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Comparative Efficacy of Different Chemical Fungicide Groups against Cotton Root Rot

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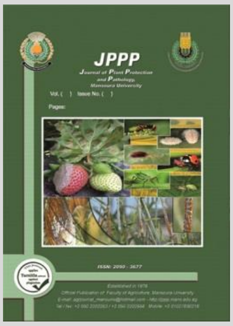

ABSTRACT

The current study was undertaken to evaluate the influence of various fungicidal treatment on the inhibition percent of pathogens and as seed treatment on cotton seedling stand establishment against root rot of cotton in *in vitro* as well as in field conditions at Sakha Agriculture Research Station during two seasons 2019 and 2020. This study was carried out to evaluate once more available fungicides, for their effectiveness against the root rot pathogens (*Rhizoctonia solani* ,*Fusarium oxysporum* and *Macrophomina phaseolina*). And upon it evaluate which of them for used it as seed treatment. All tested fungicides exhibited reduction in the radial growth of mycelium for all the testing fungi significantly compare with control. Hymexazole and Tebuconazole + fludioxnile showed excessive decreased of mycelial growth, when Hymexazole; Tebuconazole + fludioxnile; Carboxin + thiram; Triticonazole and Fludioxanile + mefenoxam (metalaxyl-m) gave best results in the reduction percent of inhibition) for the three tested pathogens. Efficiency of fungicide seed treatments were expressed as increased in standing percent; plant height and dry weight of plant. Disease incidence was very low in both Propanocarb HCl + fostyl Al and Fludioxanile + mefenoxam (metalaxyl-m). Generally, the fungicide treatments ended a little or no difference in plant height or dry weight. Under the field conditions (low disease pressure), results indicated that, fungicide seed treatments are slightly effective in increasing standing percent. Diniconazole-M was the most effective in disease reduction (expressed as 100% standing percent). These treatments were translated into increased plant height and dry weight of plants.

Keywords: Comparative efficacy, chemical fungicide, root rot, cotton, *Gossypium barbadence L*

INTRODUCTION

Cotton (*Gossypium barbadence L.*) is the most important fiber crop in the worldwide textile manufacturing and establishes more than half of all consumption material fiber in the worled (Karademir *et al*., 2011, and subsequently soybean as the best source of plant proteins while it's the fifth best oily plant after soybean, palm-tree, colza and sunflower (Texier, 1993). Several diseases have attacked cotton plants, damping-off one of them which induces suffer heavy losses particularly during the early stage of plant development (Nawar, 2008). The pathogens associated with the cotton seedling disease complex include *Rhizoctonia solani* Kuhn, teleomorph *Thanatephorus cucumeris* (A. B. Frank) Donk, *Fusarium* spp., *Pythium* spp. (R. Hesse) and *Thielaviopsis basicola* (Berk. & Broome) Ferraris (syn. *Chalara elegans* Nag Raj & Kendrick), (DeVay, 2001; Rothrock and Buchanan, 2017). The major fungi involved in root rot disease arer *Rhizoctonia. solani*, *Fusarium* spp. and *Pythium* spp. (Watkins 1981). *M. phaseolina* and *Sclerotium rolfsii* also involved but they are less important. *Rhizoctonia solani* and *Fusarium oxysporum* are the active contributors in complex cotton seedling disease with varying in virulence degrees. (Colyer, 2001). Infection of *Fusarium* spp. consequences seed rot, pre- and post-emergence damping-off, and seedling root rot that joined to reduce the seedling vigor (Chimbekujwo, 2000; Wang *et al*., 2004). Aly *et al*., 2000 mentioned that *Macrophomina phaseolina* (Tassi) Goid., was the widespread pathogen in the Egyptian soil, and it was easily and commonly isolated one form cotton roots at the late period of the growing seasons. *Fusarium*, *Rhizoctonia* and *Macrophomina* are the most habitually pathogens in the soil which associated with damping-off, and are considered the most imperative causal agents in Egypt. These pathogens can act individually or in mixture to cause a series symptoms. Damping-off is the most severe problem in seedlings nursery. Usually soil-borne pathogens are associated with damping-off in the earlier stages, whereas in the latter stages seed-borne pathogens can indorse damping-off. However, both explanations understand that damping-off includes inhibition of seeds germination or seedling emergence after germination, or rotting and breakdown of seedlings over the soil (Kraft et al. 2000). Cotton seedling disease complex sources of serious economic losses in several production countries annually. Pathogens of damping-off can survive in the soil for many years, even in the absence of the host. At the adverse condition the pathogens are capable of survive as saprophytic or resting structures (Menzies 1963). Under the field conditions the management of these fungi is the most difficult problems because of the wide host range of them. There is no country or geographic area without damping-off problems. Wilt and root rot disease causes extensive losses in cotton farms, in the absence of suitable resistant donors; fungicides are the main answer to check these diseases. The fungicides seed treatment is a practice most be used. There's no amount of seeds treated with fungicides. Thus, it is necessary evaluate the fungicides efficiency to control this pathogen in cotton seeds.

