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EFFECT OF THE INSECTICIDE GAUCHO ON THE EFFICIENCY OF THE FUNGICIDE MONCEREN IN CONTROLLING COTTON SEEDLING DISEASE

Osman, Eman A.M.
Plant Pathology Research Institute, Agric. Res. Center, Giza, Egypt.

ABSTRACT

A two-season (2003 and 2004) greenhouse study conducted to study the effect of cotton seed treatment with the insecticide Gaucho on the efficiency of the fungicide Monceren in controlling seedling disease. Thus 4 treatments were evaluated on seven Egyptian cotton cultivars (Giza 80, 83, 85, 86, 88, 89, and 90). The treatments were: seed treated with Monceren and Gaucho, seed treated with Monceren, seed treated with Gaucho, and untreated control. In 2003, cotton cultivar and treatment were highly sources of variation on pre-emergence damping-off, while their interaction was significant source of variation. Treatment was the only significant source of variation on the incidence of postemergence damping-off. Both cultivar and treatment were highly significant sources of variation on survival. All sources of variation were nonsignificant sources of variation on dry weight of seedlings. In 2004, cultivar and treatment were highly significant sources of variation on incidence of preemergence damping-off but their interaction was nonsignificant sources of variation. All source of variation were nonsignificant on postemergence damping-off. Cotton cultivar was a highly significant source of variation on survival and the treatment was significant source. The interaction between cultivar and treatment was nonsignificant. Regarding the dry weight, treatment was the only significant source of variation. In 2003, thirteen fungal genera were isolated from roots of seedlings of different treatments. These genera were: *Fusarium, Rhizoctonia, Penicillium, Aspergillus, Alternaria, Stemphylium, Rhizopus, Chaetomium,* unknown sterile isolate, unknown sporulated isolate*, Helminthosporium, Trichoderma,* and *Cladosporium*. In 2004, nine fungal genera were isolated from seedlings of different treatments. These genera included: *Fusarium, Rhizoctonia, Penicillium, Alternaria, Aspergillus, Nigrospora, Trichoderma, Chaetomium,* and *Phoma*. In each year, effects of treatments on isolation frequency of fungi was evalulated. The correlation between isolation fraquancy of fungi and seedling disease variables was also evaluated.

INTRODUCTION

Cotton is one of the most important economic crops contributing to the national income in Egypt. The occurrence of major losses of cotton seedlings from disease and insect damages is not uncommon in all cotton-production areas in Egypt. These losses vary over years and locations but characteristically result in poor stands. Stands may be replanted if severely damaged and, even if damage is not sever enough for replanting, it may make weed control and other cultural practices different difficult for the remainder of the season. Replanting, poor stands and seedling development, and weed competition ultimately affect plant maturity, fiber quality and seed cotton yield (Kappelman, 1977). Thus, the use of fungicides and pesticides, during seedling stage, has become indispensable under Egyptian conditions for obtaining maximum seedcotton yield although other control measures may also be used (Aly *et al.*, 1994). Insecticide-fungicide combination may induce synergistic or antagonistic effects on plant (Abdel-Aziz *et al.*, 1996). Papavizas and Lewis (1979) mentioned that insecticides could decrease soil borne plant diseases by various mechanisms, although these mechanisms are not clearly understood or elucidated. Phorate, used as cotton-seed treatment for insect and spider mite control, protected cotton seedlings from damping-off caused by *Rhizoctonia solani* (Erwin and Reynolds, 1958; Erwin *et al.*, 1959 and Hacskaylo and Stewart, 1962). Phorate or a breakdown product; however increased cotton damping-off caused by *Pythium* spp. (Erwin *et al*., 1961). Erwin *et al.* (1959) found that seed treatment of cotton with systemic insecticide Thimed 440 in the absence of any fungicide caused significant reduction in the stand of seedling plants in four of seven field tests conducted in several cotton-growing areas of California. Stands were improved when seeds were treated with fungicide prior to adding the Thimed coating.

Sensitivity of insects and *Rhizoctonia solani* to different pesticides such as Gaucho and Monceren was recorded by several authors (Kataria *et al.*, 1991, and Ismail and Aly, 1997). Monceren is considered as a non-systemic seed-dressing fungicide (Abdel-Aziz *et al.*, 1996, and Ismail *et al.*, 1996), while the seed-dressing Gaucho is an effective systemic insecticide after its uptake through the root system (Altman, 1991). Both pesticides were used widely either alone or mixed together at different raties, for controlling seedling diseases of different crops (Lisker and Meiri, 1992, and Ismail and Aly, 1997).

Ibrahim and Ismail (1998) reported that Monceren had the ability to control damping-off and root rot diseases of cotton when it was used at the recommended rates or their halves. This ability could be enhanced, when Monceren is used in combination with Gaucho. Therefore, seed treatment with Monceren increased germination, emergence and survival of cotton plants. Gaucho has a protective action against virus-transmitting and sucking insects.

