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EFFECT OF SOME NON-CHEMICAL, SEED AND FOLIAGE APPLICATIONS ON COTTON DAMPING OFF DISEASE INCIDENCE AND YIELD CHARACTERISTICS

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ABSTRACT: **Four different beneficial microorganisms namely (*Trichoderma harzianum, Bacillus subtilis, Pseudomonas fluorescens* and mixture of mycorrhizal fungi *Glomus etunicatum, G. intraradices, G. fasciculatum*), were used as seed treatment to study their effects on cotton seedlings damping off disease incidence in comparison with the effect of recommended dose of fungicide moncirine. These treatments were implemented under greenhouse (artificial heavily infested soil) and field (naturally infested soil) conditions.**

Foliage treatments were only applied under field conditions to study their effects on quality and seed oil content. Foliage field applications included, *Trichoderma harzianum* and *Bacillus subtilis*, humic acid, and calcium chloride preparation. Data of greenhouse show that soaking cotton seeds for 48 h in *T. harzianum* and *B. subtilis* preparations led to best disease control and highest number of survived plants, compare with control treatment. Data also showed that cotton plant protection was positively correlated with concentration of bioagents and length of soaking period.

Results obtained from field experiments were in harmony with those obtained from greenhouse ones regarding damping off percentage, and survived plants. Plant heights were also determined in survived plants after one month in different treatments. Data obtained show that *B. subtilis* followed *T. harzianum* if compared with fungicide or control ones. Regarding effect of foliage treatment on fiber quality and seed oil content, obtained data show that

different treatments were varied in their effects on different parameters, color, fiber length, fiber strength and elongation percentage, fiber fineness and maturity lea product and percentage of seed oil contents. *T. hazianum* showed the best results on the previously measured parameters. No significant effect on color yellowness was obtained. *B. subtilis* occupied the second rank after *T. harzianum* where it improved lea product and fiber length. Foliage treatment with $CaCl_2$ led to improvement in fiber fineness and maturity, Foliage treatment with humic acid 45 % at 100 ml / 20 l. Water show no significant differences in all measured parameters compared with control one.

Key words: Biological control, Damping off, cotton yield characteristics, *Trichoderma harzianum*, *Bacillus subtilis*, *Pseudomonas fluorescens*, mycorrhizae.

INTRODUCTION

Seedling diseases of cotton are among the most important diseases that limit cotton lint and seed production. In 2001 the estimated loss in bales of cotton due to seedling diseases was 2.34% or approximately $ 169, 820, 640 (Blasingame and Mukund 2001). Moreover, the widespread use of the chemicals has become a subject of public concern and scrutiny mainly due to their potential harmful effect on non-target organisms, development of resistant races of pathogens and possible carcinogenicity of some chemicals. There is need to examine the potential for non chemical approaches to disease management (Misaghi *et al.*, 1998.)

Trichoderma spp. long have been known for their abilities to control plant pathogenic fungi mechanisms primarily have included direct effects upon target fungi via competition, mycoparasitism and antibiosis (Abd-El Moity 1981, Chet 1987). In addition, these fungi have been shown to directly increase plant growth (Chang *et al.*, 1986). They also have abilities to solubilize plant nutrients and to increase plant nutrient uptake (Lindsey and Baker 1967, Altomare *et al.*, 1999, Yedidia *et al.*, 2001 and Harman *et al.*, 2004).

Treated cotton seedlings with effective biocontrol strains of *T. virens* have higher levels of defense-related compounds such as terpenoids and higher peroxides activity in the roots than seedlings treated with ineffective isolates (Howell *et. al.* 2000). Effective biocontrol strain of *Trichoderma virens* can induce the production of defense-related compounds in the roots of cotton. Ineffective strains do not induce these compounds to significant levels. This elicitation was found to be heat stable, in soluble chloroform. (Hanson and Howell, 2004). Many plant species stimulate and support populations of rhizosphere bacteria (*Rhizobacteria*) as a first line of defense against soil borne plant pathogens (Cook *et al.,* 1995). Several *Bacillus spp.* including *B. subtilis* are antagonistic to plant pathogenic fungi and bacteria. *Bacillus spp.* produced at least 66 different antibiotic compounds (Ferreira *et al.,* 1991). Several strains of *B. subtilis* were used to suppress take all disease and *Rhizoctonia* root rot on wheat seedling and promote wheat seedling growth (Ryder *et al.,* 1999). Phloroglucinols (PG) are phenolic, secondary metabolites produced by plants, algae and bacteria (Bangera and Thomashow, 1996, 1999, Ishigureo *et al.,* 1998 and Bokesch *et al.,* 1999).

