

IN VITRO EVALUATION OF SOME FUNGICIDES, COMMERCIAL BIOCONTROL FORMULATIONS AND NATURAL PLANT EXTRACTS ON PEANUT ROOT-ROT PATHOGENS

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Abstract

Evaluation of different fungicides revealed that Maxim was the most effective as it prevented the *in vitro* growth of *F. solani*, *M. phaseolina*, *B. theobromae*, *S. rolfsii* and *R. solani*, at 1-5 ppm, followed by Benlate at (10-800 ppm), Vitavax-T (25-200 ppm) and Rizolex-T (200-800 ppm). Apron and Monceren had no or little effect and failed to produce a considerable reduction in growth of all tested fungi even at 800 ppm. Among the tested plant products, thyme extract was the most effective *in vitro* against all tested fungal pathogens, followed by Trilogy (neem oil) and Kenze oil (castor oil). Reduction in fungal linear growth was increased more or less by increasing the concentration of these plant products; however, Leek extract had no effect in this respect. As for antagonistic microbes, both Rizo N and Plantguard caused significant decrease in linear growth of the tested fungi. Rizo N was significantly better than Plantguard; however, both antagonistic microbes, may be considered weak in terms of their toxicity against the tested pathogens.

INTRODUCTION

Peanut (*Arachis hypogea* L.) is one of the most important leguminous crops in Egypt as well as in many parts of the world. Several serious diseases such as pod rot, crown rot, root rot and others attack growing plants and fruits of peanut. Root rot caused by *Rhizoctonia solani*, *Sclerotium rolfsii*, *Fusarium solani*, *Fusarium oxysporum*, *Macrophomina phaseolina* and *Botryodiplodia theobromae* is one of the most serious diseases on peanut plants in Egypt (El-Deeb, 1977, Saleh, 1997 and Abdel-Ghany, 2001). Reduction in peanut yield due to root rots reached 25.1% as recorded by El-Deeb *et al.*, (1977).

Tolclofos-methyl at 4 ppm and benomyl at 8 ppm were more effective against *R. solani in vitro* than dichlofluanid, copper oxyquinolate + Carboxin or pencycuron (Osman *et al.*, 1990). Henriquez and Montealegre (1992) tested 11 fungicides *in vitro* against *S. rolfsii* and found that Vitavax-T, Basitac, Plantavax, Rizolex, Bayleton and Baytan were the most effective. Benlate was the most inhibitive fungicide *in vitro* against *Macrophomina phaseolina*, *Fusarium spp.*, *Alternaria alternata* and *R. solani* followed by Rizolex-T (Tolclofos-methyl + thiram) and vitavax + captan (Saleh, 1997).

Plant extracts such as leaf oil of *Azadirachta indica* was the most effective followed by *Eucalyptus globulus* and *Ocimum canum* against *Sclerotium rolfsii* (Singh and Dwivedi 1990). Neem oil was the most effective of the volatile and nonvolatile fractions tested against *Sclerotium rolfsii* where sclerotial germination was only 8% compared to 71% in the untreated control. Wilson *et al.*, (1997) tested 49 essential oils and found that palamarosa (*Cynobopogon martin*), red thyme (*Thymus zygis*), cinnamon leaf (*Cinnamomum zeylanicum*) and clove buds (*Eugenia caryophyllata*) showed the most antifungal activity against *B. cinerea*. These compounds increased the activity of chitinase and peroxidase associated with the induction of resistance. Furthermore, they stimulated the accumulation of phenolic compounds, as antifungal substances, in plant tissues.

Benhamou and Chet (1993) observed, using scanning electron microscopy investigations, that coiling of the antagonist (*Trichoderma harzianum*) around its host (*R. solani*) was an early event preceding hyphal damage. Saleh (1997) stated that *Bacillus subtilis* isolated from the rhizosphere of naturally infected plants was inhibitory to the *in vitro* growth of the tested fungi; *Fusarium campactum*, *Fusarium oxysporum*, *Macrophomina phaseolina*, *R. solani* and *Sclerotium rolfsii*. El-Garhy (2000) reported that all biocontrol agents *Trichoderma harzianum*, *Gliocladium virens*, *Paecilomyces farinosus*, *Bacillus subtilis* and *Streptomyces griseoviridis* significantly decreased the mycelial radial growth of *R. solani* and *Sclerotinia sclerotiorum* on PDA medium compared with the control.

The present work aimed at evaluating the effect of some fungicides, commercial antagonistic microbes and natural extracts on peanut root-rot pathogens under laboratory conditions.