The objective of this study was to determine the effect of the insecticide Gaucho on the efficiency of the fungicide Monceren in controlling seedling disease under greenhouse conditions.

MATERIALS AND METHODS

The experiments were conducted at Giza Agricultural Research Station on 15th of April in 2003 and on 22nd of April 2004. Natural field soil was used in the experiments. Seven Egyptian cotton cultivars (*Gossypium barbedense* L.) were used (Giza 80, 83, 85, 86, 88, 89, and 90). Seeds of each cotton cultivar were treated as follows; seeds were treated with Gaucho (insecticide) at the rate of 7 gm/kg seed and Monceren (fungicide) at the rate of 3 gm/kg seed (T_1), seeds were treated with Monceren only at the previously mentioned rate (T_2), seeds were treated with only Gaucho at the previously mentioned rate (T_3), and the control was untreated seds (T_4).

The pesticides were added to slightly moist seeds and shaken thoroughly in plastic bags for 5 min. and allowed to dry before being planted. Natural field soil was dispensed in 50-cm-diameter clay pots and planted with 50 seeds/pot (5 hills, 10 seeds in each hill). Three replicates were planted with each cultivar for each treatment. Data were recorded forty days after sowing in terms of percentage of preemergence damping-off, postemergence damping-off and survival. The pots then were thinned to three plants per pot. Plant dry weights of thinned seedlings were recorded for each treatment. Fungi were isolated from roots of infected seedlings and identified according to Aly *et al.* (2000).

Statistical analysis:

Analysis of variance (ANOVA) was used to compare between treatment means. Percentage data were subjected to appropriate transformation before carrying out ANOVA to produce approximately constant variance. Correlation analysis was used to study the degree of association between seedling disease variables and the isolated fungi. ANOVA and correlation analysis were performed with the statistical package MSTAT-C.

RESULTS AND DISCUSSION

ANOVA of the effect of cotton cultivar, pesticide treatments, and their interaction on cotton seedling damping-off in 2003 (Table 1) showed that the percentage of preemergence damping-off was significant affected by cultivar ($p \leq 0.01$), treatment ($p \leq 0.01$), and their interaction ($p \leq 0.05$). Postemergence damping-off significantly affected ($p \leq 0.01$) only by treatment, while survivals were significantly affected by both of the cotton cultivar ($p \leq 0.01$) and the treatment ($p \leq 0.01$). All sources of variation had no significant effect on dry weight of seedlings. Table (2) showed that responses of cotton cultivars to different treatments differed regarding preemergence damping-off. Thus, percentage of preemergence damping-off of cultivar G-80 significantly decreased by Gaucho treatment (T_3), while cultivar G-83 significantly decrease by Monceren treatment (T_2). Three cultivars didn't show any significant decrease in percentage of preemergence damping-off (transformed data) as a result of any of treatments. These cultivars were G-85, G-88, and G-89. Cultivar G-86 showed significant decrease in preemergence damping-off as a result of the treatment of Monceren + Gaucho treatment (T_1) and Monceren treatment (T_2). T_1 was the only treatment, which significantly reduced preemergence damping-off on G-90. Richardson (1960) reported improved emergence of pea seedlings from the application of various insecticide-fungicide combination seed treatment as compared with single treatment with either insecticides or fungicides. Our results indicated that cotton cultivar play an important role in determining the outcome of the association between fungicides and insecticides on cotton seedling damping-off because the results of Richardson are in agreement with our results only in case of G-90.

Table 1: Analysis of variance of the effect of cotton cultivar, pesticide treatment, and their interaction on cotton seedling damping-off under greenhouse conditions in 2003.

Parameter and source of variation	D.F.	M.S.	F. value
1. Preemergence damping-off			
Cultivar (C)	6	364.32	8.54**
Treatment (T)	3	407.51	9.55**
C x T	18	80.23	1.88*
Error	56	42.69	
2. Postemergence damping-off			
Cultivar (C)	6	121.11	1.15
Treatment (T)	3	1251.32	11.88**
C x T	18	133.38	1.27
Error	56	105.32	
3. Survival			
Cultivar (C)	6	428.42	4.49**
Treatment (T)	3	1582.00	16.59**
C x T	18	105.50	1.11
Error	56	95.35	
4. Dry weight			
Cultivar (C)	6	16516.13	2.17
Treatment (T)	3	14572.41	1.91
C x T	18	7190.06	0.94
Error	56	7625.50	

It clears from Table (2) that all treatments were effective in reducing postemergence damping-off regardless cotton cultivar. Addition of Gaucho to Monceren in treatment (1) had no significant effect on postemergence damping-off compared with treatment with Monceren (T_2) but it had significant effect compared with untreated seeds or seeds treated with Gaucho (T_3).