More than 60 PG derivatives have been described and were reported to have antiviral, antimicrobial, insect and mammal antifedant, phytotoxic, antioxidant, cytotoxic, antitumor plant growth regulating activities (Yajima and Munakata. 1979, Arisawa. *et al.,* 1990, Toda *et al.,* 1990, Keel *et al.,* 1992, Cornion *et al.,* 1997, Lawler *et al.,* 1999, Te-Chato. and Lim 1999., Debabrata and Naik 2000 and Ito *et al.,* 2000)

Strains of fluorescent Pseudomonas that produce the antibiotic 2, 4 diacetylphoroglucinol (2.4 DAPG) are among the most effective rihizobacteria controlling diseases caused by soil borne pathogens (Landa *et al.,* 2003 and De Suza *et al.,* 2003).

Roots of plants, support the growth of complex microorganisms that in concert can have a profound effect on the life cycle and survival of the plant. Among these organisms arbuscular mycorrhizal fungi (AMF) that are known to improve the nutritional status of their host (Smith and Read, 1997) and provoke alternations in the hosts physiology (Linderman, 1992) and exudation from roots (Schwab *et al.,* 1984 and Bansal and Mukerji, 1994.). The mode of action of (AMF) include in direct interaction such as competition between the symbiont and pathogen for infection sites, (Muchovej *et al.*, 1991) or indirect interactions such as altera of root exudation and / or of the mycorhizosphere microbial community (Hassan *et al.*, 1997. and Filion *et al.*, 2003).

The present work was carried out to study the role of biological control on damping off diseases in cotton plants compared with chemical control. In addition, the effect of spraying of some preparations on fiber quality and percentage of cotton seed oil, was also investigated.

MATERIALS AND METHODS

Inoculum Preparation and Soil Greenhouse Infestation

a) Pathogenic fungi

Three fungi (*Sclerotium rolfsii* Sacc., *Rhizoctonia solani* and *Fusarium solani*) were pathogenic to cotton seeds which kindelly obtained from Integrated Control Research Dep., Plant Pathology Institute, ARC, Giza. Pathogenic fungi were prepared using the method mentioned by Abd-El Moity 1985 as follows: *Sclerotium rolfsii* isolate was inoculated in Petri dishes containing PDA medium then incubated at 27°C. After 15 days sclerotia were harvested and added to soil at the rate of 100 Sclerotia of *S. rolfsii* /kg soil. Bottles 600 ml in capacity, each contained 100 g of modified sand corn meal media (25 g corn + 7 kg sand + 1 litre of peptone solution) were inoculated with equal disks 0.5 cm in diameter of *Rhizoctonia solani* from cultures three days old. Inoculated bottles were then incubated at 20°C. After 30 days. Inoculum of *R.solani was* added to soil at the rate of 10 g of sand corn meal / kg of soil and each gram contains (5×10^6 cfu). Isolate of *Fusarium solani* was grown in bottle 600 ml contained 100 ml Richard slants medium and incubated at 25°C. After 2 weeks, 50 ml sterilized distilled water were added to each flask on the medium surface and rubbed gently using small brush to prepare spore suspension. The number of conidia were determined using haemocytometer slide and adjusted to be contain approximately 7×10^8 conidia / ml (12 ml / kg soil).