MATERIALS & METHODS

Five isolates i.e., *Rhizoctonia solani*, *Sclerotium rolfsii*, *Fusarium solani*, *Macrophomina phaseolina* and *Botryodiplodia theobromae* isolated from rotted roots of peanut plants and tested for their pathogenicity to peanuts as mentioned by Abd-El- Ghany (2001) were used in the following experiments.

1. Evaluation of some fungicides on growth of the pathogenic fungi :

This experiment was conducted for studying the effect of some fungicides as shown in Table (1), namely, Maxim, Topsin-M, Rizolex-T, Benlate, Vitavax-T, Monceren and Apron on the linear growth of the pathogenic fungi *Rhizoctonia solani*, *Sclerotium rolfsii*, *Fusarium solani*, *Macrophomina phaseolina* and *Botryodiplodia theobromae*. The fungicides were tested at different concentrations up to 800 ppm based on their active ingredient. PDA medium was poisoned with each fungicidal concentration immediately before solidification and poured into 9-cm plates. Plates were inoculated at the center by 5-mm discs taken from 7 day-old cultures of the above mentioned pathogenic fungi and incubated at 28°C. Four plates were used for each particular treatment as replicates. Linear growth of the tested fungus was measured when its mycelial growth completely covered the surface of the medium in the control treatment (un-poisoned medium) by calculating the average of two perpendicular diameters of fungal growth in mm.

2. Evaluation of some natural plant products on growth of the pathogenic fungi :

In this experiment, Trilogy (neem oil 90%) and kenze oil 2000 (castor oil 70%) as commercial plant products in addition to leaf extracts of leek (*Allium porrum*) and thyme (*Thymus vulgaris*) were used. The latter two leaf extracts were prepared as follows: A known weight (100 g) of fresh leaves of leek and thyme were washed under running tap water, air dried for one hour in the laboratory and homogenized in 100-ml sterile distilled water using electric blender. The homogenates were centrifuged at 3000 rpm for 15 min. and filtered through filter paper (Watman No. 1). The supernatants were sterilized using bacteria proof Seits filter and kept as stock solutions (100% conc.) in dark sterile bottle in a refrigerator.

The above mentioned plant products and leaf extracts were added to PDA medium before pouring the plates at different concentrations i.e. 0, 100, 250, 500, 750 and 1000 ppm (v/v). Four plates for each concentration were inoculated at the center with discs (5-mm) taken from 7 day-old culture of tested fungi. The plates were incubated at 28°C. Linear growth of the tested fungi was measured as mentioned before.

Table 1. List of tested fungicides, their active ingredients, recommended dose and formulators.

Trade name & formulator	Common name & Active ingredient	Chemical formula	Dose (ml or g / Kg seed)
Maxim (Novartis)	Fluioxonil (35%)	4-2,2-difluoro-1,3-benzodioxol-4-yl-1H-pyrrole-3-carbonitrile (IUPAC)	3 ml
Topsin-M-70 (Nippon-soda-Japan)	Thiophanate-methyl (70%)	Dimethyl (1,2 phenylene) bis (iminocarbonyl-thiole)bis carbonate	3 g
Rizolex-T (Sumitomo Chem. Co., LTD)	Tolclofos-methyl+thiram -50%	20% Rizolox-T:tolclofos-ethyluro 0-dimethyl)-0-2,6 dichloro-4-methyl-phenyl phosphoro thiole 30% thiram (TMTD) : bis(dimethyl - thiocarbamyl disulphide.	3 g
Benlate (Du-pont, France)	Benomyl (50%)	Methyl 1-(butyl carbamoyl)-2-benzimidazole carbamate.	3 g
Vitavax-T (Uniroyal, England)	Carboxin (31.5%) + thiram (37.5%)	5,6-dihydro-2-methyl-N-phenyl-1,4-oxathiin-3-carboxamide-Bis(dimethyl thio-carbamyl)disulfide	3 g
Monceren (Bayer)	Pencycuron -25%	1-(4-chlorobenzyl)-1-cyclophenyl-l urea.	3 g
Apron (Novartis)	Metalaxyl (35%)	N- (2,b-dimethyl phenyl) -N(methoxy acetyl)-D1-kg alanine methyl ester (CAS)	3 g