Regarding survival of seedlings (Table 3), it is clear that all treatments had highly significant effect on survival regardless cotton cultivars. Monceren treatment (T_2) gave the highest percentage of seedling survival. Ranney (1972) reported that treatment with any of protected fungicides resulted in improved seedling survival, germination, and increased rate of seedling growth. This benefit on germination and seedling growth was probably due to both control of seedborne disease organisms and inhibition of spread of disease from seed internally infected to adjacent uninfected seedlings. Cultivar G-90 gave the highest percentage of survival regardless treatment, while cultivar G-83 gave the lowest percentage of survival regardless treatment.

ANOVA (Table 4) of 2004 shoed that preemergence damping-off was affected by both cotton cultivar and treatment, while their interaction had no significant effect. All sources of variation had no significant effect on postemergence damping-off. Cotton cultivars showed highly significant effect on survival, while treatment showed significant effect on survival. The interaction between cultivar and treatment had no significant effect on survival. Treatment had highly significant effect on dry weight of seedlings, while cultivar and the interaction between cultivar and treatment had no significant effect on dry weight.

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Table 4: Analysis of variance of the effect of cotton cultivar, pesticide treatment, and their interaction on cotton seedling damping-off under greenhouse conditions in 2004.

Parameter and source of variation	D.F.	M.S.	F. value
1. Preemergence damping-off			
Cultivar (C)	6	480.78	16.06**
Treatment (T)	3	125.26	4.18**
C x T	18	37.83	1.26
Error	56	29.93	
2. Postemergence damping-off			
Cultivar (C)	6	1.79	1.31
Treatment (T)	3	2.56	1.86
C x T	18	1.20	0.88
Error	56	1.37	
3. Survival			
Cultivar (C)	6	356.59	10.92**
Treatment (T)	3	117.25	3.60*
C x T	18	37.42	1.15
Error	56	32.65	
4. Dry weight			
Cultivar (C)	6	18679.00	1.37
Treatment (T)	3	321375.28	23.57**
C x T	18	12421.73	0.91
Error	56	13633.14	

Percentage of preemergence damping-off (Table 5) significantly increased as a result of gauch treatment (T_3) compared with all the other treatments regardless of cotton cultivar. Hacskaylo and Stewart (1962) believed that the insecticide may have increased cotton damping-off by predisposing the host to this rather mild soilborne pathogens. The insecticide may also retard emergency of seedlings (Kholeeg and Klatt, 1986). Cotton cultivar G-80 was the most susceptible cultivar to preemergnece damping-off (Table 5), while cultivar G-89 was the least susceptible cultivar regardless of treatment.

Regarding survival (Table 6), it is clear that the application of Monceren increased percentage of survival in both T_1 (Monceren + Gaucho) and T_2 (Monceren) compared with Gaucho treatment (T_3), however, this increase was not significant compared with untreated seeds (T_4). Insecticide treatment significantly decreased percentage of survival compared with the other treatments. These results are in agreement with Erwin *et al.* (1959) who found that seed treatment of cotton with the systemic insecticide Thimed 44D in the absence of a fungicide caused significant reduction in the stand of seedling plants in four of seven field tests conducted in several cotton growing areas of California. Stands were improved when seeds were treated with a fungicide prior to adding the Thimed coating.

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Dry weight of seedling (Table 6) significantly decreased as a result of both Monceren + Gaucho treatment (T_1) and Monceren treatment (T_2) compared with untreated seeds or seeds treated with Gaucho regardless of cotton cultivar. This decrease in dry weight could be attribute to the increase in the number of healthy plants as a result of fungicide treatment, so the competition between healthy seedlings in the pots increased causing a decrease in their dry weight.

Thirteen different fungal genera were isolated from roots of cotton seedlings in 2003 (Table 7). These genera were *Fusarium, Rhizoctonia, Penicillium, Aspergillus, Alternaria, Stemphylium, Rhizopus, Chaetomium,* unknown sterile isolate, unknown sporulated isolate*, Helminthosporium, Trichoderma,* and *Cladosporium*. Some other genera were isolated in a very low frequency, so they were ignored. Isolation frequency of *Fusarium* and *Rhizoctonia* from seedlings significantly decreased as a result of Monceren treatment (T_2) and Monceren + Gaucho treatment (T_1) compared with the untreated seed. There was no significant difference in isolation frequency of *Fusarium* and *Rhizoctonia* when seeds were treated with Gaucho (T_3) compared with untreated seeds (T_4). These results implied that seed treatment with Monceren alone or with Gaucho decreased the infection of seedling with *Fusarium* and *Rhizoctonia*. Minton and Garber (1983) and Aly *et al.* (1996) mentioned that *Fusarium* spp. occur frequently among the fungal microflora associated with seedling disease and are a major cause of seedling death in some countries. Abde El-Aziz *et al.* (1996) indicated that the insecticide Gaucho was less fungitoxic than fungicides against *Rhizoctonia solani* isolates. When Aly *et al.* (1996) conducted a survey encompassed 88 samples of infected cotton roots from different governorates of Egypt, *R. solani* was isolated from 76.1% of the samples examined. Isolation frequency of *Alternaria* decreased significantly as a result of the application of Monceren alone (T_2) or in combination with Gaucho (T_1). Mohamed (1965) isolated *Alternaria* spp., *Aspregillus niger*, and *Penicillium* spp. from diseases cotton seedlings. It is noticeable that percentage of isolation frequency of *Chaetomium* significantly increased as a result of presence of fungicide in treatment T_1 and T_2. *Cladosporium* isolation frequency significantly increased as a result of insecticide treatment (T_3).

