CHEMICAL AND BIOLOGICAL CONTROL OF SOME SOIL BORNE FUNGI UNDER INTERCROPPING CONDITIONS OF MAIZE AND SOYBEAN

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Abstract

The effect of different concentrations of tested fungicides and/or *Trichoderma* spp. were investigated against the main soil borne pathogens of maize and soybean such as: *Fusarium* spp. *Rhizoctonia solani, Caphalosporium* spp. and Macrophomina phaseli under laboratory, greenhouse and field conditions. Field experiments were carried out for two successive seasons. Results indicated that Homai 80 was the most effective fungicide followed by Ben late 50% and Vitavax thiram, while Monceren 25% was the least effective in all cases.

T.viride was the most antagonistic fungus against the main pathogens under laboratory conditions. Soil treatment with *Trichoderma* spp. under ced greenhouse and/or field conditions led to a significant reduction in damping-on and increased the survival plants.

INTRODUCTION

The cultivated area around the Nile Valley in Egypt is limited and the country is in a great need to increase grain production to meet the increase in the rate of consumption. Soil borne fungi (Fusarium spp. *Rhizoctonia solani, Cephalosporium* spp. and *Macrophomina phaseoli*) cause many diseases such as stalk-rot, late wilt, root-rot and damping-off which decrease not only the quantity but also the quality of both soybean and maize grains (Botros 1988, Liu and Sinclair 1991 and Pronezu *et al.*, 1992).

Many workers (Amein and EL-Shabrawy 1986, Khaled 1987, Singh and Siradhana 1990 and Setty *et al.*, 1991) reported several fungicides (Vitavax / captan, Homai 80, Benlate 50%, Vitavax 200, Bavistin, Bayleton and Captan) to control maize and soybean soil borne pathogens under laboratory and/or greenhouse conditions.

Many plant pathologists indicated that *Trichoderma* spp. at high inoculum potentials decreased the infection with soil borne fungi (Aly 1978, Chet *et al.*, 1979, Comporota 1985 and Khaled 1987). Using chemical and biological methods in combination showed a great value to control such diseases (Chet *et al.*, 1979).

Thus, this work was desinged to study the effect of different ways of control, chemically (with fungicides) and/or biologically with (*Trichodema* spp.), aganist maize and soybean soil borne fungi under laboratory, greenhouse and field conditions.

MATERIALS AND METHODS

1. Chemical control

1.1 Effect of six different fungicides on the linear growth of soil borne fungi under laboratory conditions

The effect of different concentrations (0, 100, 200, 400, 800 and 1000 ug/ml) of tested fungicides Homai, Benlate, Rizolex T,Vitavax 200, Vitavax 300 and Monceren on linear growth of the fungi *Fusarium oxysporum* Schlecht, *F.solani*, (Mort) Sacc, *F.moniliforme* Sheldon *F. graminearum* Schwabe, *F.culmorum* (W.G.S. Smith), Sacc. *Rhizoctonia* solani kuhn., *Cephalosporium maydis* Samra, Sabet and Hingorani, *C.gregatum* Allington and Chamberlain and *Macrophomina* phaseoli Taub.) was studied. Five petri dishes were used as replicates for each tested concentration. Different concentrations of the tested fungicides were added to PDA medium before solidification. Then disks (5 mm in diam) from the cultures of the tested fungi (7 days-old) were used to inoculate the plates and were incubated at 28^{o}C for 5 days. After incubation, when the pathogenic fungi almost covered the surface of the medium in the control treatmet, linear growth was measured in mm by taking the average of two perpendicular diameters.

1.2. Effect of different rates of fungicides on pre and post-emergence damplng-off under greenhouse conditions.

This study was conducted in pots (25 cm in diameter) under greenhouse conditions to investigate the effect of Homai 80, Vitavax thiram 75% Vitavax captan 75%, Rizolex T50% and Monceren 25%, as seed dressing at four rates of 2,3,4 and 5 gm/kg seeds. The plastic pots were sterilized in 5% formalin solution for 15 minutes then left for one week to dry. The autoclaved soil (2 kg.) was infested with each of the prepared fungal inoculum at the rate of 4% of soil weight (w/w). Seeds of Crawford soybean cultivar and Giza 2 maize cultivar were used for planting. Ten pots were assinged for each treatment and 5 seeds were planted per pot for each cultivar and treated with different rates of tested fungicides before planting. Pots were divided into two groups, the first was inoculated with the given pathogenic fungus before planting the treated seeds. The second group was incoulated with the causal organisms separately and planted with untreated seeds (as a control). Disease incidence was recorded as the percentage of pre-and post-emergence damping-off as well as healthy survival plants after 20, 40 and 90 days from planting respectively.

1.3. Effect of different fungicides on disease Incidence under field conditions.

This study was carried to investigate the efficiency of the tested fungicides as seed-dressing treatment on the disease incidence. All fungicides were applied to the maize (Giza 2 cultivar) and soybean (Crawford cultivar) seeds at the recommended doses. Three plots, each plot was 1/250 feddan with 8 ridges, for every treatment, arranged in randomized complete block design according to Snedecor and Cochran (1973), treated with the same as mentioned, except planting control treatment with untreated seeds.

The experiments were conducted in two successive growing seasons. Pattern of intercropping system was sowing maize in two ridges alternated with two soybean ridges. All field practices were followed as recommended. Disease assessment were recorded for each treatment as mentioned in greenhouse experiment. Amount of yield per feddan were also determined.

