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MANAGEMENT OF THE ROOT ROT OF PEANUT IN THE NEWLY RECLAIMED LAND IN El-BEHERA GOVERNORATE, EGYPT

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ABSTRACT

Several fungi were found to be associated with root rot of peanut in the newly reclaimed land in El-Behera governorate. *Rhizoctonia solani, Aspergillus niger, Fusarium spp., Sclerotium rolfsii, and Macrophomina phaseolina* were prevalent over the collected samples and recovered in frequencies of 74%, 69%, 66 %, 48% and 39% , respectively. *Rhizopus stolonifer, Pythium debaryanum, Mucor spp*. and *Verticillium albo-atrum* were also recovered but at much lower frequencies of 22%, 21%, 13% and 9%, respectively. The cv. G6 of peanut was the most resistant cultivar tested. Means of the pre-and post–emergence damping off incited on cv. G6 were as low as 16.8% and 20.6 %, respectively. This compared to 21.2%; 29.1% on cv. G5. and 28.6 %; 33.8% on cv.G4. The 1st of may was the best sowing date for suppressing the root rot of peanut in the newly reclaimed land in El-Behera governorate. Amount of the disease, assessed as damping off, was as low as 44.6% when peanut was seeded on the 1st of May compared to 55.6%, 51.7 %, and 59.3 % for the 15th of April, the 15th of May and the 1st June, respectively. NPK fertilization at 15-45-48 unit/fed. was the best NPK fertilization rate for minimizing damping off to 25.9% and maximizing pod yield of peanut to 827 kg/fed. Implementation of the above recommended agronomic measures along with the use of the biofungicide Plant-guard significantly decreased the damping off incited to 19.9% which was not significantly different from that of the fungicide Topsin-M (16.7%). Rizolex-T, however, aided with the above recommended agronomic measures, was of the highest effect and

suppressed root rot of peanut to 6.9% compared to 10.5% for Vitavax 200, and 31.1% for the non-treated control. This was reflected in 93.1% healthy survival plants and 1285 kg/fed. pod yield of peanut compared to 68.9% and 856 kg/fed., respectively, for the non-treated control.

INTRODUCTIN

Peanut (*Arachis hypogea* L.) is one of the most important and widely distributed crops in Egypt. It comes after cotton, rice and onion in our export crops (El-Deeb *et al*., 2002). Besides, it is considered one of the important field crops for improving sandy soil qualities as its root nodules bacteria can fix the atmospheric nitrogen (Salui and Bhatacharya, 1998). Consequently, cultivation of peanut in Egypt is mainly concentrated in the newly reclaimed land where El-Behera governorate is considered a major area.

Unfortunately, in such region peanut is negatively affected with the root rot disease. Large losses are annually occurred due to this disease which affect seed germination, plant growth, and both yield and quality of peanut.

Various methods for the control of root rot of peanut were suggested worldwide. These included the use of resistant cultivars (Bahatia *et al.*, 1996; Butzler *et al.*, 1998), cultural practices (Helal *et al.,* 1994; El-Deeb and Ibrahim, 1998), and biological and chemical control (Umamaheswar and Ramakrishnan 1994; Frank *et al.,* 1998; Siddiqui *et al.,* 2002; Cilliers *et al*., 2003). Each of these control measures is an important means in checking root rot of peanut (Helal *et al*., 1994). However, a combination of these methods is suggested for a sustainable and efficient control (Muthamilan and Jeyarajan, 1996; Butzler, 1998; Sheela *et al*., 2000 ; Cilliers *et al.*, 2003).

The present study, therefore, was conducted to determine (i) fungi responsible for the root rot of peanut in the newly reclaimed land in El-Behera governorate, (ii) effect of varietal reaction, sowing date and major macro-nutrients on root rot disease incidence and yield of peanut, and (iii) potential of the biofungicide Plant-guard as well as certain chemical fungicides for the control of root rot of peanut under field condition.

MATERIALS AND METHODS

Isolation and identification of the causal organisms.

Diseased peanut plants and seedlings showing root rot symptoms were sampled from different regions in the newly reclaimed land in El-Behera governorate during the 1998-1999 summer seasons. These regions were El-Bostan, El–Nobaria, and South El-Tahrir. Samples were washed in tap water, cut into small pieces, surface sterilized with 0.01% sodium hypochlorite solution for 2mins, rinsed in sterile distilled water, dried in sterilized filter paper and plated onto PDA. Plates were incubated at 25^{o}C in darkness for 5 days. Developed cultures were purified by the single spore isolation or the hyphal tip technique. Purified fungi were identified according to Booth (1977) and Barnett and Hunter (1987).