In 2004, nine different genera were isolated from roots of cotton seedlings (Table 8). These genera were *Fusarium, Rhizoctonia, Penicillium, Alternaria, Aspergillus, Nigrospora, Trichoderma, Chaetomium*, and *Phoma*. The different treatments had no significant effects on isolation frequencies of all fungi except *Rhizoctonia*. Moceren (T_2) decreased isolation frequency of *Rhizoctonia* compared with the untreated control (T_4) and Gaucho (T_3). Addition of Gaucho to Monceren significantly decreased *Rhizoctonia* isolation frequency compared with Gaucho alone. Abdel-Aziz *et al.* (1996) indicated that the insecticide Gaucho was less fungitoxic than fungicides against *R. solani* isolates.

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Table 8: Effect of seed treatment on frequency of fungi isolated from cotton seedling in 2004.

Treatment A	*Fusarium* D	*Rhizoctonia* C	*Penicillium* D	*Alternaria* C	*Aspergillus* B	*Nigrospora* D	*Trichoderma* D	*Cladosporium* D	*Phoma* D
T_1	6.67 a[E]	15.43 ac	14.65 a	32.45 a	13.83 a	4.60 a	4.77 a	4.70 a	2.90 a
T_2	9.10 a	9.56 a	7.72 a	28.62 a	22.52 a	3.80 a	15.52 a	2.38 a	0.78 a
T_3	3.75 a	35.08 b	2.20 a	25.17 a	17.17 a	0.53 a	13.07 a	3.03 a	0.0 a
T_4	7.30 a	26.93 bc	5.33 a	34.12 a	16.91 a	7.30 a	2.11 a	0.0 a	0.0 a

A: T1 seed were treated with Monceren (3 gm/kg seed) and Gaucho (7 gm/kg seed).
T2 seed were treated with Monceren (3 gm/kg seed).
T3 seed were treated with Gaucho (7 gm/kg seed).
T4 untreated seeds.
B: Percentage data were transformed into $\sqrt{x}$, where x is the percentage data.
C: Percentage data were transformed into arc sine .
D: Percentage data were transformed into $\sqrt{x + 0.5}$, where x is the percentage data.
E: Means followed by the same letter(s) are not significantly different ($p \leq 0.05$) according to LSD test.

Correlation between isolation frequency of fungi in the two seasons (2003 and 2004) and different seedling disease variables (preemergence damping-off, postemergence damping-off, survival, and dry weight) were studied (Table 9). The positive significant correlation ($r = 0.919$, $p \leq 0.01$) and the negative significant correlation ($r = -0.853$, $p \leq 0.01$) between isolation frequencies of *Fusarium* and each of postemergence damping-off and survival, respectively, suggest that *Fusarium* acts as a pathogen involved in cotton seedling disease. Aly *et al.* (1996) mentioned that *Fusarium* spp. play an important role in cotton seedling disease complex. Dry weight showed highly significant positive correlation ($r = 0.908$, $p \leq 0.01$) with isolation frequency of *Rhizoctonia*. This correlation suggests that when natural soil was more infested with *Rhizoctonia*, less surviving seedlings were found in the pots. The pots, which contained less healthy seedlings were less crowded. Accordingly, less competition occurred among healthy seedlings in these pots making them more vigorous. There were significant negative correlation between isolation frequency of *Aspergillus* and each of preemergence damping-off ($r = -0.718$, $p \leq 0.01$) and postemergence damping-off ($r = -0.925$). On the other hand, the correlation was positive between frequency of *Aspergillus* and survival ($r = 0.875$, $p \leq 0.01$). These results suggest that *Aspergillus* increased survival due to their antagonistic effects against soilborne fungi involved in cotton damping-off (Naim, 1966 and Aly and Kandil, 1999). Postemergence damping-off was significantly correlated ($r = 0.755$, $p \leq 0.05$) with isolation frequency of *Rhizopus*. This result is in agreement with other reports (Ranney, 1972 and Watkins, 1981) which indicated that *Rhizopus* spp. may cause seed root rot or decay of cotton seedlings.