2. Biological control

2.1. Antagonism between pathogens and *Trichoderma* spp. (*T.harzianun* and *T.viride*) under laboratory conditions :

This experiment was carried out to study the relationship between two *Trichoderma* spp. and the tested pathogenic fungi *Trichodema harzianum* and *T.viride*

were previously isolated from the rhizosphere of intercropped soybean and maize. These isolates were identified by the Mycology Department, Plant Pathology Institute, Agricultural Reaseach Center, Giza. Petri-dishes (9 cm in diameter) each contains 15 ml of PDA medium were used. Each Petri dish was divided into two equal halves, the first half was inoculated with a disk (5 mm in diameter) of the given species of *Trichodema* and the second half was plated with a similar disk of pathogen. Plates inoculated only with the pathogenic fungi acted as control. Each treatment was replicated five times. All Perti-dishes were incubated at 28°C for 6 days and were observed daily. After 6 days of incubation, when the pathogenic fungi almost covered the surface of the medium in control treatment, inhibition zones were measured (cm.).

2.2 Effect of *T.harzianum* and *T.viride* on the percentage of post-emergence damping--off diseases of maize and soybean under greenhouse conditions.

This study was carried out in plastic pots (25 cm in diameter). Pots were sterilized by immersion in 5% fomalin solution for 15 minutes, then left to dry. Every pot was filled with two kgs. of sterilized sandy-loam soil (50% sand and 50% loam w/w). *Trichoderma* spp. as well as the tested fungi were grown on potato broth liquid medium at 28°C for 15 days. Soil in each pot was infested with the fungal growth at the rate of 5%, of soil weight two weeks before cultivation to insure good distribution of inoclum. Five pots were infested separately with tested pathogenic fungus only to serve as a control. Pots were irrigated as needed with tap water. Ten surface sterilized seeds of Giza 2 maize cultivar and/or Crawford soybean cultivar were seeded in every pot. A set of five pots were used for each particular treatment. Pre-and post-emergence damping-off as well as survival plants were counted after 20,40 and 90 days from seeding, respectively.

2.3 Effect of *Trichoderma* spp. (*T.harzianum* and *T.viride*) on diseases incidence under field conditions :

This experiment was carried out at the Experimental farm of Faculty of Agric., Zagazig Univ., during two successive growing seasons. The field was naturally infested with soil borne pathogenic fungi. Five replicates for every treatment were arranged in randomized complete block design with plots 3 x 5.6 meters (1/250 feddan). Giza 2 maize cultivar and Crawford soybean cultivar were planted under intercropping conditions in the same way mentioned before. Inoculum of Tricho-

derma spp was prepared by growing each species in bottles (500 cm) containing 250g crushed barley grains + 0.2 liter of modified gliotoxin fermentation medium according to Brain and Hemming (1945) and Abd El-Moity (1981) and incubated at 28°C for one month under complete darkness to simulate toxin production (Abd El-Moity and Shatla 1981). *T. harzianun* and/or *T.viride* were added to soil at the time of irrigation at the rate of 200 kg/feddan. All field practices were followed as recommended. The disease assessment and the yield/feddan were recorded for each particular treatment as mentioned before.

RESULTS AND DISCUSSION

Evaluation of any given fungicide to control the tested fungi was carried out under lab., greenhouse and field conditions. In laboratory experiment, six systemic fungicides were used to test their effect on the linear growth of the pathogenic fungi. Most of the tested fungicides proved to be effective against these fungi (Table, 1). Homai 80%, Benlate 50% and Vitavax thiram were the most effective fungicides, and completely checked growth of tested fungi at 200, 400 and 400 ug/ml. The effect of Vitavax captan and Rizolex T 50 were moderate resulting in complete inhibition at 80 and 1000 ug/ml respectively , while Monceren 25% was the least effective one. The results indicated that, the fungicidal effect differed according to the given fungicide and the species of tested fungus. Differences in reaction might be due to the selective action of a tested fungicide on particular fungus. These results agree to some extent with those reported by Singh and Siradhana (1990).

In greenhouse experiment, maize and soybean seeds treated with different doses of fungicides indicateed that Homai 80, Benlate 50 and Vitavax thiram were the most effective fungicides even at lower doses (2 gm/kg seeds) followed by Vitavax capatan and Rhizolex T50 at the rate of 4 gm/kg seeds. Monceren 25% was the least effective, it gave the lowest percentage of pre-and post-emergence damping-off at 5 gm/kg seeds (Tables, 2 and 3) .

Similar results were obtained by Salem *et al.*, (1986) and Khaled (1987). When the above mentioned fungicides were used under field conditions at the rate of 3 gm/kg seeds using intercropping system, data indicated that plants treated with Homai 80%, Benlate 50% and Vitavax thiram had the highest percentage of healthy survivals and yield/feddan (Table 4). These results are in complete agreement with Amein and El-Shabrawy (1986), Salem *et al.* (1986), Khaled (1987) and Rao *et al.*

(1991). The differences in fungicides actions were attributed to the selective action of fungicides on a given fungus and due to their differences in physiology and metabolism.

