Efficacy of certain chemical Fungicides and Biofungicides on early blight disease in tomato under field conditions.

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ABSTRACT

Field experiments were conducted in a private farm in Ashmon district, Menoufia Government to evaluate the efficacy of four chemical fungicides and two biofungicides against tomato early blight disease under field conditions during the two consecutive seasons (2018-2019 and 2019-2020). The tested fungicides were, Amistar 25% SC (azoxystrobin), Anadol 80% WP (mancozeb), Ridomil Gold MZ 68% WP (metalaxyl M – mancozeb) and Score 25% SC (difenoconazole) at two rates each (25 and 50 cm^3, 125 and 250 gm, 100 and 200 gm and 25 and 50 cm^3 , $100L^{-1}$, respectively) and the two biofungicides were (Bio Arc 6% WP (*Bacillus megaterium*), and Plant guard (30 million cell ml^{-1}) (*Trichoderma harzianum*) at two rates each (125 and 250 gm, $100L^{-1}$, respectively). Each chemical fungicide and biofungicide was applied at recommended and half recommended rates as foliar spraying 3 times $season^{-1}$. The results clearly indicated that, chemical fungicides were significantly more effective than the biofungicides, and all the tested compounds particularly Score, 25%, SC Amistar 25% SC and Ridomil Gold MZ 68% WP significantly reduced incidence and severity of early blight disease in tomato and subsequently increase a tomato fruit yields in comparison with the untreated control. Also, Plant guard was more effective than Bio Arc. Regardless the examined fungicide, and as expected, the higher rate of application higher reduction of the tomato early blight disease, and subsequently higher fruit yield.

Key words: tomato, early blight disease, fungicides, biofungicides.

INTRODUCTION

Tomato (*Lycopersicon esculentum* L.= *Solanum lycopersicon* Mill) is the second most important remunerable solanaceous vegetable crop after potato (Haggag, Karima, and Farghaly, Sayeda, 2007; Gondal1 *et al*., 2012; Sahu *et al*., 2013; Dhal *et al*., 2015 and Rahmatzai *et al*., 2017). In Egypt, tomato is one of the most important solanaceous crops either for local consumption and exportation (Haggag,Karima and Farghaly Sayeda, 2007 and Ashour, 2009). Tomato is one of the most important vegetable crops cultivated for its fleshy fruits, it is considered as important commercial and dietary vegetable crop. Tomato is a rich source of minerals, vitamins and organic acid, essential amino acids, dietary fibers, and Vitamin A and C, it contains minerals like iron, phosphorus, and tomato also contains lycopene and Beta-carotene pigments. (Beecher, 1998; Giovannucci, 1999; FAO, 2003; Wilcox *et al*., 2003; Sgherri et al., 2008; Borguini and Torres, 2009 and Olaniyi *et al*., 2010). The total cultivated area of tomato in Egypt in 2018 amounted to 185,211 feddans that yielded 3,268,740 tons (Anonymous, 2018).

Tomato crop is vulnerable to infect by bacterial, viral, nematode and fungal diseases (Yashwant *et al*., 2017). Among the fungal diseases, Alternaria leaf blight of tomato caused by *Alternaria solani* is the worst damaging one that causes reduction in quantity and quality of the tomato crop (Abdel-Sayed, 2006 and Abada *et al*., 2008). *Alternaria solani* is a soil inhabiting air-borne pathogen responsible for leaf blight, collar and fruit rot of tomato disseminated by fungal spores (Datar and Mayee, 1981 and Abada *et al*., 2008). Alternaria leaf blight is an important disease of tropical and sub-tropical areas (Yashwant *et al*., 2017). *Alternaria solani* usually infect solanaceous crops including potato, tomato, eggplant and pepper (Carneiro *et al*., 2010).This fungus causes infection on leaves, stem, petiole, twig and fruits as well as leads to the defoliation, drying of twigs and premature fruit drop which ultimately reduce the yield 30 to 65 % in various states (Basu, 1974; Datar and Mayee, 1981; Kamble *et al*., 2009; Saha and Das, 2013). The disease, if favored by high temperature and humidity (crowded plantation, high rainfall and extended period of leaf wetness from dew) and plants are more susceptible to the blight infection during fruiting period (Momel and Pemezny, 2006). The pathogen causes infection on leaves, stems, petioles, twigs and fruits as well as leads to the reduction of photosynthetic area, defoliation, drying of twigs premature fruit drop which ultimately reduce the yield.

