

**CHEMICAL CONTROL OF SOME
TOMATO AND PEPPER DISEASES**

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Abstract

The test of eleven systemic and non-systemic fungicides was carried out in laboratory and pots. three fungicides namely Benlate, Quinolate and Rizolex-T. were used in concentrations 5,10,20,50,100,250 and 500 ppm to control growth of Fusarium oxysporum f.sp. lycopersici and Fusarium solani and eight fungicides namely polyram, Topsin M, Trimitox - forte, Nemispore, Tridex, Sandofan, Ridomil MZ and Dithane M45 were used in same concentrations to control growth of Alternaria solani.

It was found that the lethal effect of the different fungicides used increased with increase in concentration till at 500 ppm., no growth was observed and also at 250 ppm when quinolate and benlate were used.

Seeds of seven CVS. tomato were used; Castle rock, Strain B, Redstare, Super Marnumend, Super Queen, Ice and Val ice.

It was found that Strain B CV. of tomato was resistant to wilt symptoms while Ice, Redstar and Super Queen showed high susceptibility to wilt infection.

Rizolex-T. followed by Benlate showed high efficiency for many CVS. used when the effect of different fungicides on the length of root system was studied, while Quinolate gave maximum efficiency when the effect of different fungicides on length of shoot was studied.

Two CVS. of tomato Ice and Super Queen and two CVS. of pepper California wonder and Yolo wonder L. were used in planting in infested soil with 3% rate of Fusarium solani, other groups of seeds were treated with the tested fungicides at

recommended dose of each . It was found that the percentage of pre-emergence damping off was high and the maximum number of survival plants was obtained when seeds of tomato and pepper were treated with Rizolex T. and Benlate, respectively.

Two CVS. of tomato ; Castle rock and Strain B and two CVS. of pepper California wonder and Yolo wonder L. was sprayed with Alternaria solani. It was found that maximum efficiency was observed when Trimiltox forte and Sandofan were used and the efficiency in number reduction was found to be 91.26 and 91.00 respectively for Castle rock CV. but in case of Strain B CV. Sandofan followed by Tridex and Ridomil showed maximum activity reach to 95.67, 95.06 and 91.31 respectively . In case of pepper CV. Ridomil followed by Trimiltox showed maximum efficiency in reduction of spots number.

INTRODUCTION

Fungicides have been used by numerous investigators for controlling tomato diseases by several means of applications .

Kalra and Sohi (1984) observed that the systemic fungicides inhibited growth of F.oxysporum. The systemic fungicides Benomyl, Bavistin (carbendazim) and NF 44 (thiophanate-methyl) but not catixin, completely inhibited growth of F.oxysporum .

Difolatan , Dithane M-45 and Thiram reduced it considerably but Diathane Z-78 (Zineb) and Blitox (copper oxychloride) proved almost ineffective .

Kamlesh et al. (1986) concluded that Blitox 50(copper oxychloride) was the most effective for controlling Alternaria solani followed by Difolatan (coptafo) and Dithane M-45 (mancozeb) and these may be recommended, especially during the rainy season.

In field trials carried out by moeso (1991), captafol (Difolatan), chlorothalonil (Daconil) and Fentin acetate (Brestan) gave the best performance in 1981-82; while chlorothalonil (Daconil), fentin acetate + maneb(as Brema), copper oxychloride + maneb + zineb (as caprosan, copper salts + mancozeb (as Trimelttox forte) the most effective in 1982-83 .

The aim of the present study was to investigate the effect of some fungicides on growth of Fusarium oxysporum, F.solani and Alternaria solani. Efficacy of these

fungicides on damping - off and early blight on tomato and pepper plants was also studied .

Material and Methods

Isolation of the causal pathogens

the causal pathogens of tomato and pepper wilt and root rot diseases were isolated from untreated seeds and diseased stems and roots of tomato and pepper plants . The untreated tomato seed CV. money maker and untreated pepper seeds CV. California wonder were obtained from Agricultural Research Center-Ministry of Agriculture , Giza , Arab Republic of Egypt . The casual pathogen of early blight was isolated from infected tomato leaves from Ismailia Governorate.

Tomato and pepper seeds and plants showing the characteristic wilt , root rot and early blight symptoms (Dimond et al 1952, Walker , 1957) were cut into small pieces, surface sterilized , then transferred to the surface of PDA medium in petri dishes and incubated at 28. for 2-4 days .

The developed fungi were carefully transferred to PDA slants . pure cultures were obtained for each isolate using the single spore and hyphal tip (Riker and Riker , 1936) .

Chemical Control

laboratory studies - effect on linear growth

Effect of some fungicides on fungal growth of Fusarium - oxysporum , Fusarium-solani and Alternaria-solani were studied.

Eleven fungicides differing in their active ingredients as show in table (1) were evaluated in vitro using 5,10,20,50,100,250 and 500 ppm. of active ingredient for the poisoned technique using PDA medium (tohamy et al.1991) .