b) Antagonistic microorganisms

Different biocontrol agents (*Trichoderma harzianum, Bacillus subtilis, Pseudomonas fluorescens*) were obtained kindelly from Integrated Control Research Dep., Plant Pathology Institute, ARC, Giza, and mixture of (mycorrhizal fungi *Glomus* *etunicatum, Glomus intraradices and Glomus. fasciculatum*) this was commercial knows " Triton " were used in these studies. *Trichoderma harzianum* was grown on liquid gliotoxin fermented medium (G. F. M.) developed by Brain and Hemming (1945) and composed of Dextrose 25.0 g; Ammonium tartarate 2.0 g; $MgSO_4$ 1.0 g; KH_2PO_4; $FeSO_4$ 0.01 g and distilled water 1000.0 ml under complete darkness just to stimulate toxin production (Abd-El Moity and Shatla 1981) for 9 days. The suspension of *T. harzianum* was prepared by adjusting number of Trichoderma propagules in the suspension to be 30×10^{6} / ml. *B. subtilis* and *Ps. fluorescens* were grown on nutrient glucose broth (NGB) prepared by Dowson (1957) and composed of (beef extract 3.0 g; peptone 5.0 g; Glucose 10.0 g and distilled water 1000.0 ml.) for 48 h. The bacterial suspension was also adjust to be contain 30×10^{6} cfu./ml. Mixture of mycorrhizal fungi were used as a commercial product known as "Triton".

Greenhouse Experiments

For all greenhouse experiments unless otherwise mentioned, new pots 20 cm in diam., were used. Pots were filled with infested soil with (*Sclerotium rolfsii, Rhizoctonia solani* and *Fusarium solani* at the rate of the previousely mentioned (a. Pathogenic fungi) (1.7 kg / pot.) Ten cotton seeds of the variety Giza 83 were sown in each pot and five replicates were used for each treatment. Soil infested with pathogens was used as control treatment.

1. Evaluation of different biocontrol agents against the pathogens

In this experiment the four antagonists were used as suspensions at the rate of 20 ml or 20g (in mycorrhiza treatment)/ litre. The seeds were soaked for 24 h. On the other hand, seed treated with moncerin (as fungicide) at the rate of 1.5 g / kg seed, served as another control. Cotton seeds were then sown. Disease incidence was determined weekly for one month.

Percentage of efficacy was calculated using the next formula:-

$$A = 100 - [\frac{F1}{F2} X 100]$$

A: denotes % of efficacy

F1: denotes % of infected plants in treatment

F2: denotes % of infected plants in control

2. Effect of soaking time in different suspension of bioagents on the efficacy of biocontrolling damping off disease

Different antagonists (*Trichoderma harzianum, Bacillus subtilis, Pseudomonas fluorescens* and mixture of mycorrhizal fungi *Glomus etunicatum, Glomus intraradices and Glomus fasciculatum*) were used as which different concentrations mentioned before in (b. Antagonistic microorganisms). Seeds were soaked at different periods, 24 and 48 h. in different bioagents, to study the effect of time of application on the efficacy of the treatment.

3. Effect of different concentrations of bioagents in controlling damping off diseases

Different bioagents were used as suspensions using different concentrations at the rate of (20, 10, 5 ml or g / l water). Seeds were soaked at different bioagents at 24 h. Treated seeds were sown in infested soil, to study their efficacy of the treatment against pathogenic fungi.

Field Experiments:

This study was carried out in two seasons (2002 and 2003) in one feddan area at Manshia Dakem in Sanoras El-Fayium governorate. The experiment was divided into two plots. The first plot was used to study biocontrolling soil borne fungi. Four different biocontrol agents were used as mentioned before in (b) Antagonistic microorganisms. These bioagents were applied in three sub plots.

I- A- To evaluate the effect of biocontrol agents against soil borne pathogens.

I- B- To study the effect of soaking time (24 and 48h) with different suspensions of bioagents on the efficacy of biocontrolling damping off disease.

I- C- To study the effect of different concentrations of bioagents in controlling damping off disease.

The second plot was designed to study the effect of spraying with some materials as (calcium chloride, humic acid, *B. subtilis* and *T. harzianum* preparations) on the characteristic of the cotton fiber and percent of the oil in seed cotton.

I. Biocontrol of soil borne fungi under field conditions

I-A. Evaluation of different biocontrol agents against soil borne pathogens

In this study the four antagonists were used as suspension treatment at the rate of 20 ml or 20 g (in mycorrhiza treatment) / litre. The seeds were soaked at 24 h, and then cotton seeds were sown. Cotton seeds were sown without any treatment to serve as the first control. Seeds were treated with moncerin as fungicide at the rate of 1.5 g / kg seeds, this treatment served as a second control. Disease incidence was determined weekly for one month. Plant heights at 30 days old, were also measured.