In general, the fungicides which control *Rhizoctonia* do not control *Fusarium* and these which control *Fusarium* do not control *Rhizoctoni* or *Macrophomina*. Therefore, using a blend of fungicides to control more than one fungus will provide the highest probability of limiting damage from seedling diseases. The present study was undertaken to evaluate the different fungicides at different formulation for

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efficient control of cotton root rot. This study aimed to determine the sensitivity of pathogens to several fungicides *in vitro* and the fungicides effectiveness in cotton seed treatments under the greenhouse and field conditions.

MATERIALS AND METHODS

The current study was carried out at Cotton Pathology Section, Sakha Agriculture Research Station. A local cotton variety cv. Giza 94 seeds were treated with the tested fungicides.

Fungicides

Twenty one different fungicides were used in these experiments. Fungicides used in *in vitro* and *in vivo experiments* were formulated. Active ingredients, Chemical name, Forms and some other technical properties were presented in Table 1.

***In vitro* experiments:**

Effect of different fungicide groups on the growth rate of three major root rot pathogens (*Rhizoctonia; Fusarium and Macrophomena*, which were isolated from cotton plants) was evaluated in dual culture interaction. Paper disc plate method was used. A circular disc (5 mm dia.) of Whatman filter paper (No. 1) were cut and were positioned 1 cm inner from the margin of Petri dishes at equal four distance places after dipping in different fungicides. 5 mm plugs of agar from 7-day-old culture of the tested fungi were centrally inoculated in Petri dishes (120 mm diameter) containing potato dextrose agar (PDA) to evaluate the change of fungal growth and sealed with Parafilm. Three replicates of Petri plates were incubated at 25±3 Cº for approximately 5-7 days. Radial growth of the tested fungi was measured in millimeters until the check plates were full. Development of radial mycelia growth at right angles was recorded (every 24 hours) during the growth period. The diameters of colony were measured as the mean of two perpendicular diameters. The average of linear growth (ALG) was determined by using Elad *et al.*(1980) formula:

$$\mathbf{ALG\ (mm) = C2\text{-}C1}$$

Where:

C1: colony diameter in mm after one day of incubation;

C2: colony diameter in mm at the end of incubation period;

Table 1. Used fungicides, recommended application, and concentrations of active ingredients (C); formula (F) and Application rate/k seeds (A).