Four petri dishes , of each fungicide , were inoculated with the three fungi Fusarium Oxysporum , Fusarium solani and Alternaria solni , petridishes were incubated at 28,28 and 25C respectively, growth linear diameter was measured daily until the control plates were covered with fungus growth . for counting the spores,10 ml. sterilized water were added to each petri dish and spores were gently transferred using a camel brush .

b) pots experiments

1) Effect of fungicides on early blight .

Two tomato CVS (Castle rok and Strain B) and two pepper CVS (California wonder and Yolo wonder) were sown in pots 30 cm. in diameter containing (1/1) - sand-clay soil .

Five replicates in case of tomato and three replicates in case of pepper were used for every treatment . Seedlings , 21 days old , were inoculated using spore suspension (100,000 spores / ml.) of Alternaria solani .

Plants in each pot were covered with muslin covers for 24 hours fungicides at recommended dose (table 1) were sprayed after 15,30 and 45 days .

2) Effect of fungicides on damping off and root rot .

Two tomato CVS (Ice and Super Queen) and two pepper CVS (California wonder and Yolo wonder) were planted in soil infested with Fusarium solani . Pots ,30 cm. in diameter , containing (1/1) sand - clay soil , were infested with the fungus at rate of 3 % of soil weight , left for 5 days , then seeds treated with each of the 3 fungicides (table 1) , were planted with 30 seeds / pot and 5 replicates , in case of tomato CVS. and 20 seeds / pot and 3 replicates in case of pepper CVS.

percentage of pre and post emergence damping off for both tomato and pepper plants . and percentage of survival plants were calculated .

3) varietal reactions :-

seven tomato CVS. were tested for thier reaction to Fusarium wilt - seeds were planted in soil infested with the fungus F. oxysporum F.sp Iycopersici . Notes on wilt were recorded at the end of the experiment after 3 monthes .

RESULTS

Fungicides were tested in the laboratory and on potted plants.

a) Laboratory experiments

1) Effect of fungicides on growth of Fusarium SP:-

Results summarized in Fig.(1) show the effect of different concentration of the three fungicides ; Benlate, Quinolate and Rizolex-T. on the growth of Fusarium oxysporum f.sp. lycopersici, fungal growth was measured as diameter in cm. daily from the first day of incubation and until control plates were covered with growth .

It was found that Benlate and Quinolate were the most effective on fungal growth followed by Rizolex.T. Diameter of colonies gradually decreased when the concentration of the fungicide was increased from 5 to 100 ppm. , while no growth was observed at 250 and 500 ppm. in case of Benlate and Quinolate respectively.

Data in fig(2) , illustrate the effect of the different concentrations of the three fungicides on growth of Fusarium solani . It was clear that Quinolate gave maximum effect when compared with Benlate and Rizalex.T. growth gradually decreased with the increase in fungicide concentration , while no growth was observed at 250 and 500 ppm. of Quinolate , while Rizolex.T. resulted in the least effect when compared with Quinolate and Benlate .

2) Effect of fungicides on growth of A.solani.

Data obtained (fig. 3) show the effect of concentration of 8 fungicides on growth of Alternaria solnai at 25°C on solid PDA medium . Topsin at 500 ppm was the only fungicide which completely inhibited growth of the fungus .

On the other hand , Ridomil MZ58 followed by Tridex at all concentrations resulted in maximum reduction in growth of A.solani . Also , Topsin followed by Trimitox forte were effective and followed Ridomil M258 and Tridex in their effect at all concentrations . All fungicides used showed decrease in diameter of growth when concentration was increased . However Polyram , Sandofan , Nemispore and Ditnan M45 were the least effective

3) Effect of fungicides on sporulation of Fusarium Sp:-

Data illustrated (fig.4) show the effect of different fungicides concentration on number of spores / ml. of Fusarium oxysporum f. sp. lycopersici after 10 days on solid PDA medium. Number of spores /ml. decreased with the increase of fungicides concentration , Quinolate followed by Benlate were the most effective as no spores were produced at 250 and 500 ppm.

Also, results in fig (5), indicate that the three fungicides were effective at the different concentration on the number of total spores / ml. of Fusarium solani. However Quinolate was the most effective (no spores produced at 250 ppm) followed by Benlate (no spores produced at 500 ppm), while Rizolex T. was the least effective (spores produced up to 500 ppm).

Effect of fungicides on sporulation of A. solani :-

Results summarized in fig (6) show the effect of fungicides concentration on number of spores / ml. of Alternaria solani after 10 days growth on PDA medium. Topsin M was the most effective as no spores were produced at 500 ppm. It was followed by Redomil then Trimoltox which the least number of spores at 500 ppm followed by Tridex then Polyram. Reduction in number of spores may start sharp as in case of Tridex and Trimitox forte (6000 spores) at 5 ppm or gradually as Dithane M45 (8000 at 5ppm) which may be considered the least effective on spore production. In general all fungicides in their different concentration affected spore production with different degree.