Treatments were carried out in complete randomized plots design.

I-B. Effect of soaking time (24 and 48 h) with different suspensions of bioagents on the efficacy of biocontrolling damping off disease

Different bioagents were used as suspension. Seeds were soaked at different periods for 24 and 48 h. to study the suitable time of the application. Disease incidence and plant heights were determined as mentioned before.

I-C. Effect of different concentrations of bioagents in controlling damping off disease

Different antagonists were used as suspension with different concentrations at the rate of (20, 10, 5 ml or g / litre) to study the effect of these concentrations on the efficacy of the treatments against pathogenic fungi under natural infection in open field.

Statistical analysis was carried out in all the above treatments according to (Duncan 1954 and Gomez and Gomez 1984).

II. Effect of different preparations on field quality of the cotton plants

In this study *T. harzianum* and *B. subtilis* were used as suspension at the rate of litre/200 litre water. On the other hand,calcium chloride and humic acid 4% at the rate of 100 ml/20 litre water, were used. All previous preparations were sprayed every 2 weeks at four times during the season. All fiber quality properties of row cotton were measured on the VHI instrument according to the standard test methods of the American Society for Testing and Materials ASTM (1984), in conformity with the following designations; fiber length, D–1440–67; fiber strength and elongation, D–1445–75 micronaire reading, D – 1448 – 59 and cotton color, D – 2253 – 66. Predicted yarn strength for the tested samples were computed on HVI – 900 B system, in accordance with data of fiber properties obtained for each sample.

Fiber properties were determined at the laboratories of The Cotton Technology Research Division Cotton Research Institute, Giza, Egypt under standard atmospheric conditions of 65 ± 2% relative humidity and 21 ± 1° C temperatures. (ASTM 1984).

B) Effect of different preparations on the oil percent of seeds

In this study *T. harzianum* and *Bacillus subtilis* were used at the rate of one litre / 200 litre water, calcium chloride and humic acid 45% at the rate of 100 ml / 20 litre water. All previous different materials were sprayed every 2 weeks four times during the season. Oil percent was determined according to the official method recommended by the American Oil Chemists Society, A. O. C. S. (1970).

Determination of oil percentage was carried at the Cotton Research Institute, ARC, Giza, Egypt.

RESULTS AND DISCUSSIONS

Effect of different bioagents and their reaction against soil-borne pathogens which caused damping off in cotton was carried out under greenhouse conditions. Data presented in Table (1), showed that all tested bioagents and recommended chemical fungicide (moncerin) reduced significantly the disease incidence, if compared with control treatment.

T. harzianum was the most effective bioagent in decreasing the percentage of disease incidence (87.5% healthy survival and 81.48% of efficacy). *Bacillus subtilis, Pseudomonas flourescens,* mycorrhizal fungi and Moncerin followed by *T. harzianum* in this respect. The percentages of healthy survived plants were 83.7, 65, 50 and 50%, respectively. These results indicated that different antagonists behaved differently under the same conditions. Treatment of *T. harzianum* or *B. subtilis* led to the best reduction in disease incidence. This reduction might be due to that either *Trichoderma spp.* or *Bacillus subtilis* produce antifungal antibiotic substances. *T. harzianum* produce gliotoxin, viridin (Abd-El Moity, 1981) while *B. subtilis* produces antifungal materials *subtilin* (Johanson *et al.,* 1960). These antifungal materials inhibit growth of pathogenic fungi, consequently they become more susceptible to the effect of other microorganisms naturally exist in the soil (Hader and Gorodecki., 1991). *Ps. flourescens* occupied the third rank after *Trichoderma harzianum* and *Bacillus subtilis*. Effect of *Ps. flourescens* might be due to cleat available iron in the rhizosphere area. Under this iron starvation conditions, the pathogens cannot grow (Loper, 1988). Also *Ps. flourescens* acts through production of some antibiotic (Duffy and Defago., 1997 and Sharifi *et al.,* 1998). Arbuscular Mycorrhizal fungi (AMF) occupied the fourth rank after *T. harzianum, B. subtilis* and *Ps. flourescens.* The mode of action of (AMF) include direct interaction such as competition between the symbiont and pathogen for infection sites (Muchovej *et al.,* 1991) or indirect interactions such as alteration of root exudation and/or of the mycorrhiza share in microbial community (Hassan *et al.,* 1997 and Filion *et al.,* 2003).