Pathogenicity tests and varietal reaction.

Pathogenicity tests were conducted in 25-cm pots previously sterilized in 5% formalin for 15mins. and air dried for one week. Pots were filled with autoclaved soil mixture of clay and clean sand in 1:1 (v /v).

Inocula of the recovered fungi were prepared on autoclaved barley grains medium (Morsy, 1999) under aseptic conditions and incubated at 25^{o}C for 2 weeks. Sterilized potted soil was inoculated with fungal inocula at rate of 5% (w/w). The same amount of autoclaved barley grains medium was added to pots to serve as a control.

Seeds of three cultivars of peanut tested were obtained from the Oil Crops Section, Ministry of Agriculture, Egypt.These cultivars were the root rot susceptible cv. Giza 4 (El-Deeb, *et al.*, 2002), the moderately resistant widely grown in El–Behera cv. Giza 5 (Morsy, 1999) and the newly introduced cv. Giza 6. Seeds were surface sterilized with 0.01% sodium hypochlorite solution for 2mins, rinsed several times in sterile distilled water and sown as 10 seeds/pot in five replicate pots for each tested fungus. Pots were watered as needed and treated according to the normal agricultural practices. Reisolation was conducted to ensure the association of the tested fungi with the developed disease.

Field experiments.

A series of field experiments were conducted in El-Bostan region, El-Behera governorate, during the 2000-2003 growing seasons in fields naturally heavily infested with the root rot of peanut. Four replicate plots (4 x 3.6m) for each treatment were prepared and arranged in a completely randomized block design. Each plot contained five rows, 60 cm apart, feeded with single seeds, 20 cm apart, to comprise a total of 100 seeds/plot. Plots were treated as conventionally recommended for peanut cultivation or otherwise stated.

1- Effect of sowing date on root rot incidence:

In the 2000 and 2001 summer seasons, peanut cv.G6 was seeded at four successive dates as recommended for peanut cultivation (Abdel-Galil, 1977). These dates were the 15th of April, 1st of May, 15th of May , and 1st of June.This was to investigate the effect of sowing date on incidence of the root rot of peanut.

2- Effect of NPK fertilization on root rot incidence:

In the summer seasons of 2001 and 2002, peanut cv.G6 was sown at the recommended date obtained from the previous experiment. Nitrogen, phosphorus, and potassium fertilizers were applied at three rates recommended for peanut cultivation in different studies (Helal *et al.,* 1994; El-Deeb and Ibrahim, 1998; Morsy, 1999). NPK was applied as amonium sulphate (0,15,30 N unit), calcium superphosphate (0,30,45 P unit), and potassium sulphate (0,24,48 K unit) per feddan. Superphosphate was added before sowing, ammonium sulphate was added twice 20 and 40 days after sowing, while potassium sulphate was added twice at 25 and 45 days after sowing (El-Deeb and Ibrahim, 1998).

3- Biological and chemical control:

In the 2002 and 2003 summer seasons peanut seeds, cv. G6, were soaked for 12 hours in Plant-guard suspension (120×10^6 conidia/L) and immediately sown adopting label instruction. Plant-guard which is a *Trichoderma harzionum* formulation was supplied by El-Naasr Co. Besides, three systemic, commercially available, widely used fungicides (*i.e.,* Rizolex-T; Vitavax 200; Topsin-M) were obtained from Kafr El-Zayat Co. and tested in checking root rot of peanut. Seeds of cv. G6 of peanut were treated with the tested fungicides as seed dressing at the rat of 2g/kg of seeds. Check treatment was prepared by sowing surface sterilized peanut seeds cv.G6. Sowing date and fertilization rate were conducted according to the recommendations derived from the previous two experiments.

Disease and yield assessment.

Root rot incidence was assessed according to Helal *et al.*(1994) and El-Deeb and Ibrahim (1998) in terms of percentage of pre-emergence damping off, post-emergence damping off, and percentage of the healthy survival plants 15, 45 and 90 days after planting, respectively. Average pod yield of peanut was determined for each conducted treatment according to Morsy (1999), 120 days after planting.

Statistical analysis.

Data obtained were statistically analysed according to Snedecor and Cochran (1973) and Rangaswamy (1995). Least significant differences (LSD) test was conducted for means according to Walter and Duncan (1969) at 5 % of probability.