Active ingredient	Chemical name	C	F	A
Tolclophos-methyl 20%+ thiram30%	a- O-2Dichloro-4-methylphenyl o-o phothophorothiote b- Tetramethylthiuram disulfide: bis(dimethylthiocarbamoyl)disulfide	50%	WP	3g
Carbendazim	methyl benzimidazol-2- ylcarbamate	80%	WP	2g
Carvone	(s)-5-isopropenyl-2-methyl-2-cyclohexenone: p-mentha-6,8-dien-2-one	1.3%	D	10g
Pencycuron	1-(4-chlorobenzyl)-1-cyclopentyl-3-phenylurea	25%	WP	3g
Thiophanate methyl + hymexazole	a- dimethyl 4,4-`(o-phenylene)bis(3-thioallophanate) b- 5-methyllioxazol-3-OI	56%	WP	3g
Tetramethyl thiuram disulfide + thiram TMTD	Dimethylcarbamothioylsulfanyl *n,n*-dimethylcarbamodithioate	42.7%	FS	3ml
Hymexazole	5-methyllioxazol-3-OI	30%	SL	3ml
Tebuconazole 6% + fludioxnile 4%	a- (*RS*)-1-(4-chlorophenyl)-4,4-dimethyl-3-(1*H*,1,2,4-triazol-1-ylmethyl)pentan-3-ol b- 4(2-2difluoro-1-3benzodioxol-4-yl)pyrole-3-carbonitrile	10%	FS	0.8ml
Carboxin 20% + thiram 20%	a- 5,6-dihydro-2-methyl-1.4-oxathine-3-carboxanilide b- Tetramethylthiuram disulfide: bis(dimethylthiocarbamoyl)disulfide	40%	FS	3.5ml
Metalaxyl-M	Methyl N-(methoxyacetyl)-N-(2,6-xylyl)-D-alaninate, methyl(R) -2-[(2,6-dimethyl-phenyl)methoxycetyl]amino}propionate	48%	EC	3ml
Cyproconazole	2-(4-chlorophenyl)-3-cyclopropyl-1-(1*H*-1,2,4-triazol-1-yl)-2-butanol	40%	SC	3ml
Myclobutanil	2-(4-chlorophenyl)-2-(1,2,4-triazol-1-ylmethyl)hexanenitrile	25%	EC	3g
Thifluzamide + difenoconazol	a- *N*-[2,6-dibromo-4(trifluoromethoxy)phenyl](trifluoromethyl)-1,3-thiazole-5-carboxamide b- 1-[[2-[2-chloro-4(4-chlorophenoxy)phenyl]-4-methyl-1,3-dioxolan-2-yl]-1,2,4-triazole	27.8%	SC	3ml
Thiophanate-methyl	dimethyl 4,4-`(o-phenylene)bis(3-thioallophanate)	70%	WP	3g
Fostyl Al	Aluminium tris(ethyl phosphonate)	80%	WP	3g
Triticonazole	(I)-(E)-5-(4-chlorobenzylodene)-2,2-dimethyl-(I*H*-1 2,4trizol-1-ylmeutyl)cyclopenlanyl	2.5%	FS	3ml
Propanocarb hydrochloride	Propyl-3-(dimethyllamino)propylcarbamate hydrochloride	72%	SL	1ml
Propanocarb HCl 53% + fostyl Al 31%	a- Propyl-3-(dimethyllamino)propylcarbamate hydrochloride b- Aluminium tris(ethyl phosphonate)	84%	SL	1ml
Diniconazole-M	E)-1-(2,4-dichlorophenyl)-4,4 dimethyl-2-(1,2,4t riazol-1-YL)pent-1-en-3-ol	2%	SL	1ml
Fludioxanile + mefenoxam(metalaxyl-m)	a- 4(2-2difluoro-1-3benzodioxol-4-yl)pyrrole-3-carbonitrile b- Methyl N-(methoxyacetyl)-N-(2,6-xylyl)-D-alaninate, methyl(R)-2-[(2,6-dimethyl-phenyl)methoxy cetyl)]	3.5%	XL	0.5ml

The fungicides effectiveness against the tested pathogens was determined by evaluated the inhibition percent of radial growth (PIRG) by using this formula:

$$\mathbf{PIRG = (R1 - R2)/R1 \times 100}$$

Where:

R1: Radial growth of test pathogen in control plate.

R2: Radial growth of test pathogen in the treated plate

***In vivo* experiments:**

The effectiveness of fungicides seed treatment was conducted through greenhouse experiments to achieve a complex cotton root rot disease (*Rhizoctonia solani, Macrophomin phaseolina* and *Fusarium oxysporium*). In 500-ml glass bottles put 40 ml of tap water and 50 g of sorghum grains for growth of each fungi. Bottle contents were autoclaved for 30 minutes. From one-week-old culture the inoculum was taken and aseptically inoculated the bottle and allowed to complete colonization for three weeks. An autoclaved sandy clay soil at a rate of 50 g/kg soil was inoculated by used inoculum of each fungus . Infested soil was dispensed in 25 cm diameter plastic pots. Treatment of cotton seeds were carried out with selected fungicides at rat 2g or 2ml per kilogram of seeds. Untreated seeds was saved as control. Treated and untreated were planted in pots (10 seeds/pots) and keep in greenhouse. The experiment arranged as Complete Randomized Design (CRD) with three replications. Assessing disease percentage of pre- emergence damping-off was documented after 15 days from planting. After 45 days per planting, the plants were uprooted and data of standing plants, plant length (cm) and weight (g) of plants were recorded.