Pots experiments

Effect of fungicides on early blight caused by Alternaria solani :

Data obtained (fig. 7) illustrate the effect of spraying with 8 fungicides on the number of spots on leaves of tomato CV. Castle rok inoculated with A. solani after the 3rd fungicides application. Trimoltox and Sandofan resulted in maximum efficiency as the percent age reduction of number of spots was 94.97 % followed by Ridomil MZ58 and Dithane M45 as efficiency or percentage reduction reach 91,26 and 91,00 % for the two fungicides, respectively (fig.7). Differences between treatments were highly significant. Also fig. (8) summarize results on the effect of spraying with the same 8 fungicides on the number spots on leaves of tomato CV. strain B. Sandofan followed by Tridex and Ridomil MZ58 showed maximum efficiency in which percentage of reduction in number of spots to the sprayed plant were equal and Dithane M45 showed high efficiency as percentage reduction reaches 88.27 %.

In case of pepper CV. California wonder and Yellow wonder L , Ridonil followed by Trimitox forte showed maximum percentage of reduction in number of spots compared with the other fungicides (fig. 9) .

Effect on seedling damping off :

fig.(10 & 11) show the effect of different fungicides on seedling damping off of tomato CV. Ice and Super Queen grow in soil infested with Fusarium solani from the data , it can be concluded that percentage of pre-emergence damping off was more than that of post -emergence for the two tomato CVS. Also , the least percentage of damping off and the highest percentage survival plants was observed when seeds of the tomato CVS.were treated with Rizolex T. between Benlate and Quinolate and between Quinolate and Rizolex T. for the two tomato CVS.

The same effect was also noted when seeds of the two pepper CVS. , California wonder (fig. 12) and Yolo wonder L (fig. 13) were treated with the three fungicides . Percentage of pre-emergence damping off was more that of post-emergence Benlate proved to be the best fungicides for seed treatment ; percentage of pre-emergence damping off was the least and equal to 46.5 and 28.00 % for the two pepper CVS. , respectivley . Also, percentage of survival plants reashed the maximum when Benlate was used .

Effect of fungicides on tomato wilt caused by Fusrium oxysporum f. sp. lycopersici

The effect of different fungicides on percentage of infection with tomato wilt disease is summarized in table (2) .

It can be observed that seed of Castle rok , strain B , Super-Queen val Ice and Ice CVS. with Rizolex T. at the rate of 39/kg resulted in the least percentage of wilt , while Benlate treated seed (at rate of use 2g/kg) showed the least percentage with supermammend and red star .

- Further more difference between fungicides for length of root and shoot table (2) were significant-Rizolex T. followed by Benlate resulted in highest length of root , while Rizolex T. resulted in highest length of shoot. defference between fungicides and control were also significant .

DISCUSSION

From data obtained, it was observed that diameter of growth was gradually decreased when the concentration of fungicides used increased from 5 to 100 ppm, when the effect of different concentration of different fungicides on the growth of the three isolated fungi studied in laboratory. It was also observed that no growth was observed at 250 and 500 ppm. when Benlate and Quinolate were used to controlling growth of *Fusarium oxysporum* f. sp. *lycopersici* and *Fusarium solani*. In this case Quinolate followed by Benlate gave the best control effect, Bechet & Lordach (1983) and Kalra & Sohi (1984 9). In case of *Alternaria solani*, Ridomil followed by Tridex gave the maximum reduction of growth. No growth was observed at 500 ppm. concentration of Topsin, Fadi et al (1985).

From the same experiment the number of spores were determined and it was found that Quinolate followed by Benlate highly reduced the total number of spores /ml. after 7 days of growth of both f. *solani* on solid PDA medium. In case of growth of *Alternaria solani* on solid PDA medium containing 8 different fungicides at different conc. the total number of spores /ml. was highly reduced after 10 days growth with Ridomil followed by Tridex, Karla & Sohi (1984 a) and Fadi et al. (1985).

Spots experiment were carried out using the same group of systemic and non-systemic fungicides to control different fungal diseases appeared due to artificial infestation and from the data obtained it can be observed that Trimitox forte and Sandofan shown maximum efficiency in controlling early blight caused by *A. solani*. Also Ridomil and Dithane gave high control effect in reduction the number of spots appeared after the third application on tomato plants CV. Castle. The percentage of reduction reached 94.97 when Trimitox used highly significant differences can be observed from result obtained.

Sandofan, Tridex and Ridomil showed high efficiency in reduction in number of spots appeared on strain B CV. of tomato plant (95.67, 95.06 and 91.39) respectively, Kamlesh et al (1986) and Moesa et al (1991).

Ridomil followed by Trimitox showed maximum effect in controlling the disease on leaves, Rajagopal and Vidhyasekaram (1985).