The antagonistic effect of the two species of *Trichodema* (*T.harzianum* and *T.viride*) on the main pathogenic fungi associated with diseases of both crops were studied under laboratory, greenhouse and field conditions. Obtained data indicated that *T.viride* inhibited the growth of the fungi more than *T.harzianum* (Table 5). These results are similar to those obtained by Aly (1978) and Elad *et al.* (1983). Differences in growth on a given media might be due to the constituent of given media favouring growth of one fungus more than the other. Data of the greenhouse experiment indicated that tested *Trichoderma* spp. reduced the percentage of pre-and post-emergence damping-off in infected maize and soybean plants compared with the control treatment (Table 6). Significant differences were obtained between the tested *Trichoderma* spp on the percentage of soybean survivals. On the other hand, non signficant differences could be detected between the effect of *T.harzianun* and T.viride on the percentage of maize survivals. Similar results were reported by Aly (1978) and Chet *et al.* (1979). These differences might be attributed to the complex interaction between host, pathogenic fungi, spieces of Trichodema and other antagonists and/or competition for nutrient or colonization of host roots by various soil microorganisms. Addition of T.harzianum and/or *T.virde* to soil cultivated with maize or soybean plants reduced the percentage of pre-emergence damping-off, root-rot and stem-rot in naturally infested fields (Table, 7), In other words, there was an increase in the percentage of healthy survival plants and yield/feddan as arresult of adding *Trichoderma* spp. compared with untreated soil. These results are in line with those of Chet et al (1979), and might involve the use of *Trichoderma* spp. as a biocontrol agent .

Table 1. Effect of different concentrations of certain fungicides on the mean linear growth of tested fungi.

Tested fungicides	Conc. ug/ml	growth tested fungi (cm)								
		F.oxysporum	*F.solani*	*F.monilforme*	*F.culmorum*	*R.solani*	*C.maydis*	*C.gregatum*	*F.graminearum*	*M.phaseoli*
Homai 80%	000	9.00	9.00	8.67	8.83	9.00	8.50	8.83	8.67	9.00
	100	1.00	1.00	0.00	0.50	2.16	1.00	1.83	1.83	2.50
	200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	1.667	1.667	1.445	1.400	1.555	1.583	1.771	1.750	1.916
Benlate 50%	000	9.00	9.00	8.67	8.83	9.00	8.50	8.83	8.67	9.00
	100	2.83	2.83	0.67	1.50	2.16	1.33	2.33	2.50	2.50
	200	1.67	1.67	0.00	0.00	1.67	0.00	0.50	1.17	1.00
	400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	2.250	2.250	1.556	1.722	2.139	1.638	1.944	2.050	2.080
Vitavax captan 75%	000	9.00	9.00	8.67	8.83	9.00	8.50	8.83	8.67	9.00
	100	5.50	5.50	3.50	4.17	4.50	2.50	2.67	2.50	4.00
	200	3.50	3.50	2.33	3.00	3.33	2.33	1.67	2.33	2.83
	400	1.17	1.17	1.83	1.00	2.16	1.67	1.67	1.83	2.17
	800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	3.194	3.194	2.722	2.83	3.16	2.500	2.190	2.550	3.00
Vitavax thiram 75%	000	9.00	9.00	8.67	8.83	9.00	8.50	8.83	8.67	9.00
	100	3.16	3.16	2.83	2.83	2.83	2.17	1.83	2.33	3.67
	200	2.17	2.17	1.83	1.83	2.16	1.50	0.00	1.83	2.00
	400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	2.309	2.309	2.722	2.249	2.333	2.027	1.777	2.138	2.444
Rizolex T 50	000	9.000	9.000	8.67	8.83	9.00	8.50	8.83	8.67	9.00
	100	6.17	6.17	2.83	5.33	5.67	4.17	3.67	5.50	6.17
	200	3.16	3.16	1.83	4.17	4.17	2.67	3.00	4.17	4.17
	400	2.33	2.33	0.00	2.83	3.33	1.83	1.83	3.17	3.00
	800	1.83	1.83	0.00	1.33	1.67	0.50	1.00	1.67	2.50
	1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	3.750	3.750	2.222	3.749	3.972	2.944	3.055	3.861	4.139
Monceren 25%	000	9.00	9.00	8.67	8.83	9.00	8.50	8.83	8.67	9.00
	100	8.33	8.33	5.50	8.33	8.17	7.33	7.33	7.67	8.67
	200	6.33	6.33	3.83	6.33	5.67	4.83	5.00	5.67	7.17
	400	4.50	4.50	2.50	4.67	4.00	3.33	3.67	3.67	5.33
	800	3.00	3.00	1.17	3.00	2.67	2.17	2.67	2.50	3.50
	1000	1.83	1.83	0.00	1.17	1.17	0.00	0.00	0.00	2.00
	Mean	5.5499	5.5499	3.611	5.388	5.111	4.361	4.582	4.694	5.944
Mean		3.112	3.112	2.739	2.898	2.878	2.500	2.550	2.840	3.250

L.S.D. at 0.01 for	
Fungicides (F)	0.1506
Concentration (C)	0.1433
Fungi (M)	0.1238
F x C	0.3510
F x N	0.3034
F x C x N	0.7431

Table 2. Effect of different doses of tested fungicides on the percentage of pre, postemergence damping-off and healthy survival of maize plants of Giza 2 cultivar.