Field experiment:

At the experimental field of Sakha Agriculture Research Station (season 2018), a field experiment was conducted by using cotton variety 'Giza 94'. A Randomized Complete Block Design (RCBD) with four replications was designed for this experiment. The size of plot was 5×3 m and there were 10 rows per plot with 25 cm distance of row-to-row. The fungicide treated seeds were used in growing this experiment. Untreated seeds served as control. All agronomic practices (fertilization and irrigation) were carried out as recommended. Data on plant disease and plant growth were recorded.

Diseases assessment

Pre-emergence damping-off and healthy survival percent of plants in each treatment were evaluated 15 and 30 days after sowing respectively using this formula:

$$\textit{Pre emergence}\ (\%) = \frac{\textit{Number of non germinated seeds}}{\textit{Total number of sown seeds}} \times 100$$

$$\textit{Survival plant}\ (\%) = \frac{\textit{Number of survival plant}}{\textit{Total number of sown seeds}} \times 100$$

Plant height and dry weight of cotton plants were also estimated after 30 days from sowing.

Statistical analysis

The experiments were set up in complete randomized design and randomized blocks design. Data was analyzed by using software backache ASSISTAT (2013) – (http:/www.assistat.com) by Francisco de A.S. e Silva DEAG-CTRN-UFC (Assistat 2013). The results are subjected to ANOVA followed by used Duncan's Multiple Range Test in comparing means of treatments at $P = 0.05$.

RESULTS AND DISCUSSION

***In vitro* experiments:**

Effectiveness of different fungicide groups on of *Rhizoctonia; Fusarium and Macrophomena* growth rate was evaluated by used twenty fungicide groups. The obtained data exhibited that all the fungicides were significantly superior in inhibiting the growth of mycelium of all testing fungi compared with control. The fungicides Hymexazole; Tebuconazole + fludioxnile; Carboxin + thiram; Triticonazole and Fludioxanile + mefenoxam(metalaxyl-m) showed excessive reduction of mycelial growth for the three tested pathogens. Whereas the Carboxin + thiram; Metalaxyl-M; Fostyl Al; Triticonazole and Fludioxanile + mefenoxam (metalaxyl-m have shown great inhibition of two fungi at the same time (Table2). All fungicides able to significantly inhibit mycelial growth of testing fungi relative to the control (Fig. 1). The results were agreement with these data which reported that captan (0.2%) inhibited the *Macrophomina phaseolina* growth causing root rot disease in green gram by 78.56 percent(Ebenezar and Wesely 2000). Amrutha *et. al.*(2014), the systemic fungicide, tebuconazole suppressed the mycelial growth of Rhizoctonia by 100%. In 2008, Konde *et al.* evaluated the fungicides against *R. bataticola* causing root rot of soybean and they found that combination of carbendazim + thiram (0.1 + 0.2 %), penconozole (0.1%) and thiophanate-Methy l (0.1%) were completely inhibited the radial growth of pathogen significantly. It is resolved that under *in vitro* test the most of testing fungicides were demonstrated to be best in arresting the mycelial growth of the pathogen.

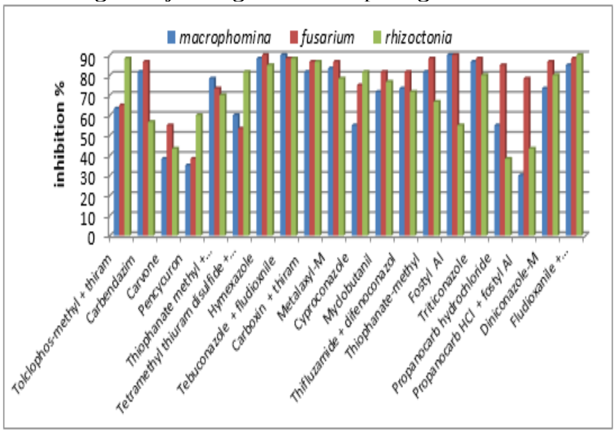

Fig. 1. Effect of testing fungicides on inhibition percent of mycelial growth of *Rhizoctonia solani*, *Fusarium solani* and *Macrophomina phaseolina in vitro*.