Effect of soaking time (24 and 48 h) at different suspensions of bioagents on the efficacy of controlling damping off disease of cotton plant was investigated under greenhouse conditions. Data obtained in Table (2) indicate that soaking in different antagonists at different periods (24 and 48 h) led to different results concerning biological control. Data obtained indicate that in most cases fungal antagonists gave the best result at 48 h of soaking where for bacterial antagonist was at 24 h. These results might be due to the fast multiplication and growth of bacteria compared with growth of fungi.

Table 1: Evaluation of using antagonistic microorganisms in controlling damping off disease of cotton plants, under greenhouse conditions

Different treatments	% of pre	% of post	% of survival plants	% of efficacy
Trichoderma harzianum	12.5	0	87.5	81.48
Bacillus subtilis	16.25	0	83.75	75.92
Pseudomonas flourescens	35	0	65	48.14
***Mycorrhiza* (Triton)**	47.5	2.5	50	25.92
Moncerin	50	0	50	25.93
control	65	2.5	32.5	0.00
L.S. D. at 5 %	1.51	0.73	2.18	

Trichoderma sp. might also act through production of destructive enzymes *i. e.* chitenase (Bolar *et al.* 2000). Action of *B. subtilis* is due to production of number of antibiotic like substances as bacteriocoin and subtilin (Farahat, 1998).

To demonstrate if there are negative or positive side effect for the treatments on plant health, cotton plant length was determined in all treatments as an indicator for plant health and physiological performance. Data in Table (4) show that different treatments were drustically varied in their effects on plant length. *B. subtilis* showed the highest length of treated plants being 62 cm if compared with control treatment (40cm). Moncerin treated plants also show stunting if compared with the plants treated with biological agents. This might be due to that chemical fungicide may has negative effect on plant cell while biological methods might have positive side effect as indicated by (Abd-El Moity, 1981) who mentioned that *T. harzianum* has stimulatory effect on plant growth. However, Grosch and Grote (1998) revealed that tomato fruit yield was significantly increased after application of *B. subtilis* comparing with control treatment. Effect of *Bacillus subtilis* in controlling damping off disease, and increasing the length and yield is due to production of antibiotics (Iturina and increase Surfactin) (Asaka and Shoda 1996; Hwang *et al.* 1996 and Ryder *et al.* 1999.).

Pseudomonas fluorescens produces some antibiotic *i.e* pyrrolnitrin, pyoluterin and 2, 4 diacetyl ploroglucinol. These antibiotics, suppress damping off and led to an increase in the growth of plant (Sarniguet *et al.*, 1995). On the other hand, mycorrhiza might protect plants through providing the unavailable phosphorus to the growing cotton plants. Such results are in accordance with those obtained by (Galal and Ali, 2004).

Time of application of seed soaking (24 and 48 h) of the different suspension concentrations of biocontrol agents effect on the efficacy of controlling damping off disease of cotton plants under field conditions, was studied. Data presented in Table (5) show that all tested bioagents significantly reduced the disease incidence if compared with control treatment. It is clear that seed soaking in suspension of different antagonists for different periods (24 and 48 h) led to different results.

Table 2: Effect of soaking time (24 and 48h) in the different suspensions of bioagents on the efficacy of the biocontrolling of damping off disease of cotton plant under greenhouse conditions

Different treatments	Soaking time							
	24 h from seed soaking				48 h from seed soaking			
	% of pre	% of post	% of survival plants	% of efficacy	% of pre	% of post	% of survival plants	% of efficacy
Trichoderma harzianum	12.5	0	87.5	81.48	6.25	2.5	91.25	85.4
Bacillus subtilis	16.25	0	83.75	75.92	17.5	0	82.5	70.8
Pseudomonas flourescens	35	0	65	48.14	45	0	55	25
Mycorrhiza (Triton)	47.5	2.5	50	25.92	37.5	0	62.5	37.5
Control	65	2.5	32.5	0.00	60	0	40	0.00
L. S. D. at 5 %	2.04	0.18	2.3		1.48	0.08	2.19	

Data recorded in Table (3) show that adding different doses of bioagents led to different degrees of protection against soil-borne pathogens. Positive correlation was observed between doses of the antagonist and efficacy of the treatments. Higher values of different antagonists were obtained at their recommended doses comparing with their half ones (Abd-ElMoity *et al.*, 1990, Aly *et al.*, 1995. and Rodriguez and Cotes 1999.