3. Evaluation of commercial antagonistic microbes on the pathogenic fungi :

In this experiment, the commercial antagonistic microbes Plantguard (one ml contains about 30×10^6 spore of *Trichoderma* spp) and Rizo-N (one gram contains about 30×10^6 cfu of *Bacillus subtilis*) were used to test their effect on linear growth

of the pathogenic fungi under study. 100 µl of plantguard or 100 µg of Rizo-N were spotted (for the first) or streaked (for the second) at two opposite sides on the surface of PDA medium and at equal distances from the peripheral of the plates. The treated as well as un-treated plates were inoculated simultaneously at their centers (between the two spots or streaks of the tested antagonistic microbe) each with a 5 mm disc of each pathogenic fungus. Four plates were used as replicates for each particular treatment and all plates were incubated at 25°C for about 5-7 days until plates of the control treatment (without antagonistic microbe) were covered by the mycelial growth of the tested fungus.

Statistical analysis:

All afore-mentioned experiments carried out under laboratory, greenhouse or field conditions were performed in a complete randomized block design. All data were analysed according to Snedecor and Cochran (1989).

RESULTS

1. Evaluation of some fungicides on growth of the pathogenic fungi :

This experiment was conducted to study the effect of different concentrations of some fungicides on the linear growth of *R. solani*, *S. rolfsii*, *F. solani*, *M. phaseolina* and *B. theobromae*.

Data in Tables (2-a, -b, -c, -d and -e) show that, Maxim and Benlate followed by Vitavax-T and Rizolex-T were the most suppressive fungicides to linear growth of all tested fungi. Adding Maxim at 1, 1, 1, 5, 5 ppm to the medium resulted in complete inhibition of linear growth of *F. solani*, *M. phaseolina*, *B. theobromae*, *S. rolfsii* and *R. solani*, respectively. However, at 1.0 ppm of Maxim, the linear growth of *R. solani* was significantly lower than that of *S. rolfsii*.

Benlate suppressed the linear growth of *M. phaseolina* at 10 ppm, *F. solani* and *B. theobromae* at 25 ppm and *R. solani* at 100 ppm. *M. phaseolina* seems to be more sensitive to Benlate than *F. solani*. At 10 ppm of Benlate, the latter two fungi showed 13 and 20 mm linear growth although growth of both was completely inhibited at 5 ppm. On the other hand, growth of *S. rolfsii* was un-affected by Benlate. At 800 ppm,

growth of *S. rolfsii* was comparable to that produced in control (un-treated) medium.

Vitavax-T was more toxic to the growth of *S. rolfsii* than to *B. theobromae*, where growth of both fungi was completely checked at 25 and 200 ppm respectively. Meanwhile, growth of *R. solani*, *F. solani* and *M. phaseolina* was stopped at 100 ppm. In this regard, *M. phaseolina* seems to be more tolerant to Vitavax-T than *R. solani* and *F. solani* where the linear growth at 50 ppm was 20, 13 and 13 mm, respectively.

Rizolex-T prevented linear growth of *R. solani*, *M. phaseolina* and *B. theobromae* at 200 ppm and *F. solani* at 400 ppm. Similar linear growth (11 mm) was reported on media treated with 100 ppm in case of the first three fungi. On the other hand, *S. rolfsii* seems to be resistant or more tolerant to this fungicide as it was still growing even on medium amended with 800 ppm showing 13 mm growth.

The data showed that, Apron was an ineffective fungicide against *in vitro* growth of *S. rolfsii* and *R. solani*, while growths of *F. solani*, *M. phaseolina* and *B. theobromae* were slightly affected even at the highest tested concentration of 800 ppm.

The above results indicated that the tested fungicides differed greatly in their toxicity against *in vitro* growth of pathogens under test. Maxim fungicide was the most toxic as it stopped *in vitro* growth at 1-5 ppm, followed by Benlate (10-800 ppm), Vitavax-T (25-200 ppm) and Rizolex-T (200-800 ppm). Apron and Monceren fungicides had no or little effect and failed to result in a considerable reduction in growth of all tested fungi even at the highest concentration.

2. Evaluation of some natural plant products on growth of the pathogenic fungi :

In this experiment, four natural plant products i.e. extracts of thyme and leek leaves, in addition to the commercial plant products Trilogy (neem oil-90%) and Kenze-2000 (castor oil-70%) were tested, at concentrations 0, 100, 250, 500, 750, and 1000 ppm for their potentialities against linear growth of the tested peanut root-rot fungi. The obtained results (Table 3) indicated that, thyme extract was the most effective against growth of all tested fungal pathogens, followed by Trilogy (neem) and Kenze (castor oil) which was not effective against *B. theobrome*, whereas leek extract showed no effect against all fungi at all tested concentrations.

