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COTTON DAMPING OFF DISEASE CONTROL UNDER INTERCROPPING SYSTEM WITH SOME WINTER CROPS.

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ABSTRACT

It well known that intercropping cotton with wheat increase the percentage of damping off infection by cotton followed by intercropping cotton with faba bean, while the lowest percentage of cotton damping off disease was recorded with intercropping cotton with onion and garlic.

Percentage of cotton damping off infection was decreased in the West Side of ridge compared with the East Side. Seed dressing decreased the percentage of pre- and post-emergence damping off, where Homai 80 and Benlate 50 followed by Vitavex captan and Rizolex T50. Using two isolates from each of *Trichoderma harzianum* and *T. viridi* decreased the percentage of infection with cotton damping off. *T. harzianum* was the most effective in controlling damping off disease incidence followed by *T. viridi*.

Keywords: Integrated Management, Cotton, Damping off isease, Intercropping, Fungicides, Biological control.

INTRODUCTION

Wheat (*Triticum sativum* L.), faba bean (*Vicia faba* L.), onion (*Allium cepa* L.) and garlic (*allium sativum* L.) are important food winter crops. Egypt needs a great increase in food production, especially wheat production, to meet the increase of rate of consumption. Area cultivated with cotton decrease land need to cultivate crops. Accordingly, relay Intercropping cotton with winter crops played an important role in increasing production of wheat, faba bean and onion. Kamel *et al.* (1992) and Metwally *et al.* (1998) reported that under intensive cropping system, population of soil borne fungi such as *Pythium* spp., *Rhizoctonia solani, Fusarium solani, Fusarium oxysporum* and *Macrophomina phaseolina* under intercropping conditions lead to increase in occurrence of damping off disease (Sumner *et al.*, 1978; Sumner and Bell, 1982; Litsinger and Mody, 1983; Botros, 1988 and Ismail, 1994).

Many investigators studied the effect of seed dressing fungicides such as Homia 80, Vitavax captan, Rizolex T. 50 and Benlate 50 % for controlling damping off, root rot and wilt diseases (Khaled, 1987; Rao *et al.*, 1991 and Ismail, 1994).

Trichoderma spp. was used by many investigators (Elad *et al.*, 1983; Camporota, 1985 and Khaled, 1987) to control diseases caused by soil borne fungi such as *Sclerotium rolfsii, Rhizoctonia solani, Fusarium solani* and *Macrophomina phaseoli.*

Ismail (1994) found that treatment soil with *Trichoderma* spp. under intercropping field conditions lead to a significant increase in percentage of healthy survival plants and yield/ feddan to both of soybean and maize plants. Thus, this investigation was conducted to study the control methods for cotton damping off by using intercropping sowing patterns, fungicides and bioagents as integrated control.

MATERIALS AND METHODS

1. Field trails:

Two field trails were conducted during two successive winter growing seasons in 1999/ 2000 and 2000/ 2001 to evaluate the effect of relay cropping of cotton with wheat, faba bean, onion and garlic under one intercropping sowing patterns (i.e. wide ridge of 120 cm width, 6 rows of wheat, faba bean, onion and/ or garlic in middle: 2rows cotton in east and west sides of ridge were sown). Plot area was 10.5 m^2 (1/ 400 Feddan). Wheat cv. Gemmiza 9, Faba bean cv. Giza 3, onion cv. Giza 20 and garlic cv. Balady (obtained from Field Crops Res. Inst., ARC, Giza, Egypt) were sown on 20*th* November except garlic was sown on 15*th* September in both seasons. Cotton cv. Giza 85 was sown on 20*th* March, which was relayed with wheat, faba bean, onion and garlic in both seasons. Wheat, faba bean seeds, seedling of onion and cloves of garlic were seeded on the middle of wide blade (120 cm width). While, cotton was seeded on both sides of the same blade (120 cm). On the other hand, wheat, garlic and onion plants were fertilized by 70 kg of N_2, 15.5 kg P_2O_5 and 48 kg of K / feddan. While, faba bean plants were fertilized by 40 kg of N_2, 15.5 kg P_2O_5 and 48 kg of K / feddan. Cotton plants were fertilized at a rate of 70 kg of urea/ feddan. Wheat, faba bean onion and garlic were harvested from 20 to 25*th* May in both seasons, respectively. In control treatment, cotton crops were seeded as sole cropping on both sides of blade (120 cm). The normal cultural practices for growing wheat, faba bean, onion, garlic and cotton were followed. Percentage of pre- and post-emergence damping off to cotton plants were recorded after 30 and 60 days from planting respectively and the percentage of healthy plants were calculated and pathogenic fungi were isolated from diseased plants.