RESULTES

Fungi associated with the root rot of peanut.

Different fungi were recovered from peanut plants showing root rot and damping off symptoms sampled from the surveyed newly reclaimed land in El-Behera governorate (Table1). *Rhizoctonia solani, Aspergillus niger, Fusarium spp., Sclerotium rolfsii* and *Macrophomina phaseolina* were prevelent over the collected samples and recovered in frequencies of 74%, 69%, 66%, 48% , and 39%, respectively. *Rhizopus stolonifer, Pythium debaryanum, Mucor spp., and Verticillium albo–atrum* were also recovered but at lower frequecies of 22%, 21%, 13%, and 9%, respectively (Table1).

Pathogenicity tests and varietal reaction.

Pathogenicity tests conducted on three cultivars of peanut, *i.e.*, G4, G5, and G6, revealed that *Rhizoctonia solani, Aspergillus* *niger*, *Fusarium solani*, *Fusarium oxysporum*, *Sclerotium rolfsii*, and *Macrophomina phaseolina* were pathogenic to the three tested cultivars and incited 16.3-47.2% and 18.7-56.4% for the pre-and post-emergence damping off, respectively (Table 2). However, *Rhizopus stolonifer*, *Mucor spp.*, *Verticillium albo-atrum* and *Pythium debaryanum*, were only pathogenic to cv. G4 and failed to induce a significant damping off on any of the G5 and G6 cultivars.

Table 1: Frequency of fungi recovered from peanut samples showing root rot and damping off symptoms collected from different localities in El-Behera governorate during 1998 - 1999 summer seasons.

Fungi	Frequency (%)*
Rhizoctonia solani	74
Aspergillus niger	69
Fusarium solani	45
Fusarium oxysporum	21
Sclerotium rolfsii	48
Macrophomina phaseolina	39
Pythium debaryanum	21
Rhizopus stolonifer	22
Mucor spp.	13
Verticillium albo-atrum	9

* Number of isolates recovered from 100 peanut samples plated on PDA.

Table 2: Pre- and post-emergence damping off incited on G4, G5, and G6 cultivars of peanut sown in potted soil artificially infested with the root rot fungi of peanut.

Fungi	%Pre-emergence damping off [a]			%Post-emergence damping off [b]		
	G4	G5	G6	G4	G5	G6
Rhizoctonia solani	37.3	27.5	22.5	56.4	45.0	32.5
Aspergillus niger	47.2	37.5	24.3	35.1	43.7	21.0
Fusarium solani	21.9	18.6	16.3	33.9	25.4	18.7
Fusarium oxysporum	33.4	24.3	17.2	45.2	44.5	27.3
Sclerotium rolfsii	41.8	25.3	20.7	52.7	43.7	37.5
Macrophomina phaseolina	43.6	28.7	21.5	49.8	37.5	25.2
Pythium debaryanum	17.3	13.9	12.1	18.3	14.2	12.9
Rhizopus stolonifer	15.6	12.7	11.5	16.8	13.7	11.2
Mucor spp.	14.7	12.3	11.3	14.1	11.3	10.1
Verticillium albo-atrum	13.3	11.6	11.1	16.2	12.4	9.8
Control (non-inoculated)	4.7	4.3	3.4	4.1	4.4	3.3
Means (inoculated)	**28.6** A	**21.2** B	**16.8** C	**33.8** A	**29.1** B	**20.6** C
LSD at 5%	**8.1**	**9.7**	**8.9**	**8.6**	**9.9**	**9.8**

[a] estimated 15 days after sowing [b] estimated 45 days after sowing.

Means followed by the same letter for each of the pre- and post-emergence damping off are not significantly different at $p = 0.05$.

The cv. G6 of peanut was the most resistant cultivar of peanut tested. Means of pre- and post-emergence damping off on cv. G6 were as low as 16.8% and 20.6 %, respectively. This compared to 28.6 %; 33.8 % on cv. G4 and 21.2%; 29.1% on cv. G5 for the pre- and post-emergence damping off, respectively (Table 2).

Field experiments.

1-Effect of sowing date on root rot incidence:

Pre-and post-emergence damping off were as low as 21.5 % and 23.1%, respectively, when peanut was seeded on the 1st of May(Table 3). This compared to 26.7% and 28.9% for the 15th of April for both phases of damping off. Delaying sowing date to the 15th of May was reflected in 25.4% and 26.3% for pre-and post-emergence damping off, respectively. A further increase of 27.6% and 31.7% for pre- and post-emergence damping off was revealed with delaying sowing date to the 1st of June. Meantime sowing of peanut on the 1st of May significantly increased both the healthy survival plants (55.4%) and pod yield of peanut (686 kg/fed.). This was significantly higher than of the other sowing dates of peanut tested (Table 3).