Table 9: Correlation between frequencies of fungi isolated from cotton seedlings and seedling disease variables.

Isolation frequency of	Seedling disease variable			
	Preemergence damping-off	Postemergence damping-off	Survival	Dry weight
Fusarium	0.680	0.919**	- 0.853**	- 0.221
Rhizoctonia	0.641	0.329	- 0.514	0.908**
Penicillium	- 0.137	0.197	- 0.034	- 0.508
Alternaria	0.157	- 0.083	- 0.038	0.591
Stemphylium	0.198	0.478	- 0.362	- 0.429
Aspergillus	- 0.718*	- 0.925**	0.875**	0.013
Rhizopus	0.439	0.755*	- 0.637	- 0.271
Chaetomium	- 0.658	- 0.572	0.653	- 0.502
Helminthosporium	- 0.439	- 0.234	0.356	- 0.297
Trichoderma	0.043	- 0.477	0.235	0.190
Cladosporium	0.088	0.354	- 0.237	- 0.189
Nigrospora	- 0.282	- 0.236	0.275	0.458
Phoma	- 0.140	- 0.277	0.223	- 0.167
Unknown sporulated fungus	- 0.201	- 0.077	0.147	- 0.412
Unknown sterile fungus	- 0.484	- 0.279	0.404	- 0.544

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تأثير المبيد الحشرى جاوشو على كفاءة المبيد الفطرى مونسرين فى مقاومة أمراض البادرات فى القطن

إيمان أمين محمد عثمان
معهد بحوث أمراض النباتات – مركز البحوث الزراعية – الجيزة – مصر.

أجريت تجربة فى الأصص تحت ظروف الصوبة لمدة عامين (٢٠٠٣ و ٢٠٠٤) لدراسة تأثير معاملة بذور القطن بالمبيد الحشرى جاوشو على كفاءة المبيد الفطرى مونسرين فى مقاومة أمراض البادرات فى القطن. وعلى ذلك احتوت الدراسة على ٤ معاملات هى: معاملة البذرة بخليط من المونسرين والجاوشو – معاملة البذرة بالمونسرين – معاملة البذرة بالجاوشو والمقارنة الغير معاملة. واختبرت هذه المعاملات من حيث تأثيرها على كل من النسبة المئوية لموت البادرات قبل ظهورها فوق سطح التربة والنسبة المئوية لموت البادرات بعد ظهورها فوق سطح التربة ونسبة النباتات الباقية على قيد الحياة والوزن الجاف للبادرات. أجريت التجربة على سبعة أصناف من القطن المصرى هى: جيزة ٨٠ ، ٨٣ ، ٨٥ ، ٨٦ ، ٨٨ ، ٨٩ ، ٩٠. فى العام الأول كان صنف القطن والمعاملة مصادر عالية المعنوية من حيث التأثير على حدوث الإصابة قبل ظهور البادرات فوق سطح التربة ، أما التفاعل بين الصنف والمعاملة كان مصدراً معنوياً للتباين. وبالنسبة لحدوث الإصابة بعد ظهور البادرات فوق سطح التربة فإن المعاملة فقط كانت هى المصدر الوحيد للتباين. ومن حيث النباتات الباقية على قيد الحياة فقد كان كل من الصنف ةالمعاملة مصادر عالية المعنوية فى التباين. جميع مصادر التباين كانت غير معنوية من حيث التباين فى الوزن الجاف للبادرات. فى العام الثانى كان كل من الصنف والمعاملة مصادر عالية المعنوية للتباين من حيث الإصابة قبل ظهور البادرات فوق سطح التربة أما التفاعل بين الصنف والمعاملة فلم يكن له تأثيراً معنوياً. جميع مصادر التباين كانت غير معنوية من حيث التأثير على الإصابة بعد ظهور البادرات فوق سطح التربة. كان الصنف مصدراً عالى المعنوية للتباين فى نسبة النباتات الباقية على قيد الحياة ، أما المعاملة كانت مصدراً عالى معنوياً للتباين بينما التفاعل بين الصنف والمعاملة لم يكن له تأثيراً معنوياً. ومن حيث التأثير على الوزن الجاف للبادرات كانت المعاملة هى المصدر الوحيد للتباين فى الوزن الجاف. فى موسم ٢٠٠٣ تم عزل ١٣ جنس من الفطريات المختلفة من جذور البادرات لكل معاملة من المعاملات الأربعة. هذه الفطريات كانت: فيوزاريوم ، ريزوكتونيا ، بنيسيليوم ، ألترناريا ، ستيمفيلويم ، أسبرجلس ، رايزوبس ، كيتوميوم ، عزلة غير معروفة عقيمة ، عزلة غير معروفة متجرثمة ، هلمنثوسبوريوم ، ترايكودرما و كلادوسبوريوم. فى موسم ٢٠٠٤ تم عزل ٩ أجناس فطرية هى: فيوزاريوم ، ريزوكتونيا ، بنيسيليوم ، ألترناريا ، أسبرجلس ، نيجروسبورا ، ترايكودرما ، كيتوميوم و فوما. درس تأثير المعاملات المختلفة على تكرار الفطريات المعزولة فى كل عام كما درس الارتباط بين المتغيرات المستعملة لقياس المرض وتكرار عزل هذه الفطريات.

