture. Powdery mildew (*Leveillula taurica)* is a major pathogen of tomato. The experiment was conducted at Debre Zeit Agricultural Research Centre in 2020/21 using Galilae tomato variety. Mascot (Metalaxyl 8% + Mancozeb 64% WP) was used as test product and Ridomol gold 68% was used at standard check. High progress was observed on control, while lower were obtained on treated plots by Mascot (Metalaxyl 8% + Mancozeb 64% WP) and Ridomil gold 68WP. More diseased leaf number (5.70) were observed on control, conversely more healthy leaf were found from treated plots by Ridomil gold 68 WP and mascot (Metalaxyl 8% + Mancozeb 64% WP). Good yield 18 t/ha is obtained on Ridomil gold 68% WP. Good yield advantage 13.5 t/kg is obtained from Ridomil gold 68% WP and Mascot has revealed 13 t/ha. Higher AUDPC; about 395% has been obtained on control, while lowest were 165% and 170% from mascot (Metalaxyl 8% + Mancozeb 64% WP) and Ridomil gold 68% WP, respectively. Plots treated with mascot (Metalaxyl 8% + Mancozeb 64% WP) and Ridomil gold 68% WP have showed lowest TDS 4.00% and 5.00%. Variation in powdery mildew infection rate due to the prevention level of the treatment was clearly observed with this regards; fungicides appropriate for the environment need to be tested to use as alternative fungicide and reduce the fungicide resistance.

Keywords: *Tomato, fungicide, Ridomil gold 68% WP, Mascot, AUDPC, TDS*

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INTRODUCTION

Ethiopia is endowed to have a varied of agro-ecology appropriate for cultivation of different crop types (horticultural crops and cereals) for both production in main rainy and under irrigation condition. Tomato (*Solanum lycopersicon* L.) is one of the cash vegetable crops grown in different parts of the country. It is cultivated with total area coverage of 6,433.73 ha with a total yield of 6.52 t/ha in Ethiopia (CSA, 2020/21). The yield potential is still lower when compared to global production. Low productivity is forced by different biotic and abiotic factors. Among biotic factors fungal diseases such as powdery mildew at dry season is one of challenging factor.Powdery mildew diseases affect cultivated tomato. *Leveillula taurica* has been known for many years as a tomato pathogen (La Mondia, et al., 1999). This fungus causes disease on a number of tomato cultivars at growth stages ranging from seedling to mature plant in the greenhouse and the field. The host range of the pathogen is broad and it is reported to attack over 60 species in 13 plant families, particularly members of the families *Solanaceae* and *Cucurbitaceae* (Huang, et al., 2000; Jones et al., 2001). Eastern black nightshade (*Solanum ptycanthum*), eggplant, tobacco, and potato have also been infected by this fungus in the greenhouse (Palti, 1988). A worldwide study confirmed that Oidium species causes economic damage on tomato. Yield and quality of fruit is affected by powdery mildew since the disease develops quickly and severely affects the leaves are killed. Powdery mildew on tomato grows in less humidity to infect leaves. The pathogen has ability to quickly produce a lot of spores/ powdery mildew diseases can develop rapidly. While moisture is not required, tomato powdery mildew develops best when the air is somewhat humid, but not above 95% RH. Main management practices for powdery mildews are selecting resistant or less susceptible varieties and applying fungicides. The objective of the trial is to find Mascot (Metalaxyl 8% + Mancozeb 64% WP) as one of fungicide for the management of powdery mildew on tomato. [1-5]

MATERIALS AND METHODS

The experiment was conducted at Debre Zeit Agricultural Research Centre in 2020/21 using hybrid seeded of Galilae tomato variety. The field was replicated three times. The plot size was 70 cm between ridges, 50 cm between plants. The test product was Mascot (Metalaxyl 8% + Mancozeb 64% WP). The test product was applied 3 kg per hectare of land in tomato production area. Agronomic practices such as hoeing, weeding, heaping and other management practices were applied as per the recommendation. Experimental plot was thoroughly plowed and leveled. Ridges were prepared carefully then the plot has the size of 2m, and 1m between width, length each and path with total area plot of $4m^2$. The spacing between plants and rows were having 0.5m and 0.7m, respectively.

Field Management:

Inorganic fertilizers as DAP and UREA were applied at the 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 was one and half months after transplanting. Recommended field management practices such as weeding, hoeing, fertilization, and cultivation was performed. Ridomil Gold Mz 68 WP (3kg/ha) was sprayed on all plots uniformly for the control powdery mildew.