Table 3: Effect of sowing date on root rot incidence and pod yield of peanut cv. G6 sown in fields naturally infested with the root rot disease during the 2000-2001 summer seasons.

Sowing date	%Pre-emergence damping off [a]	%Post-emergence damping off[b]	% Healthy survival plants[c]	Pod yield Kg/fed.[d]
15th April	26.7*	28.9	44.4	621
1st May	21.5	23.1	55.4	686
15th May	25.4	26.3	48.3	615
1st June	27.6	31.7	40.7	532
LSD at 5%	**3.8**	**3.1**	**4.9**	**58**

* Values are means of the combined data of the 2000 and 2001 summer seasons. [a] estimated 15 days after sowing, [b] estimated 45 days after sowing [c] estimated 90 days after sowing, [d] estimated 120 days after sowing

2-Effect of NPK fertilization on root rot incidence:

Data presented in Table (4) revealed that nitrogen, phosphorus and potassium application, generally, decreased percentage of pre-and post-emergence damping off. This was reflected in increasing the healthy survival plants and pod yield of peanut. The 15-45-48 unit/fed. of NPK, however, exhibited the lowest percentage of pre-emergence damping off (12.2 %) and post-emergence damping off (13.7 %). This was accompanied with the highest percentage of the healthy survival plants (74.1 %) and the highest pod yield of peanut (827 kg/fed.). This was followed by the 15-45-24 NPK fertilization rate, where pre- and post-emergence damping off were 14.4 % and 14.6 %, respectively. This was reflected in 71.0 % healthy survival plants and 785 kg/fed. pod yield of peanut (Table 4).

3-Biological and chemical control:

Data illustrated in Table (5) showed that treatment of peanut seeds before sowing with the biofungicide Plant-guard significantly decreased both pre-and post-emergence damping off to 9.6% and 10.3%, respectively. This was accompanied with 80.1% healthy survival plants and 1051 kg/fed. pod yield of peanut. On the other hand, treatment of peanut seeds with Rizolex-T fungicide exhibited a higher effect. It suppressed both pre- and post-emergence damping off to 2.7% and 4.2%, respectively. This was followed by 4.6%; 5.9% for Vitavax 200 and 7.5%; 9.2% for Topsin-M compared to 14.7%; 16.4% for the non-treated control. Meantime, Rizolex-T showed the highest healthy survival plants and the highest pod yield of peanut, *i.e.* 93.1% and 1285 kg/fed., respectively (Table 5).

Table 4: Effect of NPK fertilization rate on root rot incidence and pod yield of peanut cv.G6 sown in fields naturally infested with the root rot disease during the 2001-2002 summer seasons.

N P K (unit)	% Pre-emergence damping off	% Post-emergence damping off	%Healthy survival plants	Pod yield (kg /fed.)
0 0 0	26.1*	37.3	36.6	386
0 0 24	23.3	33.7	43.0	447
0 0 48	22.1	30.5	47.4	485
0 30 0	24.7	27.7	47.6	482
0 30 24	18.2	22.5	59.3	626
0 30 48	17.5	19.9	62.6	622
0 45 0	23.2	28.6	48.2	496
0 45 24	19.7	21.9	58.4	585
0 45 48	17.6	17.8	64.6	639
15 0 0	24.9	32.3	42.8	520
15 0 24	20.8	23.7	55.5	617
15 0 48	18.1	19.3	62.6	665
15 30 0	17.4	19.4	63.2	685
15 30 24	15.7	17.9	66.4	728
15 30 48	14.5	15.6	69.9	763
15 45 0	15.9	18.7	65.4	688
15 45 24	14.4	14.6	71.0	785
15 45 48	12.2	13.7	74.1	827
30 0 0	25.2	38.9	35.9	486
30 0 24	24.9	29.7	45.4	546
30 0 48	18.6	26.3	55.1	637
30 30 0	18.3	23.2	58.5	655
30 30 24	15.3	19.3	65.4	725
30 30 48	14.7	17.9	67.4	755
30 45 0	17.1	18.3	64.6	697
30 45 24	14.2	16.8	69.0	768
30 45 48	14.4	16.2	69.4	772
LSD at 5%	**1.3**	**1.6**	**2.3**	**69**

* Values are means of the combined data of the 2001 and 2002 summer seasons.