2. Effect of some seed disinfectant fungicides on disease incidence:

This study was carried out to investigate the efficiency of the tested fungicides as seed dressing treatment on cotton damping off disease incidence. All used fungicides were applied at the recommended dose of the producing companies as shown in Table 1. In each case, three plots were left without treatment to serve as a control. This experiments were conducted in two successive winter growing seasons in 1999/ 2000 and 2000/ 2001. Giza 85 cotton cultivar was planted under intercropping conditions. All field practices were followed as mentioned previously. Disease assessments were recorded as mentioned before for each treatment.

Table 1: List of tested fungicides; their active ingredient, chemical structure, recommended doses and manufactures.

Fungicides common name	Active ingredients	Conc.	Chemical structure	Producing company	Recommended dose (g/ kg seed)
Homai	Thiophonate methyl + thiram	80%	50% 1,2 bis (3 methyoxy caronyl, 1,2 thioreido) benzene (thiophonate-methyl), 30% Thyrum bis (dimethyl-thiocarbamyl disulphide).	Niponsora	3.0
Benlate 50	Benomyl	50%	Methioal-1-(butyl carbomoyl) benzimidazol-2- ylcarbamate.	Dupont	2.0
Rizolex T50	Tolcofos methyl + Thiram	50%	20% Rizolex: (Toklofas-methy0,0 dimethyl) 0-(2,6 dicholoro-4-methyl-phenyl phosphor-othiale. 30% Thiram (TMTD): bis (dimethyl-thiocarbamyl dissulphide)	Sumitomo Chem. Co. LTD.	3.0
Vitavex 300	Carboxin cabtan	75%	37.5% N-tricholoromethyl-meracapro-4-cyclohexane1,2-dicarboximide. 37% 5,6-dihydro-2-methyl-1,4othathin-3-carboxinilide.	Uniroyal Inc.	3.0

3. Effect of *Trichoderma* spp. (*T. harzianum* and *T. viridi*) on disease incidence:

This experiment was carried out at Experimental Farm of Tag El-Ezz Agric Research Station, El-Dakahlia during two successive winter growing seasons 1999/ 2000 and 2000/ 2001. The experimental field was known as naturally infested with pathogenic fungi. Three replicates for every treatment were arranged in randomized complete block design with 3 X 3.5 m (1/ 400 feddan). The previous mentioned cultivativars of wheat faba bean, onion, garlic and cotton were sown in suitable sowing dates for each crop under intercropping cotton with other winter crops as mentioned before. Two races from each of *T. harzianum* (R_1 & R_2) *T. viridi* (R_1, R_2) were used in this experiment. Inoculum of *Trichoderma* spp. was prepared by growing each species in bottles (500 cm) containing 250 g crushed barely grains + 0.2 liter of modified gliotoxin fermentation medium according to Abd El-Moity (1981).

T. harzianum and/ or *T. viride* were added to soil at the time of sowing irrigation cotton at the rate of 200 kg/ feddan. All field practices were followed as mentioned before. Disease assessments were recorded for each particular treatment.

4. Statistical analysis:

Statistical analysis for all the previously mentioned experiments had been carried out according to the methods described by Snedecor and Cochoran (1980).

RESULTS AND DISCUSSION

Data in Tables 2 and 3 indicate that the intercropping of cotton with wheat and faba bean plants increased the percentage of pre- and post-emergence damping off, and so, decreased the healthy survival plants of

cotton as compared with sole cropping control plants. Intercropping cotton with wheat plants was more effective in increasing percentage of pre- and post-emergence damping off, followed by intercropping cotton with faba bean plants. While, intercropping cotton with garlic and onion plants gave the lowest percentage of pre- and post-emergence damping off of cotton plants. Generally, sowing cotton seeds on East side of blade leads to decrease the percentage of pre- and post-emergence damping off disease compared with the West side of blade. It is clear from the same Tables that the best intercropping system of cotton with winter crops was suitable with garlic followed by onion due to the law percentage of pre- and post-emergence damping off in these cases.

Table 2: Effect of intercropping cotton with some winter crops on the percentage of damping off disease incidence of cotton plants; season 1999/ 2000.