Table 2. Effect of twenty one fungicides groups *In vitro* radial growth of *Macrophomina phaseolina; F. solani* and *R. solani*.

No.	fungicides	Mycelial growth of pathogen (cm)*			
		Macrophomina	Fusarium	Rhizoctonia	Average
1	Tolclophos-methyl + thiram	2.2 cdA	2.1 dA	0.7 jlB	1.7 fg
2	Carbendazim	1.1 fghB	0.8 fgB	2.6 cA	1.5 ghi
3	Carvone	3.7 bA	2.7 cB	3.4 bA	3.27 b
4	Pencycuron	3.9 bA	3.7 bA	2.4 cdB	3.33 b
5	Thiophanate methyl + hymexazole	1.3 efgB	1.6 deAB	1.8 efA	1.57 fgh
6	Tetramethyl thiuram disulfide + thiram TMTD	2.4 cA	2.8 cA	1.1 hijlB	2.10 e
7	Hymexazole	0.7 hA	0.6 gA	0.9 hijlA	0.73 op
8	Tebuconazole + fludioxnile	0.6 hA	0.7 gA	0.7 jlA	0.67 p
9	Carboxin + thiram	1.1 fghA	0.8 fgA	0.8 ijlA	0.90 no
10	Metalaxyl-M	1.0 ghAB	0.8 fgB	1.3 fghiA	1.03 mn
11	Cyproconazole	2.7 cA	1.5 eB	1.1 hijlB	1.77 f
12	Myclobutanil	1.7 deA	1.1 efgB	1.4 fghAB	1.40 hijl
13	Thifluzamide + difenoconazol	1.6 efA	1.1 efgB	1.7 efgA	1.47 ghij
14	Thiophanate-methyl	1.1 fghB	0.7 gB	2.0 deA	1.27 jl
15	Fostyl Al	0.6 hB	0.6 gB	2.7 cA	1.30 ijl
16	Triticonazole	0.8 ghAB	0.7 gB	1.2 ghijA	0.90 no
17	Propanocarb hydrochloride	2.7 cB	0.9 fgC	3.7 bA	2.43 d
18	Propanocarb HCl + fostyl Al	4.2 bA	1.3 efC	3.4 bB	2.97 c
19	Diniconazole-M	1.6 efA	0.8 fgB	1.2 ghijAB	1.20 lm
20	Fludioxanile + mefenoxam(metalaxyl-m)	0.9 ghA	0.7 gA	0.6 lA	0.73 op
21	Control	6.0 aA	6.0 aA	6.0 aA	6.00 a
mean		1.995 a	1.524 b	1.938 a	

The Tukey Test at a level of 5% of probability was applied. Values within the same column per pathogen followed by the same superscript letter are not significantly different ($p = 0.05$). lower case letters classify for columns upper case letters classify for rows

Seed treatment:

The fungicides seed treatment are generally used as management of various pathogens in cotton seedling disease complex. Conversely, these method is limited in controlling cotton root rot. The goal line of this study was to evaluate the ability of varies fungicidal seed treatment (counting some active ingredients of fungicides individually or in combination)in controlling these disease. The efficiency of fungicides seed treatments was carried out under in cooperation artificially or naturally infested soil.

In vivo experiments:

In the greenhouse trial application of fungicides increased the percentage of seedling emergence, plant height, and dry weight significantly, comparative to the inoculated control. Application of seed treatment reduced percentage of pre-emergence percent in the tested fungicides except Carvone and Carboxin + thiram compared with control (Fig. 2). This expressed in increasing of standing percent which revealed in 100% standing percent for Propanocarb HCl + fostyl Al and Fludioxanile + mefenoxam(metalaxyl-M). Only Thiophanate methyl + hymexazole and Diniconazole-M decreased plant height and dry weight of plant when compared with the inoculated control.