Disease Assessments

For disease occurrence, natural infestation was allowed upon in all experimental plots. Disease severity was assessed on 10 randomly selected and tagged plants. Powdery Mildew **(***Leveillula taurica***)** disease was scored in 0-5 scales and converted to severity percentage in accordance with the leaf area affected, which is proposed by (Ullasa *et al.*,1981) of which: 0: Resistant (no symptoms), 1: Moderately resistant (10% of the leaf area affected), 2: Moderately susceptible (11-

20% of the leaf area affected), 3: Susceptible (21-50% of the leaf area affected), 4: Highly susceptible (51% or more of the leaf area affected infection) and 5: the entire plant defoliation. Then, the rating scales were converted into percentage severity index (PSI) for the analysis of disease severity using the following formula: Percentage severity index: (sum of individual numerical rating)/ (total numbers of assessed maximum scoring scale). Area under the disease progress curve (AUDPC) and growth curve models were developed for the disease progress data. It was assessed from the test plants and the average was recorded for the respective plant.

Agronomic data's:
The agronomic data were collected from 10 sample plants from each plot. Data's such as diseased leaf count (cm) healthy leaf number (cm), individual fruit weight (gm), Fruit diameter (mm), and Yield components such as marketable and Unmarketable yield were measured as the pathogen severely affects the older leaf at the base of the plants. 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. Hence, data collected on the standard check, Mascot (Metalaxyl 8% + Mancozeb 64% WP) treated and control plot was expected to verify the efficacy of SC for the prevention of Powdery Mildew **(***Leveillula taurica***)** and its effect on tomato yield. Data on disease parameters such as terminal disease severity, Area under Disease Pressure Curve (AUDPC), DPR and yield were subjected for analysis. [6-8]

RESULT

Powdery mildew progress over time
The severity in the field tomatoes ranged from light to severe (up to 90% of foliage affected in nearly 100% of plants). The effects on yield were not determined. Symptoms included white superficial mycelium on leaves and stems, often with yellow margins, followed by desiccation, necrosis, and defoliation. High progress was observed on control, while lower were obtained on treated plots by Ridomil gold 68 %WP and Mascot (Metalaxyl 8% + Mancozeb 64% WP) shown as in the figure-1 below.

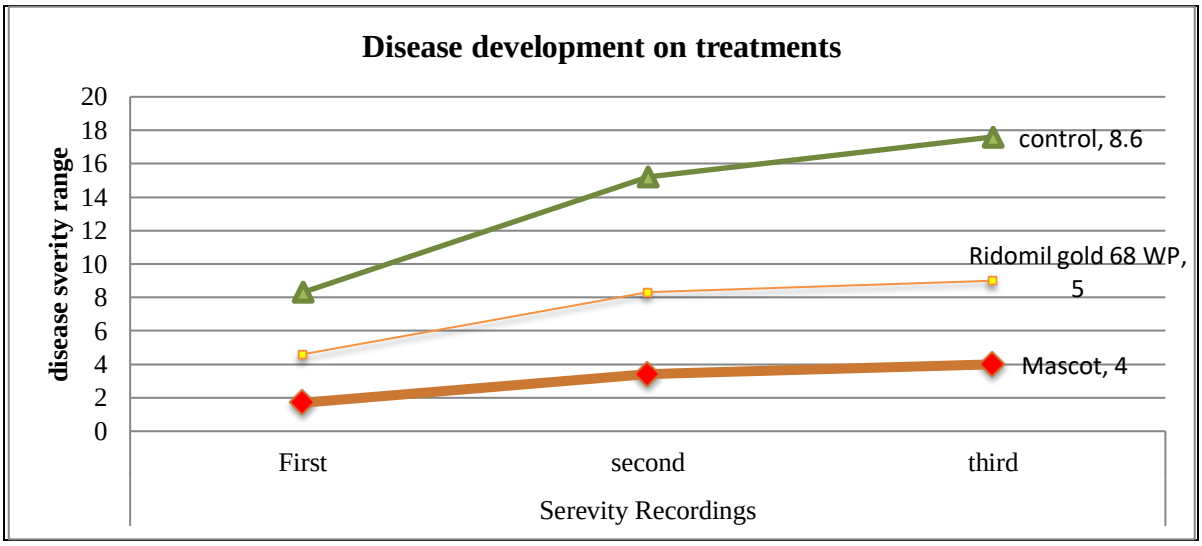

Figure -1: Powdery mildew progress on different treatments

Number of Diseased Leaf
From the disease score at before the application of the fungicide each plot was showed the similar disease pressure, but post application of the plots treated with fungicide showed different tolerance ability to the disease. Among the test fungicides; more diseased leaf number (5.70)

were observed on control, conversely more healthy leaf were found from treated plots by Ridomil gold 68% WP and mascot (Metalaxyl 8% + Mancozeb 64% WP. There is no significance difference between Ridomil gold 68% WP and Mascot (Metalaxyl 8% + Mancozeb 64% WP).