Treatments	Pre-emergence damping off (%)		Post- emergence damping off (%)		Healthy survival plants (%)	
	E.	W.	E.	W.	E.	W.
Wheat	16.0	19.0	15.0	18.0	69.0	63.0
Faba bean	14.0	16.0	12.0	14.0	74.0	70.0
Onion	2.0	4.0	3.0	4.0	95.0	92.0
Garlic	0.0	4.0	2.0	3.0	98.0	93.0
control	0.0	3.0	0.0	2.0	100.0	95.0
L.S.D. at 5 %	5.6	6.8	4.8	5.9	14.5	

E = East Side of ridge. W = West side of ridge.

Table 3: Effect of intercropping cotton with some winter crops on the percentage of damping off disease incidence of cotton plants; season 2000/ 20001.

Treatments	Pre- emergence damping off (%)		Post- emergence damping off (%)		Healthy survival plants (%)	
	E.	W.	E.	W.	E.	W.
Wheat	16.0	20.0	13.0	20.0	71.0	60.0
Faba bean	15.0	19.0	13.0	19.0	72.0	62.0
Onion	2.0	4.0	0.0	0.0	98.0	96.0
Garlic	0.0	2.0	0.0	3.0	100.0	95.0
Control	0.0	2.0	0.0	2.0	100.0	96.0
L.S.D. at 5%	5.1	6.2	5.8	4.6	12.6	14.6

E = East Side of ridge. W = West side of ridge.

Increase disease incidence under intercropping cotton with wheat and faba bean compared with cotton sole cropping and/ or intercropping cotton with onion and garlic might be due to the higher density of wheat and faba bean plants. Moreover, higher lengths of stem of faba bean and wheat plants change in microclimate among and under plants especially temperature and relative humidity. This microclimate was similar to the incubator microclimate, which led to increase the density of soil borne microorganisms. These results are in harmony with those obtained by Botros (1988) and Ismail (1994).

Rizocotonia solani, *Fusarium oxysporum*, *Macrophomina phaseoli* and *sclerotium rolfsii* were isolated from cotton damping off plants.

Concerning the effect of seed dressing by fungicides on the pre- and post-emergence damping off as well as healthy survival plants during intercropping, data in Tables 4 and 5 show that the pre- and post-emergence damping off were decreased when all fungicide treatments were used on two sides of ridge the same components increased the healthy survival plants during intercropping of cotton with winter crops i.e., wheat, faba bean, onion and garlic. The highest effect of fungicides treatment for decreasing the disease incidence was Benlate 50 % ,followed by Homai 80% then Vitavex captan, while, Rizolex T 50 % came at the end. The great reduction of the pre- and post-emergence damping off occurred under intercropping cotton with garlic plants, which treated by Benlate 50 % and Homai 80 %. Moreover, the healthy survival cotton plants were similar to control plants. Also, intercropping cotton with onion plants that were treated by Benlate 50 % and Homai 80 % as seed dressing in both seasons gave the highest percentage of survival plants

Differences in fungicide reactions might beattributed to the genetic differences of tested pathogenic fungi, which affected their metabolism living activities and cell permeability. On the other hand, it is also might be due to the active ingredients of fungicides used which was more or less toxic and consequently save or kill the pathogens. These results were in agreement with those obtained by Khaled (1987); Botros (1988) and Ismail (1994).

Table 4: Effect of some seed dressing on the percentage of pre- and post-emergence damping off and healthy survival of intercropping cotton with winter crops; season 1999/ 2000.

Treatment	Fungicide	Pre-emergence damping off (%)		Post-emergence damping off (%)		Healthy survival plants (%)	
		E.	W.	E.	W.	E.	W.
Wheat	Homai 80%	2.0	4.0	5.0	9.0	93.0	87.0
	Benlate 50%	3.0	6.0	6.0	8.0	91.0	86.0
	Rizolex T 50%	5.0	8.0	10.0	12.0	85.0	80.0
	Vitavax captan	5.0	6.0	8.0	10.0	87.0	84.0
Faba bean	Homai 80%	3.0	6.0	4.0	10.0	93.0	84.0
	Benlate 50%	2.0	6.0	6.0	10.0	92.0	84.0
	Rizolex T 50%	5.0	12.0	4.0	16.0	91.0	72.0
	Vitavax captan	2.0	10.0	5.0	13.0	93.0	77.0
Onion	Homai 80%	0.0	2.0	0.0	2.0	100.0	96.0
	Benlate 50%	0.0	0.0	0.0	0.0	100.0	100.0
	Rizolex T 50%	2.0	4.0	0.0	6.0	98.0	90.0
	Vitavax captan	0.0	3.0	0.0	3.0	100.0	94.0
Garlic	Homai 80%	0.0	0.0	0.0	2.0	100.0	98.0
	Benlate 50%	0.0	0.0	0.0	2.0	100.0	98.0
	Rizolex T 50%	3.0	4.0	0.0	4.0	97.0	92.0
	Vitavax captan	2.0	2.0	0.0	3.0	98.0	95.0
Control	Homai 80%	0.0	0.0	0.0	0.0	100.0	100.0
	Benlate 50%	0.0	0.0	0.0	0.0	100.0	100.0
	Rizolex T 50%	0.0	2.0	0.0	2.0	100.0	96.0
	Vitavax captan	0.0	0.0	0.0	3.0	100.0	97.0
L.S.D. at 5 %		2.32	3.36	2.63	3.82	15.63	12.83

E =East Side of ridge. W =West Side of ridge.