Table 2-a. Effect of different fungicides at different concentrations on linear growth (mm) of *S. rolfsii*.

Fungicides	Concentrations (ppm)											
	0	0.5	1	5	10	25	50	100	200	400	800	Mean
Maxim	90	58	22	0	0	0	0	0	0	0	0	15.5
Topsin M-70	90	80	71	57	49	39	33	20	13	0	0	41.1
Rizolox-T	90	90	82	73	69	63	52	45	33	25	13	57.7
Monceren	90	90	90	90	90	90	90	90	82	71	62	85.0
Benlate	90	90	90	90	90	90	90	90	90	90	90	90.0
Vitavax-T	90	62	41	18	9	0	0	0	0	0	0	20.0
Apron	90	90	90	90	90	90	90	90	90	90	90	90.0
Mean	90.0	80.0	69.4	59.7	56.7	53.1	50.7	47.9	44.0	39.4	36.4	57.0

L.S.D. at 5% for Concentration (C) Fungicides (F) C x F
 1.08 0.86 2.86

Table 2-b. Effect of different fungicides at different concentrations on linear growth (mm) of *R. solani*.

Fungicides	Concentrations (ppm)											
	0	0.5	1	5	10	25	50	100	200	400	800	Mean
Maxim	90	45	13	0	0	0	0	0	0	0	0	13.5
Topsin M-70	90	77	65	53	47	24	13	0	0	0	0	33.6
Rizolox-T	90	71	58	43	28	24	16	11	0	0	0	31.0
Monceren	90	90	84	75	60	45	45	33	29	22	13	53.3
Benlate	90	64	56	43	30	20	12	0	0	0	0	28.6
Vitavax-T	90	85	65	36	34	31	13	0	0	0	0	32.2
Apron	90	90	90	90	90	90	90	90	90	90	90	90.0
Mean	90.0	74.6	61.6	48.6	41.3	33.4	27.0	19.1	17.0	16.0	14.7	40.3

L.S.D. at 5% for Concentration (C) Fungicides (F) C x F
 1.43 1.14 3.79

Table 2-c. Effect of different fungicides at different concentrations on linear growth (mm) of *F. solani*.

Fungicides	Concentrations (ppm)											Mean
	0	0.5	1	5	10	25	50	100	200	400	800	
Maxim	90	38	0	0	0	0	0	0	0	0	0	11.6
Topsin M-70	90	90	71	58	40	0	0	0	0	0	0	31.7
Rizolex-T	90	90	80	68	61	43	37	25	15	0	0	46.3
Monceren	90	90	90	78	75	68	61	55	45	43	39	66.7
Benlate	90	90	70	43	20	0	0	0	0	0	0	28.5
Vitavax-T	90	90	52	45	38	33	13	0	0	0	0	32.8
Apron	90	90	90	90	90	90	90	82	71	64	59	82.4
Mean	90.0	82.6	64.7	54.6	46.3	33.4	28.7	23.1	18.7	15.3	14.0	42.9

L.S.D. at 5% for Concentration (C) Fungicides (F) C x F
 1.52 1.21 4.01

Table 2-d. Effect of different fungicides at different concentrations on linear growth (mm) of *M. phaseolina*.

Fungicides	Concentrations (ppm)											Mean
	0	0.5	1	5	10	25	50	100	200	400	800	
Maxim	90	23	0	0	0	0	0	0	0	0	0	10.3
Topsin M-70	90	65	24	16	11	0	0	0	0	0	0	18.7
Rizolex-T	90	90	90	35	21	19	15	11	0	0	0	33.7
Monceren	90	90	90	90	90	90	90	90	90	90	90	90.0
Benlate	90	20	13	5	0	0	0	0	0	0	0	11.6
Vitavax-T	90	90	90	90	78	56	21	0	0	0	0	46.8
Apron	90	90	90	90	90	82	81	78	73	72	65	81.9
Mean	90.0	66.9	56.7	46.6	41.4	35.3	29.6	25.6	23.3	23.1	22.1	41.9

L.S.D. at 5% for Concentration (C) Fungicides (F) C x F
 1.02 0.82 2.71

Table 2-e. Effect of different fungicides at different concentrations on linear growth (mm) of *B. theobromae*.