Therefore, management strategies for tomato early blight disease caused by *A. solani* depended mainly application of fungicides.

Several studies have confirmed the effectiveness of fungicides for the control of this disease on tomato crop. They concluded that the use of fungicides as protective / systemic fungicides can significantly reduce disease levels and increased tomato yield in treated versus untreated plots (Dual *et al*., 2015; Sarkar *et al*. 2016; Yashwant *et al*., 2017; Sharma *et al*., 2018 and Sreenivasulu *et al*., 2019). Also, the use of biological agents (BCAs) to control pathogenic fungi is an attractive possibility. Such approaches represent an important component of plant disease management practices. Several researchers indicated the efficacy of bio control agents (BCAs) in controlling *A. solani* (Shalini and Dohroo, 2005; Sendhilvel *et al*., 2005; Harman, 2006;Muriungi *et al*., 2013;Abdalla *et al*., 2014; Sadana and Didwania,, 2016; Singh *et al*., 2018 and Verma *et al*., 2018).

The objective of this study is to evaluate the fungicidal activity of four chemical and two biofungicides against early blight disease on tomato crop under filed condition in relation to the tomato crop yield.

MATERIALS AND METHODS

The field studies were carried out during the two consecutive seasons (2018-2019 and 2019-2020) in a private farm at Ashmon district, Menofyia Governorate, to evaluate the effect of four fungicides and two biofungicides at two rates of application (Table, 1) on early blight disease (incidence and severity) of tomato plants. Seeds of cv. Salymia 65010, supplied by the Vegetable Research Center, Ministry of Agricultural and Land Reclamation, were grown in 22 – 8- 2018 and 27 - 8 - 2019, in the two tested seasons respectively, under field conditions. The recommended cultural practices for tomato production were adopted throughout growing seasons in this district. The experiments were performed under natural infections with early blight disease. Also, the field trial was conducted to investigate the effects of these treatments on the increment of tomato yield during the two tested seasons. A 5-week-old seedlings of tomato were transplanted within the double row, 1.5m, which was spaced approximately 50 cm apart in the field. The experiments were designed as a randomized complete block design (RCBD) with three replicates for each treatment. The area of each plot was 21 m^2 (3 × 7m.). The replicates were sprayed with the tested fungicides and bioagents, for three times with 15 days intervals during the plant growth season. The first application time was applied 15 days after transplanting (Sameer, 2008).

Disease assessment:

Disease assessed during period of tuber maturation after 7 days from last treatment and 72 days from sowing. Early blight incidence was estimated as the number of infected plants showing disease symptoms in relation to the whole number of tomato plants. The average of records of the surveyed replicates for each particular treatment was calculated. The disease severity was assessed using 0-5 disease rating scales given by Mayee and Datar (1986) as mentioned below:

0 = No symptoms on the leaf

1 = 0-5 per cent leaf area infected and covered by spot.

2 = 6-20 per cent leaf area infected and covered by spot.

3 = 21-40 per cent leaf area infected and covered by spot.

4 = 41-70 per cent leaf area infected and covered by spot.

5= >71 per cent leaf area infected and covered by spot.

Five infected plants were selected randomly from each plot and five leaves were selected from each selected plant for scoring the disease intensity and finally the Percent disease index (PDI) was calculated by the following formula (Sarkar *et al*., 2016).

PDI= Sum of all numerical ratings/ Total no. of leaves observed Maximum scale **X**100

Final results were calculated as follow:-

Incidence =25 leaves / 5 plants / each replicate. (Sarkar *et al*., 2016).

Disease severity (Percent Disease Index) (Sarkar *et al*., 2016).

Fruit yield (Kg plot $^{-1}$) after 120 (DAS)

YOC% = T - C / T× 100

Where:

T = Treatment. C = Control.

Statistical analysis:

All data in the present studies were analyzed with the analysis of variance (ANOVA) and means were separated with the least significant differences (LSD) test at *p= 0.01* and *p= 0.05* according to Gomez and Gomez, 1984.