Table 2: Effect of cotton cultivar, pesticide treatment, and their interaction on cotton seedling damping-off under greenhouse conditions in 2003.

Cultivar	Preemergence damping-off Treatments[a]										Postemergence damping-off Treatments									
	T_1		T_2		T_3		T_4		Mean		T_1		T_2		T_3		T_4		Mean	
Giza 80	38.0	(37.75)[b]	34.0	(35.60)	29.33	(32.77)	49.33	(44.01)	37.67	(37.68)	0.0	(0.00)[b]	0.0	(0.00)	6.0	(14.05)	6.67	(12.23)	3.17	(6.57)
Giza 83	34.67	(35.93)	23.33	(27.88)	51.33	(45.94)	50.0	(44.99)	39.83	(38.68)	4.0	(9.45)	9.33	(12.93)	21.33	(26.94)	10.0	(14.80)	11.17	(10.03)
Giza 85	21.33	(27.44)	22.0	(27.78)	21.33	(27.42)	36.0	(36.61)	25.17	(29.81)	0.0	(0.00)	0.0	(0.00)	13.33	(16.96)	24.67	(24.84)	9.50	(10.42)
Giza 86	17.33	(24.55)	6.0	(13.31)	30.0	(33.05)	35.33	(36.41)	22.17	(26.83)	8.67	(16.43)	1.33	(3.85)	7.33	(14.42)	16.67	(23.36)	8.50	(14.51)
Giza 88	24.0	(29.16)	24.0	(28.94)	20.0	(26.43)	20.67	(26.58)	22.17	(27.78)	0.0	(0.00)	0.67	(2.71)	11.33	(18.97)	17.33	(15.38)	7.33	(9.27)
Giza 89	22.0	(27.50)	16.67	(23.37)	31.33	(33.69)	31.33	(34.00)	25.33	(29.64)	2.0	(6.56)	0.67	(2.71)	1.33	(3.85)	32.0	(33.98)	9.00	(11.77)
Giza 90	8.0	(16.21)	20.67	(26.88)	14.0	(21.66)	28.0	(31.44)	17.67	(24.05)	2.0	(6.56)	1.33	(5.42)	11.33	(18.97)	6.67	(11.71)	5.33	(16.66)
Mean	23.62	(28.36)	20.95	(26.25)	28.19	(31.56)	35.81	(36.38)			2.38	(5.57)	1.90	(3.94)	10.28	(16.31)	16.29	(19.47)		

LSD (Transformed data) for C x T ($p \leq 0.05$) = 10.67, LSD for treatment = 6.33 ($p \leq 0.05$) or = 8.42 ($p \leq 0.01$)

[a] T_1 = seeds treated with Monceren (at rate 3 gm/kg seed) and Gaucho (at rate 7 gm/kg seed).
T_2 = seeds treated with Monceren (at rate 3 gm/kg seed).
T_3 = seeds treated with Gaucho (at rate 7 gm/kg seed).
T_4 = untreated seeds.
[b] Percentage data were transformed into arc sine analysis (in parentheses) before carrying out ANOVA to produce approximately constant variance.

Table 3: Effect of cotton cultivar, pesticide treatment, and their interaction on survival and dry weight of cotton seedlings under greenhouse conditions in 2003.

Cultivar	Survival Treatments[a]										Dry weight Treatments				
	T_1		T_2		T_3		T_4		Mean		T_1	T_2	T_3	T_4	Mean
Giza 80	62.0	(52.25)[b]	66.0	(54.40)	64.67	(53.56)	44.0	(41.50)	59.17	(50.43)	364.33	460.67	397.33	387.00	402.33
Giza 83	61.33	(51.62)	67.33	(55.26)	27.33	(30.77)	40.0	(38.94)	48.99	(44.15)	266.67	295.00	291.00	313.67	291.58
Giza 85	78.67	(62.56)	78.0	(62.22)	65.33	(54.12)	39.33	(36.07)	65.33	(53.74)	339.33	246.33	401.33	286.00	318.25
Giza 86	74.0	(64.04)	92.67	(75.58)	62.67	(52.59)	48.0	(43.84)	69.34	(59.02)	287.33	258.00	371.33	385.67	325.58
Giza 88	76.0	(60.84)	75.33	60.61)	68.67	(56.28)	62.0	(52.96)	70.50	(57.67)	320.33	265.33	259.67	372.33	304.42
Giza 89	76.0	(60.93)	82.67	(66.17)	67.33	(55.39)	36.67	(36.93)	65.67	(54.85)	298.33	327.67	328.00	414.67	342.17
Giza 90	90.0	(71.94)	78.0	(62.14)	74.67	(60.28)	65.33	(54.45)	77.00	(62.20)	221.67	333.67	308.00	354.33	304.42
Mean	74.0	(60.60)	77.14	(62.34)	61.52	(51.85)	47.9	(43.53)			299.71	312.38	336.67	359.10	