Healthy Leaf Number

The test product mascot (Metalaxyl 8% + Mancozeb 64% WP) applied at a rate of 3kg has no showed significance difference compared to Ridomil gold 72 WP at a rate of 3 $kgha^{-1}$ based on healthy leaf number with the same value as 5.29 leaves. From the other recorded data; less healthy leaf number (no.) 3.10 leaves have been obtained from control. More healthy leaves point to the plants is not affected by the pathogen and the fungicide has prevented the disease by appropriate fungicide.

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

Treatments	Diseased leaf (no.)	Healthy leaf(no.)	Fruit weight (gm)	Fruit diameter (mm)
Mascot (Metalaxyl 8% + Mancozeb 64% WP)	3.29	5.29	131.67	6.01
Ridomil gold 68% WP	3.40	5.29	144.71	5.48
control	5.7 0	3.10	103.43	4.23
CV (%)	**1.37**	**1.24**	**21.85**	**0.4**

Individual Fruit Weighty (gm)

Regarding quality parameters; Fruit weight (gm) is important characters and factors. Heavy Fruit weight (gm) was found on plots treated with fungicides. Less fruit heaviness was found on control (103.43gm). There was no significant differences were obtained from between Mascot and Ridomil gold 68% WP on fruit weight (Table 1).

Fruit diameter (mm)

From the experiment large fruit diameter (mm) 6.01 mm is obtained from the treatments at Mascot (Metalaxyl 8% + Mancozeb 64% WP) wile, smaller fruit diameter 4.23 is found on control. There are significant differences between treated and untreated plots based on their fungicide application. Ridomil gold 68% WP applied at a rate of 3kg/ha has revealed 5.48 fruit diameter which doesn't have significance variation compared to Mascot (Metalaxyl 8% + Mancozeb 64% WP) (Table 1). This indicates fruit diameter is increased by application of fungicides when for tomato production.

Unmarketable yield (kg)

Poor quality is always leads for yield loss. Unmarketable yield (kg) increases yield loss which may be faced by different factors such as insect, bacteria, fungus and mechanical damage. Powdery mildew coincided with other bacterial, fungal and insects caused crop damage. Insects especially Tuta absoluta and Powdery mildew always coincide at offseason/irrigation. Comparable lower yield loss 40 kg is obtained on mascot (Metalaxyl 8% + Mancozeb 64% WP); while more unmarketable yield (kg) is obtained on control 155 kg per hectare of land. There were no significance differences between Ridomil gold 68% WP and Mascot by comparison of unmarketable yield (kg). Standard check Ridomil gold 68% WP revealed 60 kg/ha of unmarketable yield (kg).

Marketable Yield (kg)

Marketable yield provides for yield advantage. Good yield 18 t/ha is obtained on Ridomil gold 68 WP; conversely lower yield 5 t/ha is obtained from control. There were significant differences were obtained among treatments, but there were no differences between Ridomil gold 68 WP and Mascot (Table 2).

Table 2: Mean powdery mildew on yield of tomato at DZARC both locations

Treatments	Unmarketable yield (kg)	Marketable Yield (t/ha)	Yield advantage (kg)
Mascot (Metalaxyl 8% + Mancozeb 64% WP)	40	18	13
Ridomil gold 68% WP	60	18.5	13.5
control	155	5	0
CV (%)	**115.9**	**7.65**	2.64

Yield advantage (kg)

From the experiment good yield advantage 13.5 t/ka is obtained from Ridomil gold 68% WP next to this Mascot has revealed 13 t/ha. No significance difference by yield advantage between Ridomil gold 68% WP and Mascot (Metalaxyl 8% + Mancozeb 64% WP). The result implies that prevention and control of powdery mildew on tomato by fungicides is useful and increases yield and yield advantage. Mascot (Metalaxyl 8% + Mancozeb 64% WP) is good fungicide for the management of powdery mildew on tomato production during offseason/by irrigation.

Area Under Disease Progress Curve (AUDPC) %

Similarly, Higher AUDPC (395%) has been obtained on control, while lower **AUDPC** were obtained from mascot (Metalaxyl 8% + Mancozeb 64% WP) and Ridomil gold 68% WP with the value of 165% and 170% at both locations. The treated plots mascot (Metalaxyl 8% + Mancozeb 64% WP) and Ridomil gold 68% WP has greatly reduced the disease. Lowest AUDPC indicates the plot is resistant to the disease or fungicide has reduced the disease pressure and be used for fungal disease management.