RESULTS AND DISCUSSION

Effect of treatments on disease incidence:

The data presented in (Table, 2) showed the effect of treatments on disease incidence of early blight disease in tomato plants in both seasons (2018-2019 and 2019-2020). Generally, all the tested compounds at the two rates of application significantly (*P= 0.05*) reduced the disease incidence of early blight disease in tomato plants compared with the untreated control. Also, the chemical treatments were significantly better than the biological treatments. This is true in both seasons. Among the tested fungicides, Score 25% SC and Amistar 25% SC were the most effective fungicides, while Bio Arc 6% WP and Plant guard were the least effective. The remaining fungicides showed an intermediate effect. For example, Score 25% SC and Ridomil Gold MZ 68% WP, at recommended rate (50ml and 200 gm $100L^{-1}$, respectively) during the 1st season reduced the disease incidence of tomato plants to 1.33 and 2.67 leaves, respectively, while that of Bio Arc 6% WP was 9.33 leaves. 1n the second seasons, Score, 25% SC, Amistar 25% SC and Ridomil Gold MZ 68% WP gave the best results compared with the other treatments (Table, 2).

Generally, the recommended rate of fungicides or biofungicides significantly *(P= 0.05)* reduced the disease incidence compared with half-rates. For example, Amistar 25% SC, at (25ml and 50 ml $100L^{-1}$, respectively) during the 1st season reduced the disease incidence of tomato plants from 4.33 to 2.00 respectively. These results were true during the two tested seasons.

Effect of treatments on disease severity:

The data presented in (Table, 3) showed the effect of treatments on disease severity of early blight disease in tomato plants in both seasons. In general, all treatments, at each rate of applications, in first or in second seasons significantly *(P= 0.05)* reduced the disease severity comparing with the untreated control.

The chemical fungicides were more effective than biofungicides in both seasons. Among the tested fungicides, Score 25% SC and Amistar 25% SC were the most effective fungicides, while Bio Arc 6% WP and Plant guard were the least effective. For example, Amistar 25% SC and Ridomil Gold MZ 68% WP at the recommended rates (50ml and 200 gm $100L^{-1}$, respectively) during the 2nd season reduced the disease severity of tomato plants to 3.47 and 4.53 leaves, respectively, while that of Plant guard at recommended rates (250 gm $100L^{-1}$) was 15.20 leaves. When the rate of application increased, the reduction percent in disease severity was increased. Effect of treatments varied between years and this may be due the environmental conditions.

Regarding the examined rates of fungicides or biofungicides and as expected, recommended rates significantly (*P = 0.05*) reduced the disease severity compared with half-rate. For example, Anadol 80% WP at (125ml and 250 gm $100L^{-1}$, respectively) during the 2nd season reduced the disease severity of tomato plants from 13.33 to 9.07 respectively. These results were true during the two tested seasons. Amistar 25% SC, Score 25% SC, Anadol 80% WP, Ridomil Gold MZ 68% WP, Bio Arc 6% WP and Plant guard at the recommended rates (high rate) reduced the disease severity to 4.00, 2.13, 8.00, 5.60, 17.3 and 16.53 % on tomato leaves, respectively, in the first season and to 3.47, 2.67, 9.07, 4.53, 15.73 and 15.20% on tomato leaves, respectively, in the second season.

The results of the present study on effect of the tested fungicides and biofungicides on disease incidence and disease severity of early blight disease on tomato plants are consistent with those described by several authors. Arreaza and Hernandez (2001) reported low level of leaf damage due to early blight of tomato when sprayed with azoxystrobin in comparison with mancozeb. Kapsa and Osowski, (2003) reported that two sprays of Mancozeb 0.5 per cent or Propiconazole 0.05 per cent were most effective for reducing the early blight of tomato under field condition. Parvez *et al*., (2003) reported that the recommended doses (200- 250 gm acre $^{-1}$) of five protectant and eradicant fungicides viz Banko (chlorothalonil) 500 SC, Score (difenoconazole) 250 EC, Acrobat MZ 600 WP, metalaxyl+mancozeb 72 WP and Ridomil Gold (mancozeb+metalaxyl) 68 WP were tested against early and late blight disease development. All the fungicides significantly reduced disease severity comparing with to untreated control. Kumar *et al*. (2007) reported that hexaconazole (0.05%) and azoxystrobin (0.2%) were very effective in managing early blight of tomato. Ashour (2009) indicated that under greenhouse experiments, Score was the most effective fungicide against early blight disease, followed by Flint. Also, the same trend was observed in the field experiments. These results are `in a harmony with those recorded by many researchers (Singh *et al*., 2000; Gomaa, 2001; Patil *et al*., 2001, and Abdel-Sayed, 2006).