Fungicides	Concentrations (ppm)											Mean
	0	0.5	1	5	10	25	50	100	200	400	800	
Maxim	90	13	0	0	0	0	0	0	0	0	0	9.4
Topsin M-70	90	90	29	22	13	12	0	0	0	0	0	23.3
Rizolex-T	90	90	71	24	21	17	13	11	0	0	0	30.6
Monceren	90	90	90	90	90	90	90	90	90	90	90	90.0
Benlate	90	27	24	19	13	0	0	0	0	0	0	15.7
Vitavax-T	90	90	90	90	75	55	20	13	0	0	0	47.6
Apron	90	90	90	90	90	90	90	90	83	82	53	85.3
Mean	90.0	70.0	56.3	47.9	43.2	37.7	30.4	29.1	24.7	24.6	20.4	43.1

L.S.D. at 5% for Concentration (C) Fungicides (F) C x F
 0.81 0.65 2.15

Table 3. Effect of different natural plant products at different concentrations on linear growth (mm) of the pathogenic fungi.

Fungi	Product	Concentrations (p.p.m.)						Mean
		0	100	250	500	750	1000	
<i>S. rolfsii</i>	Kenze 2000	90	90	90	90	83	76	86.5
	Trilogy	90	90	80	74	70	63	77.8
	Leek extract	90	90	90	90	90	90	90
	Thyme extract	90	55	48	38	32	23	47.7
	Mean	90	81.3	77	73	68.8	63	75.5
<i>R. solani</i>	Kenze 2000	90	90	90	90	78	72	85
	Trilogy	90	71	64	52	44	39	60
	Leek extract	90	90	90	90	90	90	90
	Thyme extract	90	44	35	28	21	15	38.8
	Mean	90	73.8	69.8	65	58.3	54	68.5
<i>F. solani</i>	Kenze 2000	90	90	82	78	69	60	78.2
	Trilogy	90	64	55	46	36	30	53.5
	Leek extract	90	90	90	90	90	90	90
	Thyme extract	90	41	37	30	24	20	40.3
	Mean	90	71.3	66	61	54.8	50	65.5
<i>M. phaseolina</i>	Kenze 2000	90	90	87	81	76	68	82
	Trilogy	90	85	71	65	48	38	66.2
	Leek extract	90	90	90	90	90	90	90
	Thyme extract	90	71	64	46	32	24	54.5
	Mean	90	84	78	70.5	61.5	55	73.2
<i>B. theobromae</i>	Kenze 2000	90	90	90	90	90	90	90
	Trilogy	90	75	61	46	41	33	57.7
	Leek extract	90	90	90	90	90	90	90
	Thyme extract	90	63	50	35	23	11	45.3
	Mean	90	79.5	72.8	65.3	61	56	70.8

L.S.D. at 5% for	Concentration (C)	Natural extracts (E)	(C x E)
<i>S. rolfsii</i>	1.58	1.29	3.15
<i>R. solani</i>	1.91	1.56	3.82
<i>F. solani</i>	2.20	1.79	4.40
<i>M. phaseolina</i>	2.20	1.79	4.39
<i>B. theobromae</i>	6.02	4.92	12,04

DISCUSSION

The toxicity of the used fungicides against growth of the tested fungi i.e. *F. solani*, *M. phaseolina*, *B. theobromae*, *S. rolfsii* and *R. solani* was variable. The concentration (in ppm) at which the *in vitro* growth was completely stopped were dependent on the tested fungus. These concentrations were 1-5 ppm for Maxim; 10-100 ppm for Benlate; 25-200 ppm for Vitavax-T and 200-400 ppm of Rizolex-T. It was found that, *S. rolfsii* was not affected by Benlate even at 800 ppm, and was still able to grow at the same concentrations of Rizolex-T. On the other hand, Apron and Monceren fungicides had no or little effect and failed to produce a considerable reduction in growth of all tested fungi even at the highest concentration. Similar results were found by Anwar *et al.*, (1991) who reported that, benomyl was 100 % effective even at 20 ppm against *Fusarium solani*; Henriquez and Montealegre (1992) who reported that Vitavax-T, Basitac, Plantavax, Rizolex, Bayleton and Baytan were the most effective for controlling *S. rolfsii*; Saleh (1997) reporting that Benlate inhibited the growth of *R. solani*, *Macrophomina phaseolina* and *Fusarium* spp. at 3-5 ppm.