These results can be explained in the light of data obtained by Wolk and Sorker (1994). They stated that the efficacy of antagonists depend on their capacity comparing with other microorganisms that occupied rhizoshphere area.

Evaluation of used antagonistic microorganisms in controlling damping off disease of cotton plants under field condition revealed that all different bioagents and moncerin as a chemical fungicide significantly reduced the disease incidence compared with control treatment. Data obtained in Table (4) indicated that *T. harzianum* and *B. subtilis* were the most effective antagonists against soil-borne pathogens. This high potentiality in antagonism might be due to that *Trichoderma spp.* acts through different mechanisms including mycoparasitism (Abd-El Moity and Shatla 1981; and Benhamous and Chet 1993) also through production of anti-fungal substances (Hayes 1992).

Table 3: Effect of different concentrations of bioagents on controlling damping off of cotton plants, under greenhouse conditions

Different treatments	Different concentrations											
	*A				B				C			
	% of pre	% of post	% of survival plants	% of efficacy	% of pre	% of post	% of survival plants	% of efficacy	% of pre	% of post	% of survival plants	% of efficacy
Trichoderma harzianum	43.75	0	56.25	35	12.5	0	87.5	81.48	11.25	0	88.75	83.33
Bacillus subtilis	60	0	40	11.1	16.25	0	83.75	75.92	12.5	0	87.5	81.04
Pseudomonas flourescens	40	0	60	40	35	0	65	48.14	17.5	0	82.5	74.07
Mycorrhiza (tri-ton)	53.75	8.75	37.5	7.4	47.5	2.5	50	25.92	38.75	5	56.25	35.18
Control	65	2.5	32.5	0.0	65	2.5	32.5	0.00	65	2.5	32.5	0.0
LSD at 5 %	2.30	0.22	2.15		2.04	0.18	2.3		1.64	0.23	3.4	

*A: Half (R. D.) B: Recommended dose (R. D). C: Double (R. D.)

Table 4: Evaluation of different antagonistic microorganisms in controlling damping off disease of cotton plants under field conditions

Different treatments	% of pre	% of post	Plant heights at 30 days old	% of survived plants	% of efficacy
Trichoderma harzianum	26.7	0	60.3	73.3	55.9
Bacillus subtilis	26.7	0	62	73.3	55.5
Pseudomonas flourescens	40.0	0	56	60	33.3
***Mycorrhiza* (Triton)**	33.3	0	50.6	66.6	44.5
Moncerin	26.7	0	43.6	73.3	55.5
control	60	0	40.6	40	0.00
L. S. D. at 5%	1.55	N. S	1.78	1.63	

In general fungal antagonist gave the best result of 48 h soaking while bacterial antagonist gave the best results of 24 h of seed soaking period. This might be due to that bacteria multiplicate faster and number of population increased in a very short time (Abd-El Moity *et al.*, 2003).

Data recorded in Table (6) show that different concentrations of bioagents and chemical fungicide led to different degrees of protection against soil-borne pathogens. Positive correlation was observed between level (concentration) of treatment and percentage of survived plants except for chemical fungicide which showed negative effect on plant parameters where it shows stunting of treated plants if compared with control one. This might be due to that treatment with bioprepartion at high level increased secondary metabolites (include antifungal, antibiotics, enzymes and growth regulators...) compared with another concentrations. (Aly *et al.*, 1995, Rodriguez and Cotes, 1999).