Sameer (2008) evaluated the effects of fungicide and bioagents, at their recommended and half recommended rates, for controlling naturally early blight disease caused by *Alternaria solani*. Results indicated that spraying tomato plants with fungicides and bioagents greatly decreased the disease severity. The decrease in disease severity by using half recommended rates of fungicides and bio agents was lower than their recommended rates. The tested fungicides were more efficient to control early blight than bioagents. Pyraclostrobin + metiram seemed to be the most effective fungicide followed by difenoconazole, trifloxystrobin, tetraconazole and later metiram and mancozeb. Also, *Trichoderma harzianum* seemed to be the most effective bioagents followed by *Trichoderma album* and *Bacillus subtilis*. Zghair *et al*. (2014) mentioned that the bio agents *Trichoderma harzianum* and *Pseudomonas fluorescens* were effective in reducing the tomato early blight disease intensity.

Kumar *et al*. (2017) evaluated the 6 fungicides (Propineb 70%), Carbendazim 75%, Difenoconazole 25%, Metiram 70%, Clorothalonil 75% and Pyraclostrobin 20% against *A. solani* . They found that the highest efficacy of score was recorded when sprayed at 0.05 per cent concentration with disease severity of 16.33 per cent and disease control of 74.89 per cent followed by carbendazim fungicide (18.00%, 72.30%) when compared with control while the least efficacy was observed with the fungicides kavach (33.67%, 48.22%) and insignia (26.00%, 60.00%).

Effect of treatments on tomato fruit yield:

The data in Table (4) showed effect of treatments on tomato fruit yield at harvest during the two tested seasons (2018-2019 and 2019-2020). The average tomato yield was recorded as kg plot^{-1} and yield over control (YOC %) was calculated.it seemed that fruit yield was 54.33 and 55.33 Kg Plot^{-1}, when the plants were naturally infected with *A.solani* in the two tested seasons, respectively, (untreated control). This indicated that infection of tomato with *A.solani* greatly reduced fruit yields. Fungicidal and bio fungicide treatments improved fruit yield.

These results showed that all treatments, at each rate of applications, significantly (*P = 0.05*) increased tomato fruit yield in comparison with the untreated control. Chemical fungicides were more effective than biofungicide in both seasons. Among the tested fungicides, Scor 25% SC and Amistar 25% SC were the most effective fungicides, while Bio Arc 6% WP and Plant guard were the least effective. The remaining fungicides showed an intermediate effect. For example, Amistar 25% SC and Anadol 80% WP, at recommended rates (50ml and 250 gm 100L^{-1} , respectively) during the 1nd season, increased tomato fruit yield to 155 and 119.80 Kg Plot^{-1}, respectively, while that of Bio Arc 6% WP at recommended rates (250 gm 100L^{-1}) was 90.17 Kg Plot^{-1} during the 1st season.

Generally, the recommended rates of fungicides or bio fungicide significantly *(P= 0.05)* increased tomato fruit yield compared with half-rates. For example, Ridomil Gold MZ 68% WP, at (125ml and 250 ml 100L^{-1} , respectively) during the 2st season increased tomato fruit yield from 115.40 to 142.90 Kg Plot^{-1}, respectively, These results were true during the two tested seasons. Amistar 25% SC, Score 25% SC, Anadol 80% WP, Ridomil Gold MZ 68% WP, Bio Arc 6% WP and Plant guard. at the recommended rates (high rate) reduced the disease severity to 155, 158.90, 119.80, 140.93, 90.17and 96.20 Kg Plot^{-1}, respectively, in the first season and to 154.07, 160.17, 120.20, 142.90, 91.03 and 94.47% Kg Plot^{-1}, respectively, in the second season. It can be concluded that most of the fungicides and bioagents used gave good control of early blight disease in tomato which ultimately gave better than the control.