Tested fungicides	g/kg seed		%								
			F.oxysporum	*F.solani*	*F.moniliforme*	*F.culumorum*	*F.graminearum*	*C.maydis*	*C.graegatum*	*M.phaseoli*	*R.solani*
Homai 80%	0	Pre	40.00	30.00	33.33	30.00	33.33	36.67	16.67	43.33	33.33
		Post	20.00	20.00	23.33	16.67	23.33	23.33	6.67	33.33	26.67
		Healthy	26.67	50.00	43.33	53.33	43.33	40.00	76.67	23.33	40.00
	2	Pre	6.67	16.67	13.33	16.67	6.67	3.33	0.00	3.33	3.33
		Post	10.00	13.33	16.67	3.33	10.00	3.33	0.00	10.00	3.33
		Healthy	80.00	70.00	70.00	80.00	83.33	93.33	100.00	86.67	93.33
	3	Pre	0.00	0.00	33.33	3.33	0.00	0.00	0.00	0.00	0.00
		Post	3.33	6.67	6.67	0.00	0.00	0.00	3.33	0.00	0.00
		Healthy	96.67	93.33	60.00	96.67	100.00	100.00	96.67	100.00	100.00
	4	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00
		Healthy	100.00	100.00	96.67	100.00	100.00	100.00	100.00	100.00	100.00
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Healthy	100.00	100.00	100.00	100.00	100.00	10.00	100.00	100.00	100.00
Benlate 50%	0	Pre	40.00	26.67	33.33	33.33	33.33	33.33	20.00	36.67	36.67
		Post	20.00	20.00	33.33	33.33	26.67	26.67	10.00	36.67	23.33
		Healthy	40.00	53.33	33.33	33.33	40.00	40.00	70.00	26.67	40.00
	2	Pre	10.00	0.00	13.33	13.33	3.33	6.67	0.00	6.67	6.67
		Post	6.67	10.00	13.33	13.33	6.67	6.67	0.00	10.00	6.67
		Healthy	83.33	90.00	73.33	37.33	90.00	86.67	100.00	83.33	86.67
	3	Pre	0.00	0.00	3.33	3.33	0.00	0.00	0.00	0.00	0.00
		Post	3.33	3.33	0.00	0.00	3.33	0.00	0.00	3.33	3.33
		Healthy	96.00	96.67	96.67	96.67	96.67	100.00	100.00	96.67	96.67
	4	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Healthy	96.67	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Healthy	100.00	100.00	100.00	100.00	100.00	100.00	100.00	10.00	100.00
Vitavax captan 75%	0	Pre	30.00	33.33	36.67	36.67	23.33	40.00	16.67	36.67	30.00
		Post	26.67	23.33	26.67	26.67	20.00	23.33	6.67	23.33	20.00
		Healthy	43.33	43.33	36.67	36.67	56.67	36.67	75.67	40.00	50.00
	2	Pre	13.33	13.33	13.33	13.33	16.67	16.67	0.00	16.67	6.67
		Post	6.67	10.00	13.33	13.33	13.33	16.67	0.00	10.00	6.67
		Healthy	80.00	76.67	73.33	73.33	70.00	66.67	100.00	73.33	86.67
	3	Pre	3.33	0.00	3.33	3.33	6.67	3.33	0.00	6.67	0.00
		Post	0.00	3.33	3.33	3.33	6.67	3.33	0.00	10.00	3.33
		Healthy	0.00	96.67	93.33	93.33	86.67	93.33	100.00	83.33	96.67
	4	Pre	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00
		Healthy	0.00	100.00	100.00	100.00	96.67	100.00	100.00	100.00	100.00
	5	Pre	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Healthy	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Vitavax thiram 75%	0	Pre	33.33	30.00	36.67	36.67	36.67	46.67	16.67	43.33	33.33
		Post	20.00	16.67	26.67	26.67	23.33	36.67	10.00	20.33	16.67
		Healthy	46.67	53.33	35.67	35.67	43.67	30.00	73.33	36.67	50.00
	2	Pre	10.00	13.33	13.33	13.33	16.67	23.33	3.33	16.67	16.67
		Post	10.00	6.67	13.33	13.33	20.00	16.67	0.00	13.33	13.33
		Healthy	80.00	80.00	73.33	73.33	63.33	60.00	96.67	70.00	70.00

Table 2. Cont.

Tested fungicides	g/kg seed		%								
			F.oxysporum	*F.solanl*	*F.monilforme*	*F.culumonum*	*F.graminearum*	*C.maydis*	*C.gregatium*	*M.phaseoil*	*R.solanl*
Vitavax captan 75%	3	Pre	0.00	3.33	0.00	0.00	3.33	13.33	0.00	6.67	6.67
		Post	6.67	3.33	6.67	3.33	6.67	10.00	0.00	10.00	6.67
		Healthy	93.33	93.33	93.33	96.67	90.00	76.67	100.00	83.33	86.67
	4	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.33
		Healthy	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	96.67
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Healthy	100.00	100.00	100.00	100.00	10.00	100.00	100.00	100.00	100.00
Vitavax thiram 75%	0	Pre	35.00	33.33	43.33	33.33	33.33	30.00	23.33	46.67	40.00
		Post	20.00	30.00	23.33	26.67	16.67	40.00	10.00	26.67	30.00
		Healthy	43.00	36.67	33.33	40.33	36.67	30.00	66.67	26.67	30.00
	2	Pre	13.33	16.67	33.33	13.33	16.67	20.00	3.33	23.33	32.33
		Post	100.00	23.33	16.67	20.00	10.00	20.00	3.33	20.00	16.67
		Healthy	76.67	60.00	50.00	66.67	66.67	60.00	93.33	56.67	60.00
	3	Pre	6.67	10.00	26.67	6.67	6.67	6.67	0.33	13.33	6.67
		Post	10.00	20.00	13.33	13.33	10.00	16.67	3.33	13.33	13.33
		Healthy	83.33	70.00	53.33	80.00	83.33	80.00	96.67	73.33	80.00
	4	Pre	0.00	0.00	6.67	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	13.33	6.67	6.67	3.33	6.67	0.00	3.33	10.00
		Healthy	100.00	86.67	86.67	93.33	90.00	93.00	100.00	96.67	90.00
	5	Pre	0.00	0.00	6.67	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	3.33	3.33	0.00	23.33	3.33	0.00	3.33	3.33
		Healthy	100.00	96.67	90.00	100.00	96.67	96.67	100.00	96.67	96.67
Monceren 25%	0	Pre	36.67	33.33	46.67	33.33	30.00	23.33	13.33	43.33	46.67
		Post	20.00	30.33	30.00	26.67	16.67	43.33	13.33	30.00	13.33
		Healthy	43.33	43.33	23.00	40.60	46.67	33.33	73.33	26.67	40.00
	2	Pre	20.00	23.33	33.33	26.67	25.67	13.33	6.67	33.33	26.67
		Post	20.00	26.67	23.33	16.67	13.33	30.00	13.33	20.00	16.67
		Healthy	60.00	50.00	43.33	56.67	56.67	56.67	80.00	46.67	56.67
	3	Pre	16.67	16.67	23.33	13.33	13.33	6.67	0.00	20.00	16.67
		Post	10.00	13.33	16.67	13.33	10.00	26.67	3.33	13.33	10.00
		Healthy	73.33	70.00	60.00	73.33	73.33	66.67	96.67	66.67	73.33
	4	Pre	6.67	10.00	13.33	3.33	0.0	3.33	0.00	10.00	0.00
		Post	10.00	10.00	10.00	6.67	0.00	23.33	0.00	6.67	10.00
		Healthy	83.33	80.00	76.67	90.00	100.00	73.33	100.00	83.33	90.00
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.33	0.00
		Post	0.00	0.00	3.33	0.00	0.00	16.67	0.00	3.33	3.33
		Healthy	100.00	100.00	96.67	100.00	100.00	83.33	100.00	93.33	96.67