Fusarium solani which cause root rot of tomato and pepper plants and led to pre and post emergence damping off of seedlings , was also controlled with the same fungicides and it was found that least percentage of damping off and highest percentage of survival plants was obtained when Ice and Super - Queen CV. of tomato plants treated with Rizolex T. also high difference was obtained when California wonder and Yolo wonder L. CV. of pepper seeds were treated with Benlate , Bechet and Lordach (1983) .

When the same group of fungicides was used to control vascular wilt disease of tomato plants caused by *F. oxysporum* , Ice , Super Queen and Redstar CV. showed to be highly susceptible to wilt disease , while strain B , CV. showed a resistance to wilt symptoms . Rezolex T. and Benlate gave high effect on length of shoot system , Beihn (1973) and Nikolaeva (1978) .

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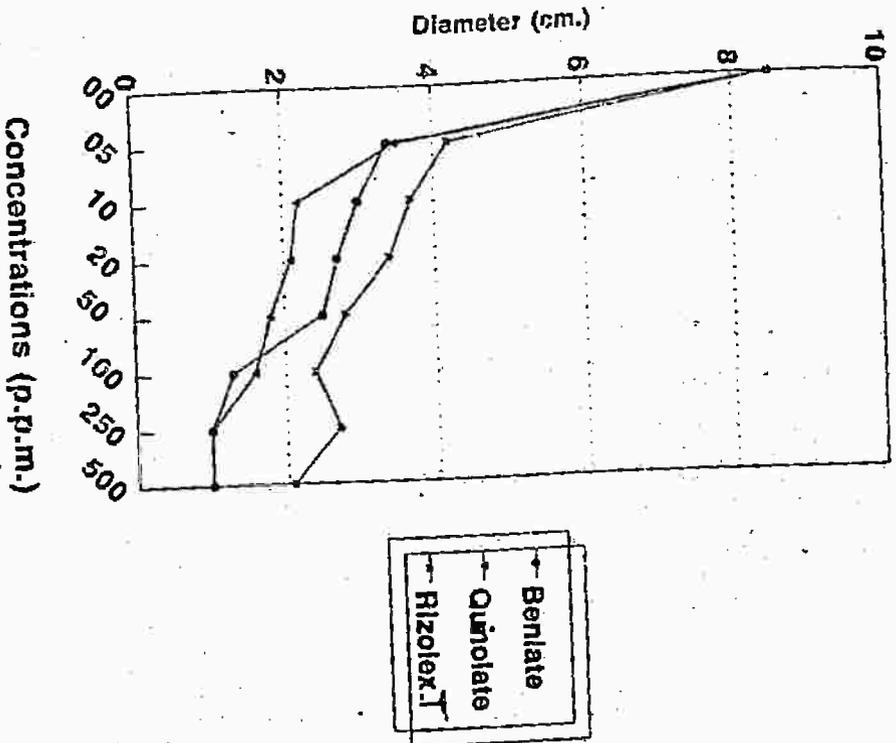


Fig. (1): Effect of different fungicides concentrations on growth of *E. oxysporus* f. sp. *lycopersici* at 28 °C.