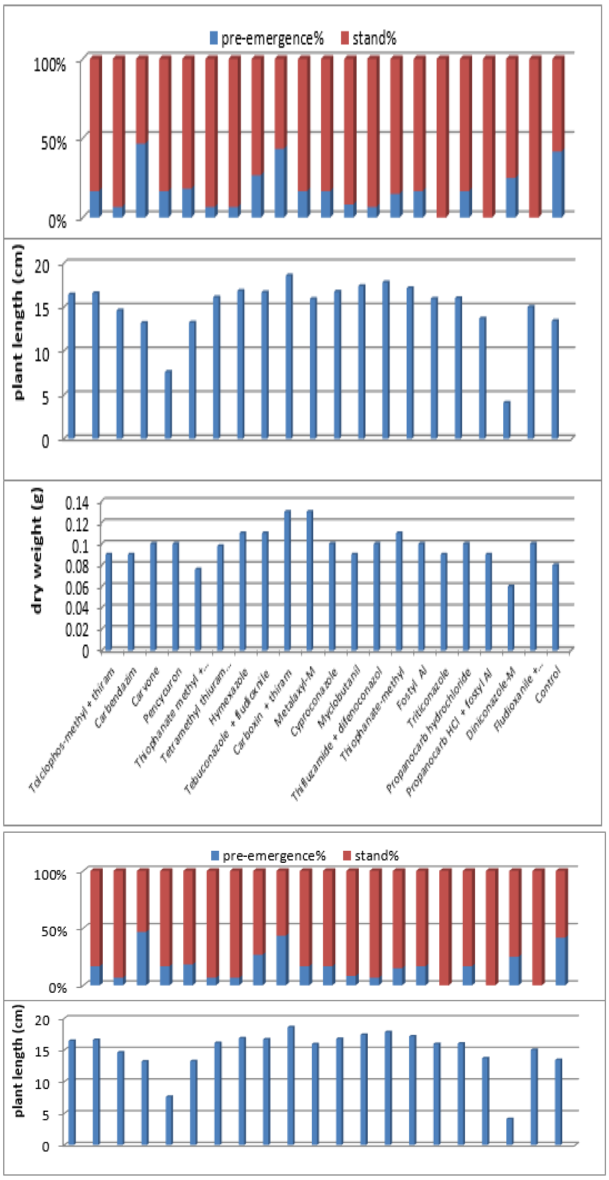

Fig. 2. Efficacy of fungicides seed treatments in controlling cotton root rot in infested soil on disease incidence (pre-emergence % and standing %) ; plant height, dry weight of cotton plants under the greenhouse conditions.

Filed experiments:

Cotton plants treated with all the tested chemicals none developed signs of phytotoxicity. The most of chemicals reduced the incidence of disease significantly. Diniconazole-M was the most effective in reducing the disease incidence, resulting in 57.9% disease reduction (expressed as 100% standing percent), (fig. 3).

Tolclophos-methyl + thiram; Thiophanate methyl + hymexazole; Hymexazole; Tebuconazole + fludioxnile; Fostyl Al and Triticonazole applied as seed treatment resulted in non significant reduction in standing percent. Applied of Myclobutanil and Carboxin + thiram to cotton plants as seed treatment, resulted in significant increasing in the plants dry weight(cotyledon; true leaves and hole plant). Myclobutanil; Thifluzamide + difenoconazol; Tebuconazole + fludioxnile; Carboxin + thiram; Triticonazole; Tolclophos-methyl + thiram and Carbendazim were the most effective in increasing the holl plant dry weight. On the other hand, Carboxin + thiram; Metalaxyl-M; Myclobutanil; Thifluzamide + difenoconazol; Thiophanate-methyl and Fostyl Al increased dry weight of cotyledon and true leaves significantly(fig. 4).

Seedling diseases result in lower plant populations and also reduced vigor, which directly translates to yield loss. Seed treatment fungicides may be an option to maintain desired final plant populations at harvest. Those seedlings that do emerge may have rotten root, resulting in decreased plant vigor and plant death. The aim of using seed treatments is not to completely control damping-off, but to sufficiently suppress disease so that a good, uniform stand is obtained. In this study all the used fungicides showed significantly lower percent of standing plants compared to control. Olsen *et al*., (2011) in the early season obtained of results indicate that, under the low disease density, fungicide seed treatments were slightly effective in increasing stands, but these were not translated into increased yield.