L.S.D. at 0.01 for	pre	Post	Healtthy
Fungicides (F)	1.480	1.480	2.459
Doses (D)	1.543	1.924	2.573
Fungi (N)	1.509	1.881	2.506
F x D	2.332	2.908	3.873
F x N	2.983	3.719	4.948
D x N	2.751	3.430	4.568
F x D x N	6.429	8.015	10.675

Table 3. Effect of different doses of tested fungicides of pre, pstemergence damping-off and healthy survival of soybean plants of Crawford cultivar.

Tested fungicides	g/kg seed		%								
			F.oxysporum	*F.solanl*	*F.monilforme*	*F.culumonum*	*F.graminearum*	*C.maydis*	*C.gregatium*	*M.phaseoil*	*R.solanl*
Homai 80%	0	Pre	36.67	36.67	36.67	26.67	26.67	33.33	10.00	36.67	46.67
		Post	33.33	36.67	43.33	36.67	33.33	33.33	13.33	36.67	36.67
		Healthy	30.00	26.67	20.00	36.67	40.00	33.33	76.67	26.67	16.067
	2	Pre	10.00	13.33	20.0	13.33	16.00	13.33	3.33	23.33	20.00
		Post	16.67	16.67	23.33	20.00	26.67	46.67	3.33	23.33	26.67
		Healthy	73.33	70.00	56.67	66.67	56.67	40.00	93.33	53.33	53.33
	3	Pre	0.00	6.67	10.00	3.33	0.00	67.67	0.00	6.67	13.33
		Post	6.67	13.33	13.33	13.33	1.67	20.0	6.67	16.67	1.33
		Healthy	93.33	80.00	76.67	83.33	83.33	73.33	93.33	76.67	73.33
	4	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	3.33	3.33	6.67	6.67	3.33	16.67	3.33	23.33	23.33
		Healthy	96.67	96.67	93.38	93.33	96.67	83.33	96.67	76.67	76.67
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	3.33	0.00	0.00	0.00	3.33	6.67	0.00	13.33	16.67
		Healthy	96.67	10.00	10.00	10.00	96.66	93.33	100.00	86.67	83.83
Benlate 50%	0	Pre	36.67	36.67	36.67	26.67	26.67	33.33	10.00	36.67	46.67
		Post	33.33	36.67	43.33	36.67	33.33	33.33	13.33	3.67	36.67
		Healthy	30.00	26.67	2.00	36.67	40.00	33.33	6.67	26.67	16.67
	2	Pre	10.00	3.33	1.00	13.33	6.67	16.67	3.33	26.67	23.33
		Post	16.67	23.33	26.67	26.67	23.33	26.67	0.00	16.67	16.67
		Healthy	73.33	73.33	63.33	60.00	70.00	56.66	96.67	56.67	60.00
	3	Pre	0.00	0.00	0.00	3.33	3.33	10.00	0.00	6.67	1.00
		Post	10.00	10.00	13.33	16.67	16.67	26.67	3.33	20.00	1.67
		Healthy	90.00	90.00	86.67	80.00	80.00	63.33	96.67	73.33	73.33
	4	Pre	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00
		Post	3.33	3.33	1.00	3.33	10.00	20.00	0.00	13.33	16.67
		Healthy	96.67	96.67	90.00	96.67	96.00	76.67	100.00	86.67	83.33
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	3.33	3.33	1.00	6.67	3.33	63.67	0.00	16.67	10.00
		Healthy	96.66	96.67	90.00	96.00	96.67	93.33	100.00	83.33	90.00
Vitavax captan 75%	0	Pre	36.67	36.66	36.67	26.67	26.67	33.33	1.00	36.67	46.67
		Post	33.33	36.66	43.33	36.67	33.33	33.33	13.83	36.67	36.67
		Healthy	30.0	26.67	20.00	36.67	40.00	33.33	76.67	26.67	16.67
	2	Pre	16.67	23.33	26.67	13.33	16.67	23.33	6.67	1.67	13.33
		Post	23.33	30.00	30.00	26.67	2.00	20.00	3.33	20.00	23.33
		Healthy	60.00	46.67	43.33	56.67	63.33	56.67	90.00	63.33	63.33
	3	Pre	6.67	3.33	6.67	6.67	13.33	6.67	0.00	0.00	6.67
		Post	20.00	20.00	26.67	23.33	20.00	23.33	3.33	6.67	23.33
		Healthy	73.33	67.76	66.67	70.70	66.00	70.00	96.67	93.33	76.67
	4	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	6.67	10.00	10.00	10.00	3.33	16.67	0.00	26.67	23.33
		Healthy	93.33	90.00	90.00	90.00	66.67	83.33	100.00	73.33	76.67
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	3.00	3.33	3.33	6.33	13.33	0.00	13.33	20.00
		Healthy	100.00	96.67	96.67	96.67	93.67	68.67	100.00	86.67	80.00
Vitavax thiram 75%	0	Pre	36.67	36.67	36.67	26.67	26.67	33.33	10.00	36.67	46.67
		Post	33.33	36.67	43.33	36.67	33.33	33.33	13.33	36.67	36.67
		Healthy	30.00	26.67	20.00	36.63	43.00	33.33	76.67	26.67	16.67
	2	Pre	6.67	13.33	16.67	13.00	1.00	23.33	6.67	13.33	26.67
		Post	13.33	26.67	20.00	20.0	16.67	33.33	10.00	26.66	26.67
		Healthy	80.00	60.00	63.33	2.00	73.33	43.33	83.33	60.00	46.67