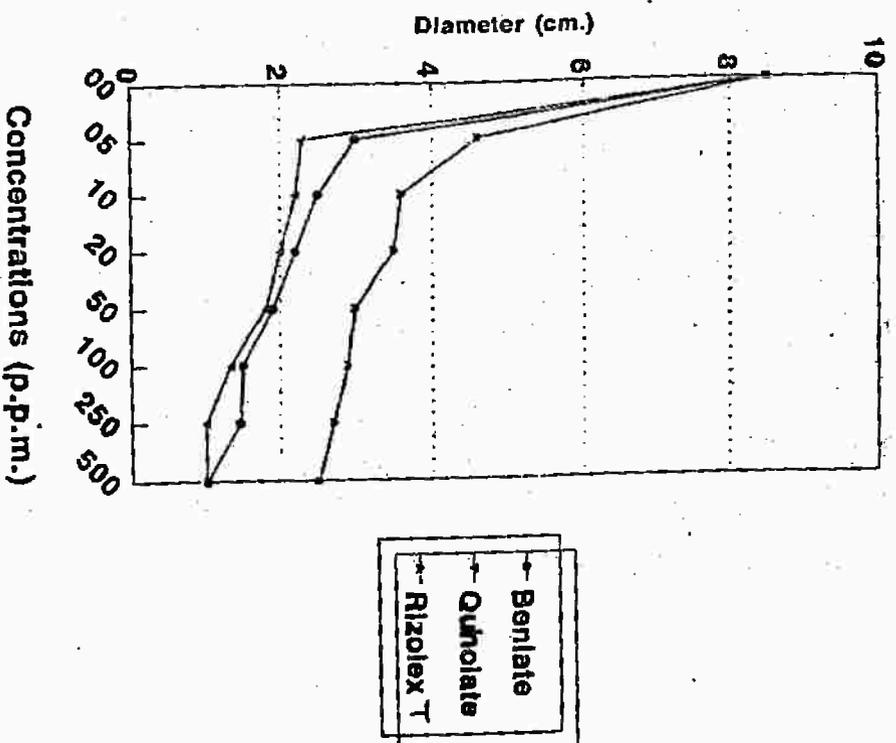
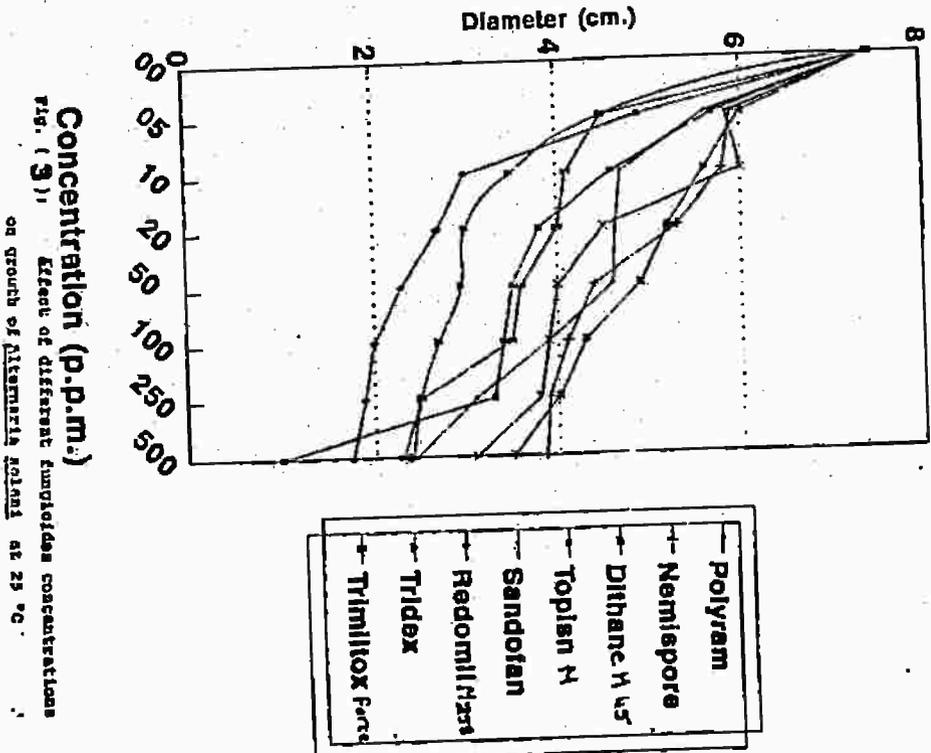
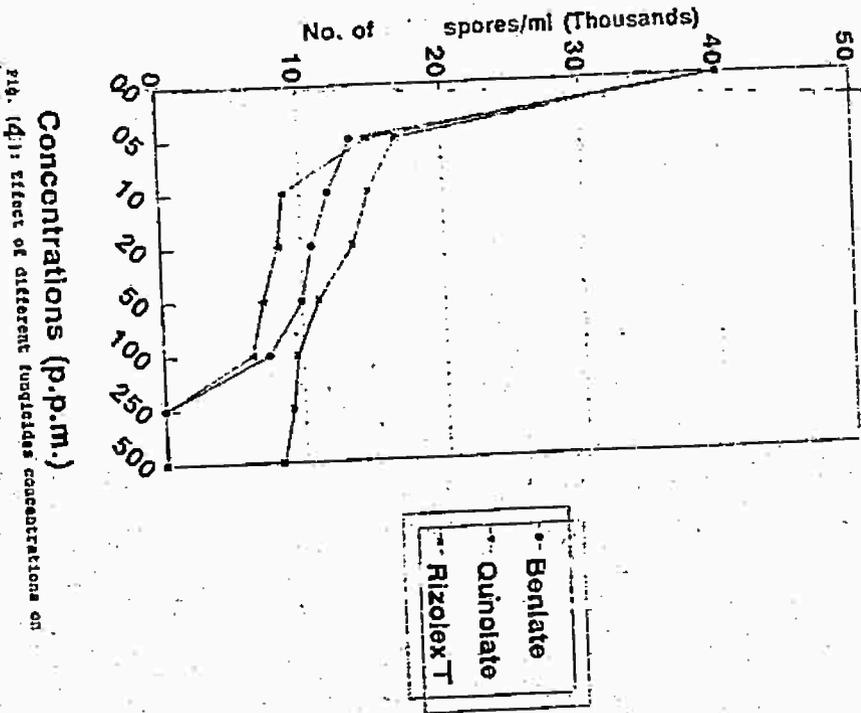