Terminal Disease Severity (TDS)

The treatments applied with fungicide showed slow disease development with lowest TDS (4.00% and 5.00%) were obtained from Mascot (Metalaxyl 8% + Mancozeb 64% WP) and Ridomil gold 68 WP; while higher terminal disease severity (8.60%) has been obtained on control, while Mascot (Metalaxyl 8% + Mancozeb 64% WP) has shown optimum TDS as standard checks with no significant difference with the value of 4.00% and 5.00% at the center and farm, respectively (table 4). Among the treatments Mascot (Metalaxyl 8% + Mancozeb 64% WP) has greatly reduced the disease than others. At the last records both fungicides has reduced the disease by half and more.

Disease Progress Rate (DPR)

Logistic model was used to describing the rate of stem rust infection. The maximum mean disease progress rate (Infection rate=0.45) was observed on the control. The lowest leaf rust progress rate on tomato was found on Ridomil gold 68 WP at a rate of 3.00 L/ha revealed (DPR=0.28). Variation in powdery mildew infection rate due to the prevention level of the treatment was clearly observed (Table 3). There were significant differences between treatments.

Table 3: Comparison of Mascot and Ridomil gold 68 WP for their powdery mildew suppression

Treatments	AUDPC	TDS	DPR
Mascot (Metalaxyl 8% + Mancozeb 64% WP)	165	4.00	0.44
Ridomil gold 68 WP	170	5.00	0.28
control	395	8.60	0.45
CV (%)	**131**	**2.42**	**0.09**

CONCLUSION

Based on the result, Mascot (Metalaxyl 8% + Mancozeb 64% WP) has showed effective disease powdery mildew management, marketable yield, fruit yield and qualities on fruit of tomato with no significant difference with Ridomil gold 68% WP by preventing and control of Powdery Mildew (*Leveillula taurica*) on tomato under natural field condition. Based on the yield (18 t/ha) obtained (Metalaxyl 8% + Mancozeb 64% WP) at a rate of $3kgha^{-1}$. Mascot (Metalaxyl 8% + Mancozeb 64% WP) contains metalaxyl which is systemic compound which used for the control of both systemic and localized diseases. Therefore, mascot (Metalaxyl 8% + Mancozeb 64% WP) at a rate of 3 $kgha^{-1}$ is recommended to be used management of Powdery Mildew (*Leveillula taurica* integrated disease with other practices on tomato under natural field condition depending disease pressure, agro-ecology and susceptible variety. The treated experiment with fungicide showed slow disease development and low damage of the crop. Sometimes powdery mildew on tomato; occurs early during the first three weeks post planting; so that mascot (Metalaxyl 8% + Mancozeb 64% WP) is the appropriate fungicide used to control the disease.

REFERENCES

1. Cerkauskas, R. F., and Brown, J. (2015). Aspects of the epidemiology and control of powdery mildew (Oidium neolycopersici) on tomato in Ontario, Canada. Can., *J. Plant Pathol.* 37, 448-464
2. CSA, 2020/21. Sample survey report on area and production of major crops (private peasant holdings, Meher season). Volume (I). ADDIS ABABA, April, 2021. 590 STATISTICAL Bulletin (590).
3. Ha, T.M., 2015. Agronomic requirements and production methods of tomatoes in the red river delta of Vietnam. *Journal of Tropical Crop Science*, 2(1); pp.33-38.
4. Huang, C., Biesheuvel, J., Lindhout, P., and Niks, R. E. 2000. Host range of Oidium lycopersici occurring in the Netherlands. Eur. J. Plant Pathol. 106:465-473.
5. Jones, H., Whipps, J. M., and Gurr, S. J. 2001. The tomato powdery mildew fungus Oidium neolycopersici. Mol. Plant Pathol. 2:303-309.
6. La Mondia, J. A., Smith, V. L., and Douglas, S. M. 1999. Host range of Oidium lycopersicum on selected Solanaceous species in Connecticut. Plant Dis. 83:341-344.
7. Palti, J., 1988. The *Leveillula* mildews. *Bot. Rev.* 54, 423–535. Doi: 10.1007/BF02858418
8. Ullasa, B.A., R.D. Rawal, D.P. Singh, M.C. Joshi, 1981. Reaction of sweet pepper genotypes to anthracnose, Cercospora leaf spot and powdery mildew. Plant Disease, 65, 600–605.