This finding is in agreement with those obtained by other authors. Anand *et al*. (2010) tested that spraying of azoxystrobin at various doses viz., 31.25, 62.50 and 125 gm a.i. ha-1 revealed that 125 gm a.i. ha-1 (500 ml ha-1) recorded only 3.90 and 4.86 per cent disease index (PDI) of leaf blight and 0.00 and 2.42 PDI of leaf spot and the same treatment also recorded the higher yield of 27.60 and 26.30 tonnes ha-1 in the first and second season, respectively. Dual *et al*. (2015) evaluated the efficacy of nine fungicides difenconazole, metalaxyl + mancozeb, propiconazole, penconazole, hexaconazole, thiophanate methyl, propineb, chlorothalonil and carbendazim + mancozeb were studied for the management of Alternaria leaf blight disease of tomato. Spraying with difenoconazole, Carbendazim, chlorothalonil and thiophanate methyl in their respective concentrations proved effective by recording minimum disease incidence i.e PDI of 3.3, 6.3, 6.9 and 10.4 respectively. Spraying with Difenoconazole (0.15%) recorded maximum marketable fruit yield of 381.7 q/ha and minimum rotted fruits (7.4 q/ha). Sharma *et al*.

(2018) evaluated the efficacy of some fungicides carbendazim 12 % + mancozeb 63 % WP, difenoconazole 25 EC, propiconazole 25 EC along with commonly used fungicides viz., mancozeb 75 WP, propineb 70 WP and copper-oxy-chloride 50 % WP were tested against early blight of tomato. All fungicide treatments reduce the disease intensity as compared to untreated check. The lowest percent disease intensity (PDI) was observed in carbendazim 12 % + mancozeb 63 % WP (18.77) followed by difenoconazole 25 EC (20.59) and propiconazole 25 EC % (21.52) treatments. Similarly, the highest yield of tomato fruits was recorded with carbendazim 12 % + mancozeb 63 % WP (35257 kg ha^{-1}) followed by propiconazole 25 EC (32328 kg ha^{-1}) and difenoconazole 25 EC (32202 kg ha^{-1}) when sprayed three times at an interval of 15 days starting from the initiation of the disease.

Maximum fruit yield was obtained from the plots treated with Score 25% SC (158.90 Kg plot $^{-1}$), Amistar 25% SC (155,00 Kg plot $^{-1}$), and Ridomil Gold MZ 68% WP (140.93 Kg plot $^{-1}$), at the high rates (50 cm^3, 50 cm^3, and 200 gm per 100 L water , respectively) in the first season. While the lowest fruit (54,33 Kg plot $^{-1}$) was obtained from untreated control plots. In the first season, the same trend of results was also observed in the second season. The high efficacy of fungicides in this study may be due to these fungicides reduced incidence and severity of the pathogen and affected the spore germination and mycelia development, which may have results in the inhibition of disease producing activity of the pathogen (*A. solani*)in the tomato plants (Chourasia, *et al.,* 2013). Also, (Hooda, *et al.,* 2008 and Prasad, and Naik, 2003) reported that mancozeb was the most effective fungicide early blight of tomato. Also, (Anand, *et al.,* 2010) found that azoxystrobin is an effective fungicide for controlling early blight and leaf spot diseases of tomato.

CONCLUSION

We concluded that the fungicides (Score 25% SC, Amistar, 25% SC and Ridomil Gold MZ 68% WP) were the most effective in controlling tomato early blight disease than other tested fungicides and increased the tomato fruit yield. Also, chemical fungicides were more effective than biofungicides, and Plant guard was more effective than Bio Arc 6% WP. These results supported the view that fungicidal treatments are essential for controlling the tomato early blight disease under field conditions.

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Table 1: The used compounds.