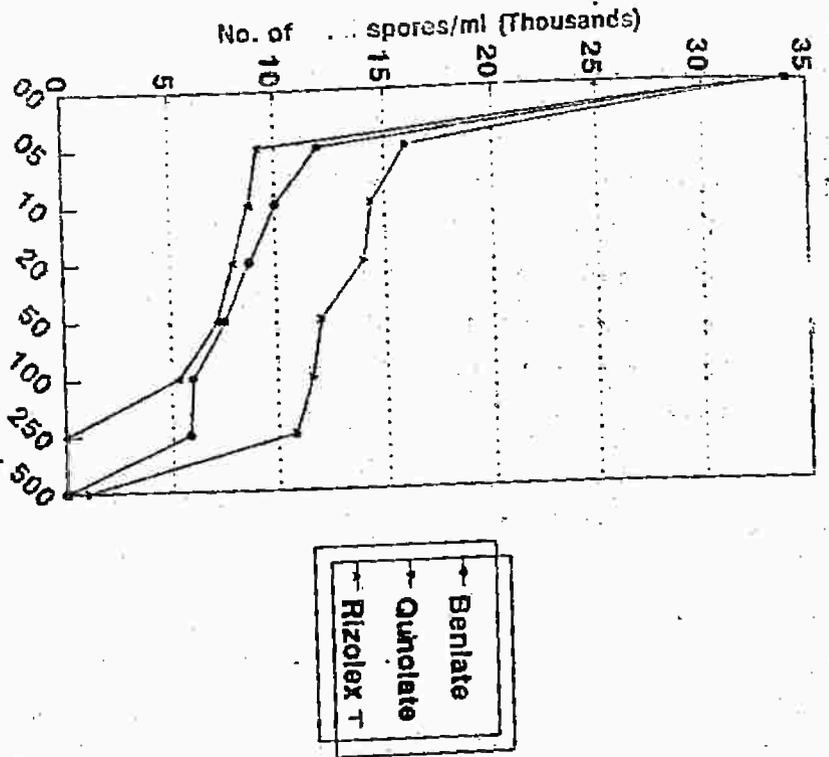
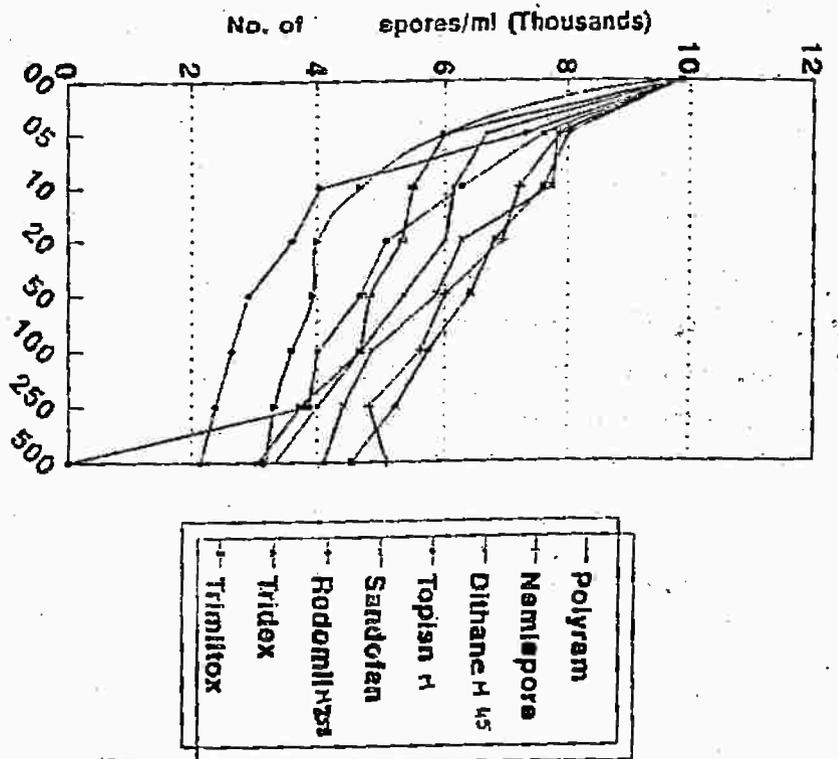