Data in Table (7) show the effect of different preparations on fiber quality of the cotton plants. Spraying plants with *T. hzianum* led to significant increase in the different parameters. This effect might be due to that *T. harzianum* produce some growth regulators or might affect through enzymes and / or antifungal substances (Padares *et al.*, 1992) or also stimulate some

Table 5: Effect of soaking time with different suspension concentrations of bioagents on the efficacy of biocontrolling dampingoff disease under field conditions

Different treatments	Time of treatment									
	24 h.					48 h.				
	% of pre	% of post	Length of plant	% of survival plants	% of efficacy	% of pre	% of post	Length of plant	% of survival plants	% of efficacy
Trichoderma harzianum	26.7	0	60.3	73.3	55.5	20	0	64.3	80	57.17
Bacillus. subtilis	26.7	0	62	73.3	55.5	33.3	0	57.6	66.7	28.69
Pseudomonas flourescens	40	0	56	60	33.3	40	0	58	60	14.34
Mycorrhiza (tri-ton)	33.3	0	50.6	66.7	44.5	26.7	0	54.3	73.3	42.8
Control	60	0	40.6	40	0.00	46.7	0	50.6	53.3	0.00
LSD at 5 %	2.3	N. S	1.82	3.04		2.30	N. S	2.7	2.30	

Table 6: Effect of different concentrations of bioagents on controlling dampingoff of cotton plants under field conditions

Different treatments	Different concentrations														
	*A					B					C				
	% of pre	% of post	Length of plants	% of survival plants	% of efficacy	% of pre	% of post	Length of plants	% of survival plants	% of efficacy	% of pre	% of post	Length of plants	% of survival plants	% of efficacy
Trichoderma harzianum	40	0	58.3	60	33	26.7	0	60.3	73.3	55.5	26.7	0	65	73.3	55.5
Bacillus subtilis	33.3	0	57.3	66.7	44	26.7	0	62	73.3	55.5	20	0	69	80	66.6
Pseudomonas flourescens	26.7	16.7	52	56.6	27	40	0	56	60	33.3	26.7	0	59	73.3	55.5
Mycorrhiza (tri-ton)	46.7	0	48.3	53.3	22	33.3	0	50.6	66.7	44.5	21.7	0	78.3	78.3	63.83
Moncerin	43.3	0	46	56.7	27	26.7	0	43.6	73.3	55.5	26.7	0	33.3	73.3	55.5
Control	60	0	40.6	40	0.00	60	0	40.6	40	0.00	60	0	40.6	40	0.00
LSD at 5 %	2.18	0.15	2.52	2.18		2.3	N. S	1.82	3.04		2.52	N. S	2.81	2.52	

*A: Half (R. D.), B: Recommended dose (R. D). C: Double (R. D.)

Table 7: Effect of different preparations on fiber quality of the cotton plants

Different treatments	Fiber elongation %	Fiber strength g/tex	Fiber lenght		Microner reading (fiber finenessanl) maturity	Lea product	color	
			Uniformity index %	*2.5 % SL mm			**Yellowness +b	***Reflectance on Rd %
Trichoderma harzianum	7.8	34.06	87.8	32.6	4.4	2019.6	12	70.6
Bacillus subtilis	7.5	32.5	87.6	32.3	4.3	1912	11.8	69.1
Humic acid	7.6	32.2	86.2	31.1	4.3	1791	12.1	68.9
Calcium chloride	7.5	30.8	86.1	30.8	4.6	1676	12.1	67.5
Control	7.3	29.9	86.2	30.1	4.1	1639	11.6	67.2
LSD at 5 %	0.45	1.14	0.53	0.60	0.31	2.22	0.56	0.67

* Sl: Span length (staple length)

** b: degree of yellowness

*** Rd %: percentage reflectance (lightness or darkness of color) compounds in the host (Howell *et al.*, 2000 and Bolar *et al.*, 2000). Such compounds might have the abilities to solubilize plant nutrient uptake (Altomare *et al.*, 1999, Yedidia *et al.*, 2001 and Harman *et al.*, 2004). *Bacillus subtilis* appeared in the second rank after *Trichoderma harzianum.* This might be due to that *B. subtilis* produces number of antibiotic and some growth promotores (Ferreira *et al.* 1991 and Ryder *et al.* 1999). Foliage treatment with $CaCl_2$ led to improvement in fiber fineness and maturity. This effect might be due to that calcium is responsible for formation of strong cell walls of fibers and in plant.

Data in Table (8) show the effect of different preparations on the oil content of cotton seeds. Treatment of *Trichoderma harzianum* significantly increased the percentage of oil in seeds. This might be due to direct increase plant growth (Chang *et al.*, 1986). They also might have abilities to solubilize plant nutrients and increase plant nutrient uptake (Altomare *et al.* 1999, Yedidia *et al.*, 2001 and Harman *et al.*, 2004).