	Trade names	Common names	Concentrations and formulations	Sources	*Rate of application (gm or ml 100L^{-1})
1	Anadol	Mancozeb	80% WP	El Helb Company.	250 - 125 gm.
2	Amistar	Azoxystrobin	25% SC	Syngenta Company	50 – 25 cm3
3	Ridomil Gold MZ	Metalaxyl M – mancozeb	68% WP	Syngenta Company	200 – 100 gm.
4	Score	Difenoconazole	25% SC	Syngenta Company	50 – 25 cm3
5	Bio Arc	*Bacillus megaterium*	2.5% WP	Organic Company for Biotechnology.	250 – 125 gm.
6	Plant Guard	*Trichoderma harzianum*	30×10^{6} spores/ mL^{-1}	Biotech Company for Fertilizers and Biocides.	250 – 125 gm.

*According to the Recommendations of Ministry of Agriculture and Land Reclamation (2018), Agriculture pesticide committee (APC).

Table 2: Effect of treatments on early blight disease incidence on tomato (c.v. Salymia 65010) grown under field conditions.

Treatments	Rates of application (gm or ml 100L^{-1})	No.of infected leaves (incidence)*			
		Seasons 2018-2019		Seasons 2019-2020	
		Mean	Reduction%	Mean	Reduction%
Azoxystrobin	25 cm^3	4.33	77.59	3.67	79.61
(Amistar 25% SC)	50 cm^3	2.00	89.65	1.67	90.72
Difenoconazole	25 cm^3	3.33	82.77	3.67	79.61
(Score 25% SC)	50 cm^3	1.33	93.11	1.33	92.61
Mancozeb	125 gm	7.33	62.07	9.33	48.16
(Anadol 80% WP)	250 gm	5.00	74.13	5.33	70.38
Metalaxyl M –mancozeb	100 gm	4.67	75.84	6.33	64.83
(Ridomil Gold MZ 68% WP)	200 gm	2.67	86.18	2.33	87.05
Bacillus megaterium	125 gm	12.00	37.92	12.33	31.50
(Bio Arc 2.5% WP)	250 gm	9.33	51.73	9.00	50.00
Trichoderma harzianum	125 gm	11.33	41.38	11.33	37.05
Plant Guard30×10^6 spores/ mL^{-1}	250 gm	9.00	53.44	7.67	57.38
Untreated control	------	19.33	------	18.00	------

*No. of infected leaves (incidence) = these numbers resulted from 25 leaves collected randomly from 5 plants in each replicate.

L.S.D at	1 %	5 %	1 %	5 %
Treatments (T.)	1.92	1.42	1.32	0.98
Rates (R.)	1.02	0.76	0.70	0.52
T.×R.	2.71	2.01	1.87	1.38

Table 3: Effect of treatments on the early blight (Disease severity) on tomato (c.v. Salymia 65010) grown under field conditions.

Treatments	Rates of application (gm or ml 100L^{-1})	Disease severity*			
		Seasons 2018-2019		Seasons 2019-2020	
		Mean	Reduction%	Mean	Reduction%
Azoxystrobin	25 cm^3	7.20	84.91	6.67	83.86
(Amistar 25% SC)	50 cm^3	4.00	91.61	3.47	91.60
Difenoconazole	25 cm^3	6.40	86.59	5.87	85.79
(Score 25% SC)	50 cm^3	2.13	95.53	2.67	93.53
Mancozeb	125 gm.	13.07	72.61	13.33	67.74
(Anadol 80% WP)	250 gm.	8.00	83.23	9.07	78.05
Metalaxyl M –mancozeb	100 gm.	9.07	80.99	8.53	79.36
(Ridomil Gold MZ 68% WP)	200 gm.	5.60	88.26	4.53	89.03
Bacillus megaterium	125 gm.	22.67	52.50	24.00	41.93
(Bio Arc 2.5% WP)	250 gm.	17.33	63.69	15.73	61.94
Trichoderma harzianum	125 gm.	21.87	54.17	20.87	49.50
Plant Guard30×10^6 spores/ mL^{-1}	250 gm.	16.53	65.36	15.20	63.22
Untreated control	------	47.73	-------	41.33	-------

* Disease severity= according to (Sarkar *et al.,* 2016).

L.S.D at	1 %	5 %	1 %	5 %
Treatments (T.)	2.46	1.82	2.84	2.11
Rates (R.)	1.31	0.97	1.52	1.12
T.×R.	3.4	2.58	4.02	2.98

Table 4: Effect of treatments on the fruit yield (Kg Plot^{-1}) on tomato (c.v. Salymia 65010) grown under field conditions.