Table 3.Cont.

Tested fungicides	g/kg seed		%								
			F.oxysporum	*F.solanl*	*F.monilforme*	*F.culumorum*	*F.graminearum*	*C.maydis*	*C.graegatium*	*M.phaseoli*	*R.solanl*
Vitavax thiram 75%	3	Pre	0.00	3.33	3.33	3.33	3.33	13.33	0.00	3.33	13.33
		Post	3.33	13.33	16.67	6.67	23.33	23.33	3.33	16.67	20.00
		Healthy	96.67	83.33	80.00	90.00	33.33	63.33	96.67	80.00	66.67
	4	Pre	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00
		Post	0.00	3.33	6.67	3.33	16.67	13.33	3.33	16.67	10.00
		Healthy	100.00	96.67	93.33	96.67	93.33	83.33	96.67	83.33	90.00
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	0.00	0.00	3.33	3.33	6.67	10.00	0.00	13.33	13.33
		Healthy	100.00	100.00	96.67	96.67	93.33	90.00	100.00	86.67	86.67
Vitavax captan 75%	0	Pre	36.67	36.67	36.67	26.67	26.67	33.33	10.00	36.67	46.67
		Post	33.33	36.67	43.33	36.67	33.33	33.33	13.33	36.67	36.67
		Healthy	30.00	26.67	20.00	36.67	40.00	33.33	76.67	26.67	16.67
	2	Pre	13.33	13.33	10.00	16.67	23.33	13.33	10.00	16.67	23.33
		Post	20.00	20.00	20.00	20.00	26.67	30.00	3.33	36.67	23.33
		Healthy	66.67	66.67	70.00	63.33	50.00	56.66	86.67	46.67	53.33
	3	Pre	3.33	0.00	3.33	3.33	6.67	6.67	3.33	6.67	10.00
		Post	16.67	20.00	20.00	13.33	16.33	16.67	0.00	23.33	20.00
		Healthy	80.00	80.00	76.67	83.33	70.00	76.67	96.67	70.00	70.00
	4	Pre	0.00	0.00	0.00	0.00	3.33	0.00	3.33	3.33	6.67
		Post	6.67	10.00	6.67	6.67	16.67	10.00	0.00	23.33	13.33
		Healthy	93.33	90.00	93.33	93.33	80.00	90.00	96.67	73.33	80.00
	5	Pre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Post	3.33	3.33	3.33	3.33	3.33	10.00	0.00	16.67	6.67
		Healthy	96.67	96.67	96.67	96.67	96.67	90.00	100.00	83.33	93.33
Monceren 25%	0	Pre	36.67	36.67	36.67	26.67	26.67	33.33	10.00	36.67	46.67
		Post	33.33	36.67	43.33	36.67	33.33	33.33	13.33	36.67	36.67
		Healthy	30.00	26.67	20.00	36.67	40.00	33.33	76.67	26.67	16.67
	2	Pre	33.33	23.33	26.67	26.67	3.33	23.33	6.67	30.00	26.67
		Post	30.00	26.67	30.00	23.33	26.67	36.67	6.67	26.67	23.33
		Healthy	36.66	50.00	43.33	50.00	43.33	40.00	86.67	43.33	50.00
	3	Pre	16.67	16.67	23.33	13.33	23.33	16.67	0.00	16.67	23.33
		Post	23.33	23.33	26.67	20.00	23.33	33.33	6.67	26.67	20.00
		Healthy	60.00	60.00	50.00	66.67	53.33	50.00	93.33	56.67	56.67
	4	Pre	13.33	3.33	10.00	6.67	0.00	6.67	0.00	6.67	13.33
		Post	13.33	13.33	16.67	16.67	3.33	23.33	3.33	26.67	23.33
		Healthy	73.33	83.33	73.33	76.67	96.67	70.00	96.67	66.67	63.33
	5	Pre	3.33	0.00	3.33	3.33	0.00	0.00	0.00	0.00	3.33
		Post	10.00	3.33	6.66	3.33	3.33	20.00	3.33	16.67	36.67
		Healthy	86.67	96.67	90.00	93.33	96.67	80.00	96.67	83.33	60.00