LSD (Transformed data) for cultivar = 7.97 ($p \leq 0.05$) or = 10.60 ($p \leq 0.01$)
LSD (Transformed data) for treatment = 6.03 ($p \leq 0.05$) or = 8.02 ($p \leq 0.01$)

LSD is non significant for treatment.
LSD is non significant for cultivar.
LSD is non significant for treatment x cultivar.

[a] T_1 = seeds treated with Monceren (at rate 3 gm/kg seed) and Gaucho (at rate 7 gm/kg seed).
T_2 = seeds treated with Monceren (at rate 3 gm/kg seed).
T_3 = seeds treated with Gaucho (at rate 7 gm/kg seed).
T_4 = untreated seeds.
[b] Percentage data were transformed into arc sine analysis (in parentheses) before carrying out ANOVA to produce approximately constant variance.

Table 5: Effect of cotton cultivar, pesticide treatment, and their interaction on cotton seedling damping-off under greenhouse conditions in 2004.

Cultivar	Preemergence damping-off Treatments[a]										Postemergence damping-off Treatments									
	T_1		T_2		T_3		T_4		Mean		T_1		T_2		T_3		T_4		Mean	
Giza 80	39.33	(38.79)[b]	46.67	(43.09)	48.67	(44.22)	32.67	(34.79)	41.84	(40.22)	0.0	(0.71)[c]	1.33	(1.18)	1.33	(1.18)	4.67	(2.02)	1.83	(1.27)
Giza 83	22.67	(28.29)	14.0	(21.44)	28.0	(31.92)	15.33	(22.68)	20.00	(26.08)	3.33	(1.55)	2.0	(1.58)	12.0	(3.21)	7.33	(2.76)	6.17	(2.28)
Giza 85	23.33	(28.85)	23.33	(28.85)	38.67	(38.44)	20.0	(26.49)	26.33	(30.66)	4.0	(1.65)	2.0	(1.47)	0.67	(1.00)	12.0	(2.99)	4.67	(1.78)
Giza 86	27.33	(31.51)	24.67	(29.78)	33.33	(34.97)	34.67	(36.02)	30.0	(33.07)	1.33	(1.29)	4.67	(1.94)	9.33	(2.75)	8.0	(2.77)	5.83	(2.19)
Giza 88	39.33	(38.77)	28.67	(32.10)	37.33	(37.58)	37.33	(37.65)	35.67	(36.52)	4.67	(1.74)	2.0	(1.32)	0.0	(0.71)	2.0	(1.47)	2.17	(1.31)
Giza 89	12.0	(18.94)	16.0	(23.19)	15.33	(22.86)	19.33	(24.88)	15.67	(22.46)	3.33	(1.79)	5.33	(2.12)	5.33	(2.18)	1.33	(1.29)	3.83	(1.85)
Giza 90	17.33	(23.83)	24.67	(29.66)	26.0	(30.48)	13.33	(20.49)	20.33	(26.11)	6.67	(2.20)	1.33	(1.29)	0.67	(1.00)	7.33	(2.76)	4.0	(1.81)
Mean	25.90	(29.85)	25.43	(29.73)	32.48	(34.35)	24.67	(29.00)			3.33	(1.56)	2.67	(1.56)	4.19	(1.72)	6.09	(2.29)		

LSD (Transformed data) for cultivar = 5.87 ($p \leq 0.01$) or = 4.42 ($p \leq 0.05$)
LSD (Transformed data) for treatment = 4.44 ($p \leq 0.01$) or = 3.34 ($p \leq 0.05$)

LSD is non significant for treatment.
LSD is non significant for cultivar.
LSD is non significant for treatment x cultivar.

[a] T_1 = seeds treated with Monceren (at rate 3 gm/kg seed) and Gaucho (at rate 7 gm/kg seed).
T_2 = seeds treated with Monceren (at rate 3 gm/kg seed).
T_3 = seeds treated with Gaucho (at rate 7 gm/kg seed).
T_4 = untreated seeds.