Treatments	Rates of application (gm or ml 100L^{-1})	yield weight (Kg plot^{-1})) at harvest *			
		Seasons 2018-2019		Seasons 2019-2020	
		Mean	YOC**	Mean	YOC**
Azoxystrobin	25 cm^3	123.20	55.89	121.67	54.50
(Amistar 25% SC)	50 cm^3	155.00	64.94	154.07	64.08
Difenoconazole	25 cm^3	126.30	56.92	128.63	56.97
(Score 25% SC)	50 cm^3	158.90	66.00	160.17	65.45
Mancozeb	125 gm	101.80	46.65	101.20	45.28
(Anadol 80% WP)	250 gm	119.80	54.47	120.20	53.97
Metalaxyl M –mancozeb	100 gm	113.83	52.24	115.40	51.95
(Ridomil Gold MZ 68% WP)	200 gm	140.93	61.44	142.90	61.26
Bacillus megaterium	125 gm	76.03	28.54	77.33	28.37
(Bio Arc 2.5% WP)	250 gm	90.17	39.54	91.03	39.15
Trichoderma harzianum	125 gm	83.67	35.04	83.33	33.55
Plant Guard30×10^6 spores/ mL^{-1}	250 gm	96.20	43.52	94.47	41.41
Untreated control	------	54.33	-------	55.33	------
*yield weight = average weight of all tubers in each plot (kg polt^{-1})					
** Yield over control (YOC) = Increase %					
L.S.D at		1 %	5 %	1 %	5 %
Treatments (T.)		5.96	4.41	5.35	3.96
Rates (R.)		3.18	2.36	2.86	2.12
T.×R.		8.42	6.24	7.57	5.61

فاعلية بعض مبيدات الفطريات الكيماوية والحيوية علي مرض الندوة المبكرة في الطماطم تحت الظروف الحقلية

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الملخص العربي

تم إجراء التجارب الحقلية في منطقة أشمون محافظة المنوفية بهدف تقييم فاعلية أربعة من مبيدات الفطريات الكيماوية واثنين من المواد الحيوية ضد مرض الندوة المبكرة في الطماطم تحت الظروف الحقلية خلال موسمي (2018-2019 و 2019- 2020) وكانت مبيدات الفطريات هي الأميستار 25 % SC (أزوكسيستروبين) , أنادول 80 % WP (مانكوزيب) , ريدوميل جولد ام زد 68% WP (ميتا لاكسيل +مانكوزيب) و سكور25 % SC (دايفينوكونازول) علي معدلات (25سم^3 و 50 سم^3, 125 جرام و 250 جرام , 100 جرام و 200 جرام , 25سم^3 و 50 سم^3 لكل 100 لتر ماء علي التوالي, والمركبات الحيوية هي بيو أرك 2.5 % WP (باسيليس ميجايتريوم) , بلانت جارد 30 مليون جرثومة/ مل (تريكوديرما هارزيانم) علي معدلات 125 جرام و 250 جرام, لكل 100 لتر ماء علي التوالي, جميع المبيدات المختبرة طبقة بطريقة الرش خمس مرات في الموسم بالمعدل الموصى به ونصفه.

أوضحت النتائج أن المبيدات الكيماوية كانت فعالة أكثر من المبيدات الحيوية وجميع المبيدات المستخدمة وبصفة خاصة سكور والأميستار وريدوميل جولد ام زد كانت معنوية من حيث تأثيرها علي وجود وشدة مرض الندوة المبكرة في الطماطم وقد أدي ذلك إلي زيادة محصول ثمار الطمطم عند المقارنة بالكنترول,وكان مبيد البلانت جارد أكثر فاعلية من مركب البيو أرك. عموماً قد بينت النتائج أن رش مبيدات الفطريات لمكافحة مرض الندوة المبكرة في الطماطم أمر أساسي لمكافحة المرض ويؤدي ذلك إلي زيادة محصول ثمار الطماطم.

الكلمات الاسترشادية: الطماطم, مرض الندوة المبكرة, مبيدات الفطريات, المركبات الحيوية.