Table 5: Effect of seed treatment of peanut, cv.G6, with the biofungicide Plant-guard and certain chemical fungicides on root rot incidence and pod yield of peanut.

Treatments	Dose g/kg seeds	% Pre-emergence damping off	% Post-emergence damping off	%Healthy survival plants	Pod yield (kg /fed.)
Rizolex-T	2	2.7	4.2	93.1	1285
Vitavax 200	2	4.6	5.9	89.5	1213
Topsin-M	2	7.5	9.2	83.3	1119
Plant-guard	Soaking*	9.6	10.3	80.1	1051
Control (non-treated)	-	14.7	16.4	68.9	856
LSD at 5%		**2.3**	**2.9**	**3.3**	**87**

Values are means of the combined data of the 2002 and 2003 summer seasons.
* Plant-guard suspension (120×10^6 conidia/L).

DISCUSSION

Several fungi were found to be associated with root rot of peanut in the newly reclaimed land in El-Behera governorate where peanut is intensively cultivated in Egypt. *Rhizoctonia solani*, *Aspergillus* niger, *Fusarium spp*., *Sclerotium rolfsii*, *and Macrophomina phaseolina* were prevalent over the collected samples and recovered in frequencies of 74%, 69%, 66 %, 48% and 39%, respectively. *Rhizopus stolonifer*, *Pythium debaryanum*, *Mucor spp.* and *Verticillium albo-atrum* were also recovered but at much lower frequencies of 22%, 21%, 13% and 9%, respectively. These findings are in harmony with reports from Egypt and other parts of the world (Helal *et al*., 1994; Shim *et al.*, 1996; El–Korashy, 1998; Frank *et al*., 1998; Morsy, 1999, El-Wakil and Ghonim, 2000; Cilliers *et al*., 2003).

The cv. G6 of peanut was the most resistant cultivar tested. Pre-and post-emergence damping off, as a classical assessment for the root rot of peanut (Abdel-Galil, 1977; El-Deeb and Ibrahim, 1998; Morsy, 1999), were as low as 37.4% (combined data) on the cv. G6. This compared to 50.3% on cv. G5 and 62.4% on cv. G4 of peanut.

These results are in agreement with Helal *et al*. (1994), El-Deeb and Ibrahim (1998), El-Korashy (1998), and Morsy (1999).

The 1st of May was found to be the best sowing date, recommended (Abdel–Galil, 1977), for suppressing the root rot of peanut. Damping off developed when peanut was seeded on the 1st of May, was as low as 44.6% (combined data) compared to 55.6%, 51.7%, and 59.3% for the 15th of April, the 15th of May, and the 1st of June, respectively, in fields heavily infested with the root rot disease. These results are supported by Helal *et al.* (1994), and Morsy (1999).

Nutritional management for the advantage of plant host and disadvantage of plant pathogen is a new approach for plant diseases control (Jones *et al.*, 1989; Rush *et al*., 1997). NPK fertilization at 15-45-48 unit/fed. was found to be the best NPK fertilization rate for minimizing both phases of damping off to 25.9% (combined date) and maximizing pod yield of peanut cv. G6 to 827 kg/fed. These findings are in harmony with Helal *et al*. (1994), El-Deeb and Ibrahim (1998), and Morsy (1999).

The use of *Trichoderma* is a promising tool as a biocontrol agent for plant diseases control (Adams, 1990). The *Trichoderma* formulation, Plant-guard, as seed treatment effectively suppressed both phases of damping off on cv. G6 of peanut to 19.9% (combined data) compared to 31.1% for the non-treated control. The use of *Trichoderma*, however, is still in need for further studies for optimizing, probably, doses, methods, and time of application. Genetic engineering can play a part to maximize its antagonistic effect to reach to an effective and eco-friendly biofungicide for the root rot control of peanut (Persly and Mac Intyre, 2002). These results are in agreement with Umamaheswar and Ramakrishnan (1994), Muthamilan and Jeyarajan (1996), Mehrotra *et al.* (1997), and El-Deeb *et al*. (2002).