[b] Percentage data were transformed into arc sine analysis (in parentheses) before carrying out ANOVA to produce approximately constant variance.

[c] Percentage data were transformed into $\sqrt{x + 0.5}$ (in parentheses) before carrying out analysis of variance to produce approximately constant variance.

Table 6: Effect of cotton cultivar, pesticide treatment, and their interaction on survival and dry weight of cotton seedlings under greenhouse conditions in 2004.

Cultivar	Survival Treatments[a]										Dry weight Treatments				
	T_1		T_2		T_3		T_4		Mean		T_1	T_2	T_3	T_4	Mean
Giza 80	60.67	(51.21)[b]	52.0	(46.15)	50.0	(45.01)	62.67	(52.35)	56.34	(48.68)	379.67	420.67	537.33	664.67	500.58
Giza 83	74.0	(59.60)	84.0	(66.83)	60.0	(50.83)	77.33	(61.64)	73.83	(59.73)	308.67	316.33	589.67	466.00	420.17
Giza 85	72.67	(58.64)	74.67	(59.78)	60.67	(51.17)	68.0	(55.83)	69.0	(56.35)	272.00	344.33	525.67	525.67	416.92
Giza 86	71.33	(57.65)	70.67	(57.28)	57.33	(49.52)	57.33	(49.29)	64.17	(53.43)	281.00	353.33	569.00	616.33	454.92
Giza 88	56.0	(48.45)	69.33	(56.75)	62.67	(52.42)	60.67	(51.16)	62.17	(52.20)	418.67	229.00	457.33	492.33	399.33
Giza 89	84.67	(67.30)	78.67	(62.51)	79.33	(63.43)	79.33	(64.22)	80.5	(64.37)	407.00	227.67	554.33	487.33	419.08
Giza 90	76.0	(60.67)	74.0	(59.43)	73.33	(59.12)	79.33	(63.25)	75.67	(60.62)	463.33	300.37	565.67	630.00	489.92
Mean	70.76	(57.65)	71.91	(58.39)	63.33	(53.07)	69.24	(56.82)			361.48	313.14	542.71	554.62	

LSD (Transformed data) for cultivar = 4.65 ($p \leq 0.05$) or = 6.19 ($p \leq 0.01$)
LSD (Transformed data) for treatment = 3.52 ($p \leq 0.05$)

LSD for treatment = 73.19 ($p \leq 0.05$) or = 97.35 ($p \leq 0.01$).

[a] T_1 = seeds treated with Monceren (at rate 3 gm/kg seed) and Gaucho (at rate 7 gm/kg seed).
T_2 = seeds treated with Monceren (at rate 3 gm/kg seed).
T_3 = seeds treated with Gaucho (at rate 7 gm/kg seed).
T_4 = untreated seeds.
[b] Percentage data were transformed into arc sine analysis (in parentheses) before carrying out ANOVA to produce approximately constant variance.

Table 7: Effect of seed treatment on frequency of fungi isolated from cotton seedling in 2003.

A Treatment	*Fusarium* [B]	*Rhizoctonia* [B]	*Penicillium* [C]	*Alternaria* [B]	*Stemphylim* [B]	*Aspergillus* [C]	*Rhizopus* [D]	*Chaetomium* [C]	Unknown sterile [C]	Unknown sporulating [B]	*Helmintho-sporium* [D]	*Trichoderma* [D]	*Cladosporium* [D]
T_1	7.30 ab[E]	4.28 ab	7.92 a	5.72 a	10.18 a	19.10 a	0.40 a	12.92 b	14.32 a	16.34 a	0.0 a	1.44 a	0.0.a
T_2	3.25 a	4.66 a	36.80 a	0.0 a	0.0 a	18.85 a	0.0 a	17.10 b	10.70 a	0.0 a	3.33 a	3.13 a	0.0 a
T_3	12.27 abc	16.06 abc	12.79 a	13.49 b	13.13 a	10.07 a	3.26 a	2.46 ab	2.94 a	6.73 a	0.0 a	0.61 a	6.29 b
T_4	23.71 c	20.63 c	25.36 a	12.97 b	7.13 a	3.67 a	1.87 a	0.24 a	2.44 a	1.16 a	0.36 a	0.0 a	0.0 a

A: T1 seed were treated with Monceren (3 gm/kg seed) and Gaucho (7 gm/kg seed).
T2 seed were treated with Monceren (3 gm/kg seed).
T3 seed were treated with Gaucho (7 gm/kg seed).
T4 untreated seeds.
B: Percentage data were transformed into $\sqrt{x}$, where x is the percentage data.
C: Percentage data were transformed into arc sine.
D: Percentage data were transformed into $\sqrt{x + 0.5}$, where x is the percentage data.
E: Means followed by the same letter(s) are not significantly different ($p \leq 0.05$) according to LSD test.