L.S.D. at 0.01 for	pre1.405	Post	Healtthy
Fungicides (F)	1.405	1.445	2.033
Doses (D)	1.465	1.498	2.119
Fungi (N)	1.432	1.464	2.072
F x D	2.214	2.263	3.202
F x N	2.828	2.891	4.091
D x N	2.611	2.669	3.777
F x D x N	6.102	6.237	8.826

Table. 4. Effect of six fungicides on the percentage of the disease incidence incidence and yield of maize and soybean plants during two successive seasons.

Tested fungicides	Growing seasons	Percentage of: Pre-emergence damping-off		Root-rot		Stalk-rot		Late wilt		Healthy survival plant		Yield ton/feddan	
		Maize	Soybean	Maize	Soybean	Maize	Soybean	Maize	Soybean	Maize	Soybean	*Maize	**Soybean
Homai 80%	1st season	2.667	3.333	3.333	3.667	3.333	5.000	8.667	-	81.000	88.000	1.410	0.955
	2nd season	2.333	3.333	0.667	6.333	3.000	6.333	6.333	-	87.667	84.000	1.517	0.955
Benlate 50%	1st season	5.000	4.667	4.66	6.333	4.333	6.000	8.333	-	77.667	83.000	1.328	0.945
	2nd season	3.000	5.667	1.667	9.000	0.667	9.333	7.667	-	87.000	75.000	1.517	0.897
Rizolex T 50%	1st season	10.667	14.333	3.667	6.667	7.667	9.333	11.667	-	66.333	69.667	1.043	0.774
	2nd season	10.667	11.333	5.000	10.000	8.000	12.333	12.000	-	64.333	66.333	1.029	0.762
Vitavax thiram 75%	1st season	8.333	13.333	3.667	13.000	5.333	10.000	7.667	-	75.000	63.667	1.132	0.838
	2nd season	8.000	12.333	4.000	10.667	5.667	9.333	8.667	-	73.607	67.667	1.029	0.800
Vitavax captan 75%	1st season	7.667	9.000	5.000	6.000	4.333	4.000	11.333	-	71.667	81.000	1.08	0.832
	2nd season	6.333	6.333	4.333	8.000	3.000	6.333	10.667	-	75.667	79.333	1.223	0.820
Monceren 25%	1st season	13.000	21.667	8.333	1.000	5.66	10.000	12.333	-	60.667	57.333	0.940	0.602
	2nd season	13.000	21.667	9.333	11.000	6.333	11.667	10.667	-	60.667	55.667	0.922	0.525
Control	1st season	20.000	29.333	7.667	14.333	6.667	13.000	13.667	-	51.667	43.333	0.758	0.614
	2nd season	18.667	35.000	9.333	17.000	6.333	15.333	11.333	-	54.333	32.667	0.826	0.509

L.S.D. at 0.01 for	* Seasons (S)**		* Fungicides (S)**		* S x F**	
Pre-emergence damping-off%	0.739	N.S.	2.177	3.391	N.S.	3.538
Root-rot %	2.249	0.939	3.181	1.946	1.940	2.752
Stalk-rot%	N.S.	2.168	1.498	2.999	2.119	N.S.
Late wilt %	N.S.	-	1.659	-	N.S.	-
Healthy survival plants %	N.S.	N.S.	3.143	4.116	4.432	5.821
Yield (ton/feddan)	N.S.	N.S.	0.147	0.250	0.217	N.S.

Table. 5. The antagonistic effect of T.harzianum and T.viride one the tested pathogenic fungi measured as width of inhibition zone (cm).

Pathogenic fungi	Length of inhibition zone (cm)		
	Control	*T.harzianum*	*T.viride*
F. oxysporum	0.0	2.7	2.1
F.solani	0.0	3.2	3.0
F.culmorum	0.0	3.2	3.5
F.moniliforme	0.0	2.2	3.2
F.graminearum	0.0	2.1	2.7
C.maydis	0.0	3.3	3.7
C.gregatum	0.0	3.0	3.5
M.phaseoli	0.0	2.0	2.4
R.solani	0.0	3.2	3.5

L.S.D. at 0.01 for

Antagonistic fungi	0.10
Pathogenic fungi	0.25
Interaction	0.43

Table. 6. Effect of Trichoderma harzianum and T.viride on the percentage of pre, post-emergence damping-off and healty survival of maize and soybean plants under re-enhouse conditions.