Under field conditions it should be noted that the presence of non-germinated seeds does not necessarily mean that the fungicide was the cause for non-germination and/or non-emergence. Cotton germinate and emerge quickly was affected by many factors Including excessive moisture; soil temperatures; optimal seeding depth. Tillage may also help to control disease, as crusted or compacted soil tends to favor seed and seedling disease by delaying emergence or damaging emerging seedlings. The fungicides seed treatment is a practice that has been used by an increasing number of growing cotton farmers. There's no quantity of cotton seeds treated with fungicides. Thus, it is necessary to evaluate the efficacy of fungicides to improve the root rot control in cotton. Aly *et al*. (2001) and Omar (2005) revealed that the best fungicides in controlling cotton root rot under greenhouse conditions were Monceren, and Tolclofos-methyl. This superiority was attributed in they effectiveness in increasing the percentage of standing plants; plant height and dry weight of seedlings. In field trials efficacy of fungicides seed treatment in improvement the survive plant and root health was demonstrated by (Hillocks *et al*., 1988; Kaufman *et al*., 1998; Minton *et al*., 1982; Wang and Davis, 1997; Wheeler *et al*., 1997). The fungicides azoxystrobin, carboxin, fludioxonil, myclobutanil and triadimenol were used against *R. solani* (Borum and Sinclair, 1968, Butler *et al*., 1996 and Arthur, 1996). In study to discover the effect of Rizolex (Tolclofosmethyl) on growth of *Rhizoctonia solani* results exhibited that Rizolex was strongly inhibited the growth of *R. solani* (100%) at all concentrations(Hameed,2008).

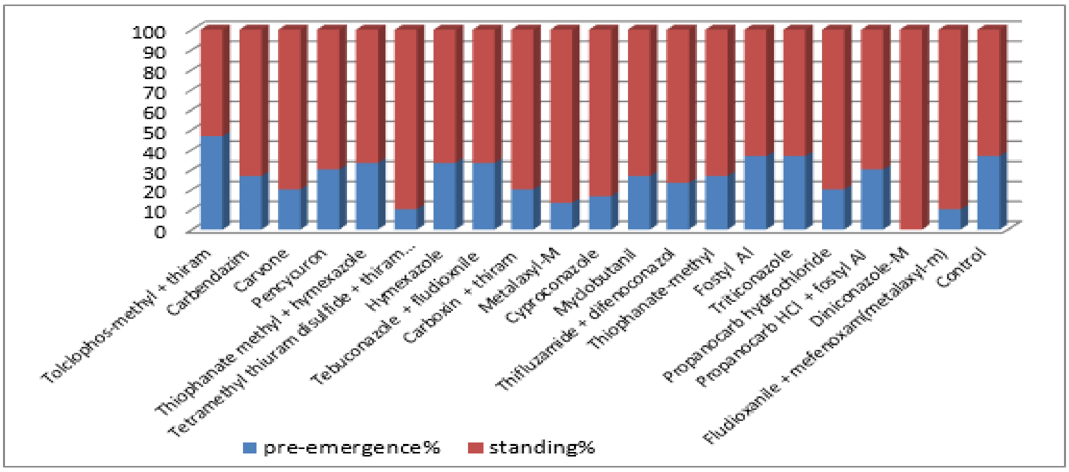

Fig. 3. Effect of seed treatments controlling cotton root rot disease in naturally infested soil.