Table 5: Effect of some seed dressing on the percentage of pre- and post-emergence damping off and healthy survival of intercropping cotton with winter crops; season 2000/ 2001.

Treatment	Fungicide	Pre-emergence damping off (%)		Post-emergence damping off (%)		Healthy survival plants (%)	
		E.	W.	E.	W.	E.	W.
Wheat	Homai 80%	2.0	6.0	5.0	8.0	92.0	86.0
	Benlate 50%	0.0	6.0	3.0	8.0	97.0	86.0
	Rizolex T 50%	8.0	8.0	10.0	15.0	82.0	77.0
	Vitavax captan	6.0	10.0	7.0	10.0	87.0	80.0
Faba bean	Homai 80%	10.0	12.0	6.0	8.0	84.0	80.0
	Benlate 50%	6.0	12.0	4.0	6.0	90.0	82.0
	Rizolex T 50%	12.0	15.0	10.0	15.0	98.0	70.0
	Vitavax captan	10.0	13.0	8.0	12.0	82.0	75.0
Onion	Homai 80%	0.0	2.0	0.0	5.0	100.0	93.0
	Benlate 50%	0.0	0.0	2.0	4.0	98.0	96.0
	Rizolex T 50%	4.0	5.0	3.0	5.0	93.0	90.0
	Vitavax captan	2.0	3.0	4.0	5.0	93.0	92.0
Garlic	Homai 80%	0.0	0.0	0.0	0.0	100.0	100.0
	Benlate 50%	0.0	0.0	0.0	0.0	100.0	100.0
	Rizolex T 50%	0.0	2.0	0.0	2.0	100.0	96.0
	Vitavax captan	0.0	1.0	0.0	0.0	100.0	99.0
Control	Homai 80%	0.0	0.0	0.0	2.0	100.0	98.0
	Benlate 50%	0.0	0.0	2.0	4.0	98.0	96.0
	Rizolex T 50%	0.0	4.0	5.0	5.0	95.0	91.0
	Vitavax captan	0.0	0.0	4.0	5.0	96.0	95.0
L.S.D. at 5 %		.92	23.21	2.62	3.41	14.52	13.92

E = East Side of ridge. W = West Side of ridge.

Tables 6 and 7 show that the effect of *Trichoderma* spp. (*T. harzianum* and *T. viridi*) on the percentage of the pre- and post-emergence damping off as well as healthy survival of cotton plants during its intercropping with certain winter crops (wheat, faba bean, onion and garlic). There was a reduction in the pre- and post-emergence damping off as well as increasing healthy survival plants due to the application by any races of *T. harzianum* or *T. viridi.* It is worthy to mention that, the first species of *Trichoderma* was the most effective in decreasing the percentage of the pre- and post-emergence damping off for cotton plants as compared with second species. However, the decrease in disease incidence due to bioagent treatment of *T. harzianum* was more than that occurred by fungus *T. viridi.* Generally, the intercropping of cotton with wheat plants led to the increase in the pre- and post-emergence damping off disease followed by intercropping cotton with faba bean and onion. While, the intercropping cotton with garlic decreased disease incidence.

The differences between different races of *T. harzianum* and/ or races of *T. viridi* might be due to co-parasitism or differences in the ability of lysis of pathogenic fungi, competition for nutrients and the differences in the ability of production of antibiotics. These results were in the line with those of Khaled (1987); Botros (1988) and Ismail (1994).

Table 6: Effect of *T. harzianum* and *T. viridi* races on the percentage of pre - and post-emergence damping off and healthy survival of cotton plant intercropping with certain winter crops; season 1999/ 2000.