Fig. (2): Effect of different fungicides concentrations on growth of *Fusarium solani* at 28 °C.





Concentrations (p.p.m.)
 FIG. (9): Effect of different fungicides concentrations on number of *Fusarium solani* spores/ml. at 10 days growth on PDA medium.



Concentrations (p.p.m.)
 FIG. (10): Effect of different fungicides concentrations on number of *Alternaria solani* spores/ml. at 10 days growth on PDA medium.

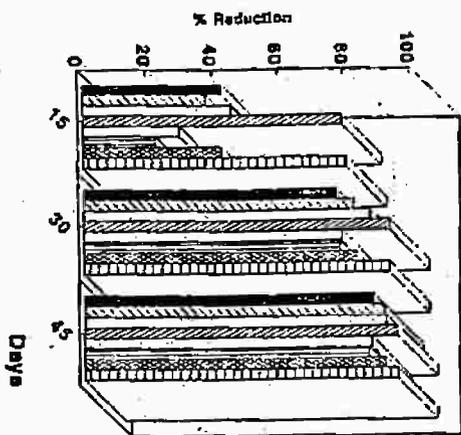


Fig. (7): The effect of spraying with different fungicides on the number of spots on tomato leaves cv. Florida 702.

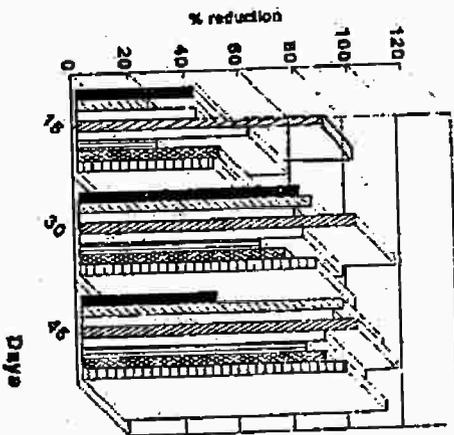


Fig. (8): The effect of spraying with different fungicides on the number of spots on tomato leaves cv. Strain B.

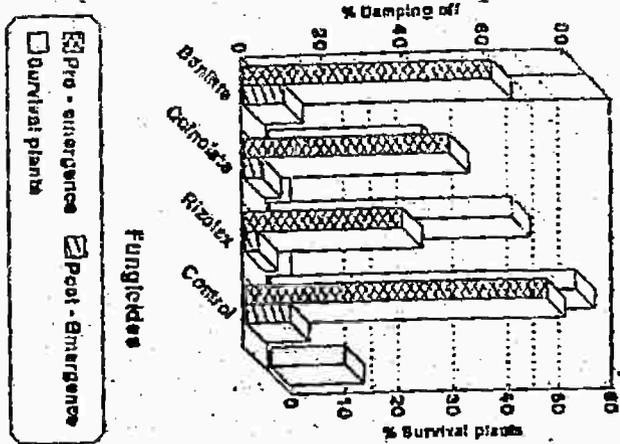


FIG. (10): Effect of different fungicides on percentage damping off (pre and post emergence) and survival tomato plants cv. Tom.

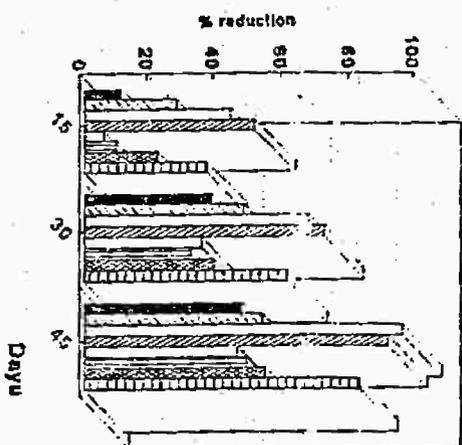


FIG. (11): The effect of spraying with different fungicides on the number of spots on parrot leaves cv. California wonder.

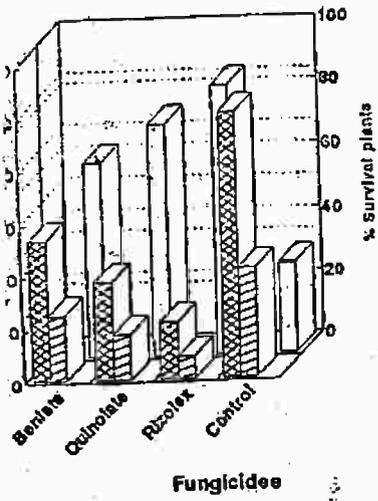


Fig. (17): Effect of different fungicides on percentage damping off (pre and post emergence) and survival tomato plants cv. Super-queen.

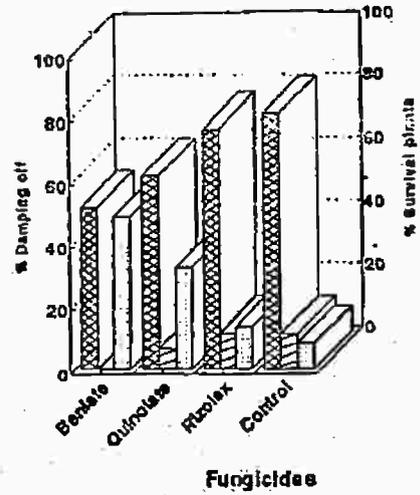


Fig. (18): Effect of different fungicides on percent damping off (pre and post emergence) and survival pepper plants cv. California wonder.