Toxicity of the natural plant products i.e. leaf extracts of thyme and leek, Trilogy (neem oil-90%) and Kenze-2000 (castor oil-70%) against *in vitro* growth of the tested peanut root-rot fungi was also variable. Thyme extract seems to be the most toxic followed by neem and castor oil; however, Leek extract had no effect in this respect. *B. theobromae* was the most affected by Thyme extract followed in order by *R. solani*, *F. solani*, *S. rolfsii* and *M. phaseolina*, meanwhile neem oil was more effective against *F. solani* followed by *B. theobromae*, *M. phaseolina* and *R. solani* and seems to be less toxic against *S. rolfsii*. Kenze 2000, however, had no effect on the growth of *B. theobromae* and shows little toxicity against *F. solani* and *M. phaseolina*, *R. solani* and *S. rolfsii*. Toxicity of these natural plant products against fungi might be attributed to their negative effect on enzymatic activities and other vital processes of these pathogens. Several investigators obtained similar results on other plant products like Singh and Dwivedi, (1990) and Abd-El-Baky, (1999) who found volatile plant substances can cause linear growth inhibition in *F. oxysporum f. sp. vasinfectum* and *R. solani*, except in the case of coriander (for *F. oxysporum f. sp. vasinfectum*) and leek (*Allium porrum*) for both fungi where, no inhibition was observed. They added that the essential oils of blue gum, castor-bean (*Ricinus communis*) and coriander resulted in variable linear growth inhibition

in case of *Fusarium oxysporum f. sp. vasinfectum* and *R. solani*. Favaron *et al.*, (1993) found that extracts of onion and leek contained factors that inhibited, to various extents, polygalacturonases produced *in vitro* by several fungi including *F. moniliforme*, *Sclerotium cepivorum* and *M. phaseolina*.

The antagonistic microbes Plantguard (*Trichoderma harzianum*) and Rizo-N (*Bacillus subtilis*) exhibited little decrease in growth of the tested fungi. Rizo N was significantly better than Plantguard. Several mechanisms were suggested to explain the effect of these antagonistic microbes including antagonistic action, hyperparasitism and antibiotic production (Brask, 1991 and Benhamou and Chet 1993). El-Awadi (1993) revealed that *Trichoderma viride* inhibited *in vitro* growth of *F. oxysporum f. sp. cicri* and *R. solani*. Saleh (1997) stated that *Bacillus subtilis* was inhibitory to the fungi *F. compactum*, *F. oxysporum*, *M. phaseolina*, *R. solani* and *S. rolfsii* *in vitro*.

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التقييم المعملى لبعض المبيدات الفطرية وعوامل التضاد الحيوى التجارية والمستخلصات الطبيعية ضد المسببات المرضية لأعفان جذور الفول السودانى

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أظهر التقييم المعملى لعدد من المبيدات الفطرية قدرة مبيد الماكسيم على إيقاف نمو فطريات الفيوزاريوم سولانى ، ماكروفومينا فاصولينيا ، بوتريوبيلوديا ثيوبورومى ، سكلروشسيوم رولفسياى و الريزوكتونيا سولانى بتركيز يتراوح بين ٠,١ جزء فى المليون حسب الفطر وتبعه فى ذلك مبيد البذليت بتركيزات تتراوح بين ١٠ إلى ٨٠٠ جزء فى المليون ثم مبيد الفيتافاكس عند ٢٥-٢٠٠ جزء فى المليون فمبيد الرايزولكس-ت بتركيزات ٢٠٠-٨٠٠ جزء فى المليون. كما ظهر أيضا أن مبيدات الأبرون والمونسرين ليس لها تأثير أو ذات تأثير ضعيف وفشلت فى عمل واضح فى نمو الفطريات المختبرة حتى عند ٨٠٠ جزء فى المليون. وقد أظهر إختبار بعض المستخلصات النباتية الطبيعية أن مستخلص الزعتر هو الأكثر كفاءة ضد جميع المسببات المرضية المختبرة تبعه فى ذلك زيت النيم وزيت الخروع ، وقد تزايد الإختزال فى النمو الفطرى بزيادة تركيز تلك المنتجات النباتية ، كما ظهر أيضا أن مستخلص الكرات ليس له أى تأثير يذكر. وأظهر إختبار عوامل التضاد الحيوى أن كلا من مركب ريزون- والبلانتاجارد قد خفضا معنويا من نمو جميع الفطريات المختبرة وكان الريزون- أفضل من البلانتاجارد فى ذلك الشأن ، ومع ذلك فإن كلا المنتجين يمكن إعتبارهما ذو تأثير ضعيف ضد مسببات أعفان الجذور فى الفول السودانى عند مقارنتهما بتأثير بعض المبيدات والمستخلصات النباتية المختبرة.