Despite that biological control and the agronomic control measures are gaining much interests for several environmental concerns, the use of fungicides is still a major component of any integrated pest management programme (Dent 1995). In the present study, use of the fungicides Rizolex-T, Vitavax 200, and Topsin-M as seed treatment (2g/kg seed), significantly decreased damping off to 6.9-16.7% (combined data). Rizolex-T, however, was of the highest effect as suppressed damping off developed to 6.9% compared to 10.5%, 16.7%, and 31.1% for Vitavax 200, Topsin-M, and the non-treated control, respectively.

Consequently, the use of the resistant cv. G6 of peanut, the right sowing date of the 1st of May, the optimum NPK fertilization rate of 15-45-48 unit/fed. and the fungicide Rizolex-T (2g/kg.) as seed dressing, in integration, has resulted in a significant suppression to the root rot of peanut to be as low as 6.9 %, in heavily infested fields in the newly reclaimed land in El-Behera governorate. This was accompanied with a considerable increase in both of the healthy survival plants (93.1%) and pod yield of peanut (1285 kg/fed.). Such increase in plant yield is due to the reduction in disease severity and the consequent better plant vigor. These findings are in harmony with results obtained by Muthamilan and Jeyarajan (1996), Butzler *et al.* (1998), El-Deeb and Ibrahim (1998), Morsy (1999), El-Wakil and Ghonim (2000), Sheela *et al*. (2000), El-Deeb *et al*. (2002), and Celliers *et al*. (2003).

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الملخص العربي

مكافحة عفن جذور الفول السودانى فى الأراضى المستصلحة الجديدة بمحافظة البحيرة – جمهورية مصر العربية

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في دراسة إستهدفت الكشف عن الفطريات المسببة لعفن جذور الفول السوداني في الأراضي المستصلحة الجديدة بمحافظة البحيرة تم عزل فطريات *Rhizoctonia solani* و *Aspergillus niger* و *Fusarium spp.* و *Sclerotium rolfsii* و *Macrophomina phaseolina* وكانت نسبة تواجدها 74% ، 69 % ، 66 % ، 48 % ، 39% علي التوالي، كما عزلت فطريات *Rhizopus stolonifer* و*Pythium debaryanum* و *Mucor spp.* و *Verticillium albo-atrum* بنسبة أقل هي 22 % ، 21 % ، 13% ، 9% علي التوالي ، وقد أظهر الصنف جيزة 4 قابلية شديدة للإصابة (62.4%) بفطريات عفن الجذور المعزولة بينما أظهر الصنف جيزة 5 قابلية متوسطة (50.3%) بينما كان الصنف جيزة 6 هو الأكثر مقاومة فى إختبارات القدرة المرضية حيث لم تتعدى نسبة إصابته 37.4% بفطريات عفن الجذور المعزولة، وفي سلسلة من التجارب الحقلية بحقول مصابة بعفن جذور الفول السوداني بالأراضى المستصلحة الجديدة بمنطقة البستان بمحافظة البحيرة أعطت الزراعة في أول مايو للصنف جيزة 6 أقل نسبة مئوية (44.6 %) للإصابة بموت البادرات قبل وبعد ظهورها فوق سطح التربة وذلك بالمقارنة بباقي مواعيد الزراعة الأخري المختبرة وهي 15أبريل (55.6%)، 15 مايو (51.7 %) ، والاول من يونيو (59.3 %) كما أدى التسميد بمعدل 15-45-48 وحدة نيتروجين ، فوسفور ، بوتاسيوم علي التوالي إلى خفض أكثر لنسبة الإصابة لتصل إلي 25.9 % ، وكذا فقد وجد أنه بزراعة الصنف جيزة 6، فى الأول من مايو مع التسميد الموصى به ومعاملة البذور قبل الزراعة بالمبيد الحيوي Plant-guard أدى إلى إنخفاض أكثر فى نسبة الإصابة لتصل إلي 19.9 % وكان ذلك لا يختلف معنوياً عن تأثير المعاملة بالمبيد الفطرى توبسين- M (16.7%)، هذا إلا ان معاملة البذور برايزولكس- T كانت الأكثر فاعلية حيث أدت إلي إنخفاض نسبة الإصابة بأعفان الجذور إلي 6.9 % بالمقارنة بـ 10.5% للمعاملة بفيتافاكس -200 و 31.1% للغير معامل وقد كان ذلك مصحوباً بزيادة نسبة النباتات السليمة إلى 93.1% وزيادة المحصول الناتج إلى 1285 كجم/فدان بالمقارنة بـ 68.9% نباتات سليمة ومحصول 856 كجم/فدان فى غياب المعاملة بأى من المبيدات الفطرية الحيوية أو الكيماوية .