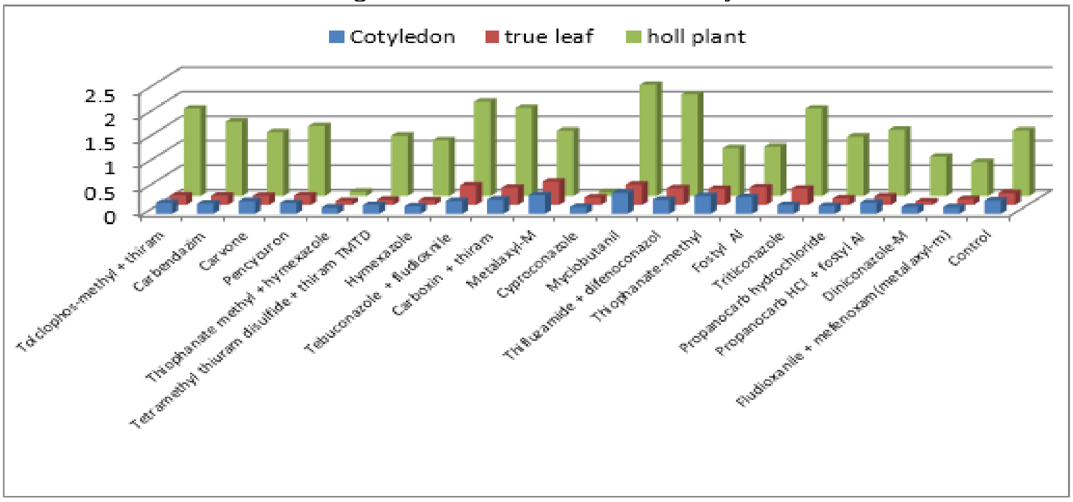

Fig. 4. Effect of fungicides applied as cotton seed treatment in the plants dry weight (cotyledon; true leaves and whole plant).

In controlling seedling disease complexes, mixtures of fungicides were found to be effective (Arthur 1996). When the cotton seeds were treated with a mix of triadimenol, captan and metalaxyl the yield increased (Wheeler *et al.* 1997). the cotton plants stands increased significantly by using a commercial mixture of the metalaxyl, triadimenol and thiram fungicides (Zaki *et al.* 1998).

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الفعالية المقارنة لمجموعات مختلفة كيماويا من المبيدات الفطرية ضد اعفان جذور القطن

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اجريت هذه الدراسة في محطة البحوث الزراعية في سخا في خلال عامي 2019 و 2020 لتقييم تأثير المعاملة بعدد من المبيدات الفطرية على نسبة تثبيط نمو المسببات المرضية لاعفان جذور القطن وكذلك تأثير معاملة البذور بالمبيدات على نسبة بقاء نباتات القطن وذلك تحت ظروف المعمل وكذلك تحت ظروف الحقل على حدا سواء. وقد كان الهدف من هذه الدراسة تقييم فاعلية بعض مجاميع المبيدات الفطرية من حيث فعاليتها ضد المسببات المرضية المسؤولة عن اصابة نبات القطن باعفان الجذور وهى *Fusarium oxysporum* ؛ *Rhizoctonia solani* و *Macrophomina phaseolina* ، وتحديد أي منها يمكن استخدامه فى معاملة للبذوركعلاج لهذا المرض. أدت جميع مبيدات الفطريات المختبرة إلى تثبيط نمو الفطريات المختبرة مقارنةً بالكنترول. وقد أظهرت المبيدات Hymexazoleو Tebuconazole و Triticonazole ثيرام + كاربوكسين ؛ فلوديوكسينيل + تيبوكونازول ؛ Hymexazole فى حين اعطى ، فى نمو الفطريات نقصًا واضحا في+ fludioxnile Fludioxanile + mefenoxam (metalaxyl-m)أفضل النتائج في تخفيض نسبة تثبيط المسببات المرضية الثلاثة المختبرة. وقد تم تحديد فعالية معاملة البذور من خلال تقدير النسبة المئوية للاصابة ؛ ارتفاع النبات والوزن الجاف للنباتات. وقد كانت الاصابة بالمرض منخفضًة جدًا في كل من Propanocarb HCl + fostyl Alو Fludioxanile + mefenoxam (metalaxyl-m) . وفقد كان تأثير المبيدات الفطرية بشكل عام ضئيل أو معدوم على طول النبات أو الوزن الجاف. اما تحت ظروف الحقل (حيث انخفاض نسبة الاصابة فقد أشارت النتائج إلى أن معاملة البذور بمبيدات الفطريات كان له تأثير طفيف في زيادة النسبة المئوية للنباتات القاءمة.اما مبيد Diniconazole-M فقد كان أكثر فعالية في الحد من المرض (معبراً عنه بنسبة 100٪ من النباتات القائمة). حيث ترجمت هذه المعاملة فى زيادة طول النبات والوزن الجاف للنباتات.