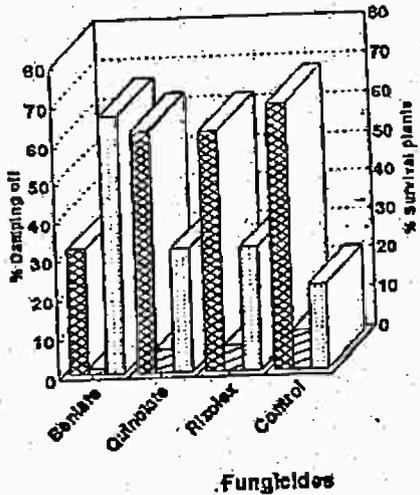


Fig. (19): Effect of different fungicides on percentage damping off (pre and post emergence) and survival pepper plants cv. Yolo wonder.

Table (1): List of systemic and non-systemic fungicides .

Trade name	Chemical constituent	Manufacturer
1- Sandofan	Oxadixyl 8% + Mancozeb 56% 2- methoxy -N- (2- oxy- 1,3 - oxazolidin - 3 - yl) acet - 2,6 - xylidide.	Sandoz AG.
2- Dithan M45 (Mancozeb)	1,2- ethanediybis = (Carbam- dithioato) [2-] manganese	Rohm and Hass
3- Quinolate (Oxine-Copper)	Bis (quinolin - 8 - olato) copper	Bayer
4- Benlate (Benomyl)	Methyl 1-(butylcarbamoyl) ben- zimidazol -2- ylcabamate	E.I. dupont
5- Trimiltox forte	20% mancozeb + 21% cupper salts + 6 stimulant additive	Sandoz AG.
6- Rizolex -T 50% WP	20% tolcofos-methyl + 30% thiram o-2,6-dicloro -4- methylphenyl o,o- dimethyl phosphorothiate + Bis (dimethyl thiocarbamoyl) disulphide.	Sumitomo chemical Co.
7- Polyram (Metiram)	Zinc ammoniate ethylenebis (di- thiocarbamate) -pdy (ethylenebis (thiuram disulphide)	BASF, AG.
8- Topsin M 70 (Thiophanate)	Diethyl 4,4 - (o-phenylene) bis (3- thioallophanate)	Nippon Soda Co.
9- Ridomil MZ 58	Metalaxyl + Mancozeb Methyl D,L -N- (2,6 dimethyl- phenyl)-N- (2- methoxyacetyl) - alaninate+ Dithiocarbamate	Ciba - Geigy AG.
10- Nemispore	80% (16% Manganese + 2% Zinc + 62% Ethylene bisdithiocarbamate)	Lotus
11- Tridex	44% FL + ethanediy bis= (Carba- modithioate) (2-) manganese	Ron Blank

Table (2): Effect of different fungicides on percentage of infection with tomato wilt disease.

Fungicides	Rate of use /kg. seed	Percentage of wilt						
		Castle rock	Strain B	Super-marmed	Super-Queen	Valice	Redstar	Ice
Benlate	2 g.	12.1	11.0	11.8	19.1	15.7	11.6	28.8
Quinolate	3 g.	14.6	9.5	18.8	24.3	18.1	23.9	33.4
Rizolex T	3 g.	9.1	5.4	14.2	14.9	12.6	16.6	22.1
Control		22.7	14.7	27.0	35.2	23.4	30.5	44.4
L.S.D =		0.138	0.130	0.261	0.131	0.133	0.264	0.262

Table (2): Effect of different fungicides on length of root system of tomato plants grown in soil infested with F. oxysporum .

Fungicides	Rate of use /kg. seed	Length of root (cm.)						
		Castle rock	Strain B	Super-marmed	Super-Queen	Valice	Redstar	Ice
Benlate	2 g.	11.8	9.2	8.4	7.9	9.0	9.9	11.0
Quinolate	3 g.	12.7	6.3	11.2	7.0	9.0	8.8	10.0
Rizolex T	3 g.	16.0	8.2	8.4	8.3	12.1	10.2	9.3
Control		11.5	5.2	7.4	6.0	6.9	8.5	7.8
L.S.D =		0.98	0.74	0.53	0.39	0.32	0.45	0.44

Table (2): Effect of different fungicides on length of shoot system of tomato plant grown in soil infested with F. oxysporum .

Fungicides	Rate of use /kg. seed	Length of shoot (cm.)						
		Castle rock	Strain B	Super-marmed	Super-Queen	Valice	Redstar	Ice
Benlate	2 g.	17.0	13.2	10.2	14.2	15.2	13.2	18.0
Quinolate	3 g.	12.8	9.4	14.2	13.9	17.0	13.0	17.3
Rizolex T	3 g.	15.7	9.3	11.2	15.2	20.0	14.0	12.2
Control		11.9	8.3	10.0	13.0	13.5	12.3	10.4
L.S.D =		0.226	0.238	0.226	0.302	0.272	0.130	0.228