Pathogenic fungi	Pre-emergence damping-off	Biocontrol: Control		*T.harzianum*		*T.viride*	
		Maize	Soybean	Maize	Soybean	Maize	Soybean
F.oxysporum	Pre-emergence	33.333	36.667	6.667	10.000	16.667	16.667
	Post-emergence	26.667	30.000	10.000	3.333	10.000	13.333
	Healthy survival	40.000	33.333	83.333	86.667	73.333	70.000
F.solani	Pre-emergence	33.333	26.667	10.000	6.667	13.333	16.667
	Post-emergence	36.667	20.000	16.667	6.667	20.000	20.000
	Healthy survival	30.000	53.333	73.333	86.667	66.667	63.333
F.culmorum	Pre-emergence	33.333	26.667	10.000	13.333	16.667	23.333
	Post-emergence	30.000	26.667	10.000	10.000	20.000	16.667
	Healthy survival	40.000	46.667	80.000	76.667	63.333	60.000
F.oniliforme	Pre-emergence	30.000	33.333	16.667	10.000	16.667	20.000
	Post-emergence	30.000	36.667	10.000	10.000	16.667	23.333
	Healthy survival	40.000	30.000	73.333	80.000	66.667	56.667
F.graminearum	Pre-emergence	40.000	20.000	10.000	13.33	23.333	10.000
	Post-emergence	26.667	23.333	23.333	6.667	16.667	10.000
	Healthy survival	33.333	56.667	66.67	80.000	60.000	80.000
C.maydis	Pre-emergence	43.333	13.333	13.333	6.667	16.667	23.333
	Post-emergence	33.333	16.667	13.333	6.667	6.667	20.000
	Healthy survival	23.333	70.000	73.333	86.667	76.667	56.667
C.gregatum	Pre-emergence	16.667	26.667	3.333	16.667	3.333	10.000
	Post-emergence	16.667	30.000	3.333	13.333	3.333	13.333
	Healthy survival	66.667	43.333	93.333	70.000	93.333	76.667
M.phaseolfi	Pre-emergence	43.333	33.333	20.000	13.333	20.000	10.000
	Post-emergence	40.000	36.66	13.333	10.000	16.667	13.333
	Healthy survival	16.667	30.000	66.667	76.667	63.333	76.667
R.solani	Pre-emergence	36.667	30.000	13.333	13.333	16.667	13.333
	Post-emergence	33.333	23.333	13.333	13.333	19.000	13.333
	Healthy survival	30.000	46.667	73.333	73.333	73.333	73.333

L.S.D. at 0.01 for	* Pathogenic funig (P)**		* * Treatments (T)**		* P x T**	
Antigonistic fungi	6.962	6.962	8.778	8.788	N.S.	N.S.
Pathogenic fungi	11.711	11.140	7.806	7.806	N.S.	N.S.
Interaction	8.861	8.861	8.899	8.899	11.55	11.550

Table. 7. Effect of Trichoderma harzianum and T.viride on the percentage of some disease incidence and yied of maize and soybean plants.

Characters	Growing seasons	Biocontrol					
		T.harzianum		*T.viride*		Control	
		Maize	Soybean	Maize	Soybean	Maize	Soybean
Pre-emergence damping-off %	1st season	2.667	5.333	4.000	7.667	21.333	27.667
	2 nd season	2.00	2.000	3.333	8.000	18.333	28.333
Root-rot %	1st season	3.333	2.333	4.333	5.667	15.333	18.333
	2 nd season	2.667	2.333	3.333	6.667	16.333	23.667
Stalk-rot %	1st season	1.333	2.333	1.000	7.667	12.667	17.333
	2 nd season	1.667	1.667	0.667	8.667	14.333	17.333
Late wilt %	1st season	5.000	-	5.333	-	20.333	-
	2 nd season	5.000	-	7.667	-	20.333	-
Healthy survival plants %	1st season	87.667	90.000	85.333	79.000	30.333	36.667
	2 nd season	88.667	94.000	85.000	76.667	30.667	30.667
Yield (ton/feddan)	1st season	1.789	0.191	1.757	0.810	0.744	0.412
	2 nd season	1.773	0.923	1.888	0.822	0.072	0.512

L.S.D. at 0.01 for	* Seasons (S)**		* * Treatments (T)**		* S x T**	
Pre-emergence damping-off %	1.107	1.107	1.739	1.739	N.S.	N.S.
Root-rot%	N.S.	N.S.	1.991	1.991	N.S.	N.S.
Stalk-rot%	N.S.	N.S.	1.549	1.549	N.S.	N.S.
Late wilt %	N.S.	-	8.013	-	N.S.	-
Healthy survival plants %	N.S.	N.S.	3.681	3.681	N.S.	N.S.
Yield (ton/feddan)	N.S.	N.S.	0.337	2.410	N.S.	N.S.

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المقاومة الكيماوية والحيوية لبعض امراض الذرة الشامية وفول الصويا تحت ظروف التحميل

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تم دراسة تأثير التركيزات المختلفة للمبيدات المختبرة وكذلك أنواع الفطر تريكودرما ضد الفطريات القاطنة بالتربة المسببة لبعض أمراض الذرة الشامية وفول الصويا مثل : أجناس الفيوزايوم والسيفالوسبوريم وكذلك ريزوكتونيا سولانى وماكروفومينا فاسيولاى تحت ظروف المعمل والصوبة والحقل و أجريت تجارب الحقل فى موسمين زراعيين متتاليين.

وقد أثبتت الدراسة أن مبيد هومای ٨٠ كان أقوى المبيدات تأثيراً يليه المبيد الفطرى بنليت ٥٠٪ والفيتافاكس ثيرام ٧٥٪ بينما كان المبيد الفطرى مونسرين ٢٥٪ أقل هذه المبيدات تأثيراً ومن ناحية أخرى وجد أن الفطر تريكودرما فيردى كان أكثر الأنواع المستخدمة تضاداً لجميع الفطريات الممرضه بينما كان الفطر تريكردرما هارزيانم أقل تأثيراً تحت ظروف المعمل. وقد أظهرت التجارب التى أجريت تحت ظروف الصوبة والحقل أن أنواع الفطر – تريكودرما المستخدمة أدت الى انخفاض ملحوظ فى مرض موت البادرات وبالتالى زيادة فى النسبة المئوية للنباتات السليمة.