Treatment	Fungus	No.	Pre-emergence damping off (%)		Post-emergence damping off (%)		Healthy survival plants (%)	
			E.	W.	E.	W.	E.	W.
Wheat	*T. harzianum*	R1	6.0	8.0	3.0	6.0	91.0	86.0
		R2	7.0	8.0	5.0	7.0	88.0	85.0
	T. viridi	R1	8.0	10.0	8.0	9.0	84.0	81.0
		R2	11.0	11.0	12.0	16.0	77.0	73.0
Faba bean	*T. harzianum*	R1	5.0	9.0	5.0	8.0	90.0	83.0
		R2	7.0	11.0	6.0	12.0	87.0	76.0
	T. viridi	R1	9.0	13.0	8.0	11.0	83.0	76.0
		R2	10.0	15.0	7.0	10.0	83.0	75.0
Onion	*T. harzianum*	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
	T. viridi	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
Garlic	*T. harzianum*	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
	T. viridi	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
Control	*T. harzianum*	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
	T. viridi	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
L.S.D.			3.96	4.53	3.64	4.63	11.53	12.53

E = East Side of ridge. W = West Side of ridge.

Table 7: Effect of *T. harzianum* and *T. viridi* races on the percentage of pre- and post-emergence damping off and healthy survival of cotton plant intercropping with certain winter crops; season 2000/ 2001.

Treatment	Fungus	No.	Pre-emergence damping off (%)		Post-emergence damping off (%)		Healthy survival plants (%)	
			E.	W.	E.	W.	E.	W.
Wheat	*T. harzianum*	R1	10.0	13.0	10.0	13.0	80.0	74.0
		R2	12.0	11.0	5.0	13.0	83.0	76.0
	T. viridi	R1	13.0	12.0	11.0	15.0	76.0	73.0
		R2	12.0	14.0	13.0	16.0	75.0	70.0
Faba bean	*T. harzianum*	R1	9.0	10.0	9.0	11.0	82.0	79.0
		R2	10.0	12.0	7.0	8.0	83.0	80.0
	T. viridi	R1	10.0	10.0	8.0	14.0	82.0	76.0
		R2	8.0	12.0	8.0	13.0	84.0	75.0
Onion	*T. harzianum*	R1	0.0	2.0	0.0	4.0	100.0	94.0
		R2	0.0	1.0	0.0	3.0	100.0	97.0
	T. viridi	R1	0.0	4.0	0.0	5.0	100.0	91.0
		R2	0.0	5.0	0.0	3.0	100.0	92.0
Garlic	*T. harzianum*	R1	0.0	3.0	0.0	5.0	100.0	92.0
		R2	0.0	4.0	0.0	4.0	100.0	92.0
	T. viridi	R1	0.0	2.0	0.0	3.0	100.0	95.0
		R2	0.0	3.0	0.0	5.0	100.0	92.0
Control	*T. harzianum*	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
	T. viridi	R1	0.0	0.0	0.0	0.0	100.0	100.0
		R2	0.0	0.0	0.0	0.0	100.0	100.0
L.S.D. at 5 %			4.4	4.7	4.8	15.2	12.8	13.6

E = East Side of ridge. W = West side of ridge.

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مقاومة مرض سقوط بادرات القطن تحت ظروف التحميل مع بعض المحاصيل الشتوية

عادل الصادق أحمد إسماعيل
معهد بحوث أمراض النباتات – مركز البحوث الزراعية- مصر

اتضح أن تحميل القطن مع القمح أعطى أعلى نسبة إصابة بمرض سقوط بادرات القطن ، أعقبه تحميل القطن مع الفول البلدي ، بينما تحميل القطن مع الثوم أقل أعلى نسبة إصابة لمرض موت بادرات القطن ، أعقبه تحميل القطن مع البصل. و لقد وجد أن الإصابة بمرض سقوط بادرات القطن كانت مرتفعة عند زراعة القطن على الريشة الغربية من الخط ، بينما زراعة القطن على الريشة الشرقية للخط أعطت أقل نسبة إصابة. و كذلك اتضح أن استخدام بعض المبيدات كمطهرات بذرية أدى إلى خفض نسبة الإصابة بمرض سقوط البادرات ، وكان أفضل هذه المبيدات هو مبيد البنليت ٥٠% ، أعقبه مبيد الهوماي ٨٠% ، بينما كان مبيد الفيتافاكس كابتان و الريزولكس ت ٥٠ اقل تأثيرا على مرض سقوط بادرات القطن. و قد أدى استخدام عزلتين من فطر تريكودرما هرزيانم و عزلتين من فطر تريكودرما فيردي إلى خفض نسبة الإصابة بمرض سقوط بادرات القطن ، و كان فطر تريكودرما هرزيانم أكثر فاعلية في المقاومة عن فطر تريكودرما فيردي.