On the other hand, obtained data showed no significant differences between all the past treatments and control one in cotton seed oil contents.

Table 8: Effect of different preparations on field quality of the oil percent of cotton seeds.

Different treatments	*Trichoderma harzianum*	*Bacillus subtillis*	Humic acid solution	Calcium chloride	control
% of oil in seeds	21.75	18.6	18.2	18.4	17

LSD at 5 % 2.27

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تأثير بعض المعاملات الغير كيماوية على البذور والمجموع الخضرى فى مقاومة مرض موت البادرات فى القطن وتأثيرها على الصفات المحصولية لمحصول القطن

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المعمل المركزى للزراعة العضوية – مركز البحوث الزراعية– جيزة – مصر

تم معاملة بذور القطن بأربعة كائنات حية دقيقة نافعة وهى (ترايكودرما هارزيانم، باسلس ستلس وسيدوموناس فلورسنت وخليط من فطريات الميكروهيزا وهى جلوماس إنتيكاتم وجلوماس انتروديكس جلوماس فاسكيليتم) وذلك لدراسة تأثيرها على مقاومة مرض موت البادرات فى القطن وذلك مقارنة مع الجرعة الموصى بها من مبيد المونسرين وقد أجريت المعاملات تحت ظروف الصوبة (حيث التربة التى تم عدوتها صناعيا) وظروف الحقل (حيث العدوى الطبيعية للتربة).

معاملات المجموع الخضرى تمت فقط تحت ظروف الحقل المفتوح وذلك لدراسة تأثيرها على جودة المحصول والمحتوى الزيتى للبذور. ولقد أشتملت المعاملات على تحضيرات من الترايكودرما هارزيانم، باسيلس ستلس وحامض الهيوميك وكلوريد الكالسيوم. ولقد أظهرت نتائج الصوبة أن البذور التى تم نقعها لمدة ٤٨ ساعة فى تجهيزات التريكودرما هارزينم، باسيلس ستلس أعطت أفضل مقاومة للمرض وقد أعطت أعلى عدد للنباتات الحية الباقية وذلك مقارنة بالكنترول (المقارنة). والنتائج أظهرت أيضا علاقة موجبة بين حماية النباتات ومقاومته للمرض وتركيز تجهيزات الكائنات الحية وطول فترة نقع البذور بها.

النتائج المتحصل عليها فى تجارب الحقل كانت متوافقة مع النتائج المتحصل عليها فى الصوبة وذلك فى مقاومة مرض موت البادرات والنباتات الباقية. كما تم تحديد طول النباتات التى ظلت باقية عند عمر شهر وذلك فى كل التجارب. وأظهرت النتائج أن أفضل معاملة كانت الترايكودرما هارزيانم يليها معاملة الباسلس ستلس إذا تم مقارنتها بمعاملة المبيد أو المقارنة. وبالنظر إلى تأثير معاملات المجموع الخضرى على جودة الألياف والمحتوى الزيتى للبذور أظهرت النتائج أن المعاملات المختلفة كانت ذات تأثير متغير على القياسات المختلفة. وقد تم دراسة تأثير هذه المعاملات على اللون، طول الغزل، متانة الغزل، نسبة الاستطالة، نعومة الغزل ونضوجه والمحتوى الزيتى للبذور ولقد أظهرت معاملة التريكودرما هارزينم أفضل النتائج على القياسات المختلفة وكانت ذات تأثير إيجابى على اللون وطول الغزل ومتانته ونسبة الاستطالة ونعومة الغزل ونضوجه وعلى نسبة الزيت كما أنها لم تؤثر معنويا على اللون الأصفر فى الغزل. ولقد احتلت معاملة الباسلس ستلس الدرجة الثانية بعد معاملة الترايكودرما هارزيانم بينما أدت إلى زيادة نضج الغزل وطوله. أدت المعاملة بكلوريد الكالسيوم إلى زيادة نعومة الألياف ونضجها بينما كانت معاملة حامض الهيومك بتركيز ٤٥% فى ١٠٠مللى/ ٢٠لتر لم تعطى أى تغير معنوى فى أى قياس مقارنة بالكنترول (المقارنة).