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THE ROLE OF FOLIAR SPRAYING OF SOME MICRO-ELEMENTS ON PEANUT LEAVE SPOT, ROOT AND POD ROT DISEASES INCIDENCE AND YIELD

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ABSTRACT

The linear growth of the tested fungi [*Macrophomina phaseolina, Sclerotium rolfsii* and *Fusarium moniliforme*] the cause of peanut root rot and pods disease increased by increasing the concentration of the applied microelements [manganese,zinc and cupper as sulphates] at 25-100 ppm, then decreased after wards at 250-1000 ppm. While, the linear growth of *Aspergillus flavus*, decreased by increasing the concentration of all microelements tested. On the other hand, sporulation and sclerotial formation of the tested fungi of all microelements increased by increasing the concentration then decreased after wards at 500-1000 ppm. Generally, cupper sulfate followed by zinc sulphate were the most effective in this respect, especially when the concentrations were high with all tested fungi.

Under field conditions, three concentrations i.e. 250,500 and 1000 ppm of each aforementioned microelements were applied. Microelements were sprayed twice after ,60 and 90 days of sowing significantly reduced leaf spot diseases compared to the untreated control in both Locations ; Ismailia and Behera Governorate(south Tahrir) during season 2003. The same trend was found in peanut root rot diseases except in 250, and 500 ppm. of $ZnSO_4$ and 250 ppm of $CuSO_4$.

Foliar application at all tested microelements (1000 and 500 ppm respectively were effective against pod rot diseases (brown lesions, pink discoloration and breakdown). All microelements significantly increased pod yield (gm/plant) compared to the untreated ones.

Generally, $CuSO_4$ at 1000 and 500 ppm followed by $ZnSO_4$ at 1000 ppm were the best in reducing leaf spot, root and pod rot diseases and increased the yield (gm/plant), while $MnSO_4$ at 250 and 500 ppm were the least in this respect.
Keywords:- Microelements,leaf spot, root and pod rot, peanut

INTRODUCTION

Peanut (*Arachis hypogaeal*) is an important agricultural crop in Egypt and many parts of the world, as it improves soil properties by increasing organic matter and nitrogen content. It is a main world source of edible oil and protein.

The seeds contain more than 40% oil and 25-30% protein. As well as, it fixes atmospheric nitrogen in soil which is sufficient for subsequent crop (Ahlwat *et al*,1981) In Egypt, it is one of the main crops for export-ation. Also, it is roasted for local direct, human consumption and used for animal feeding. Peanut is attacked by several destructive pathogenic air and soil borne fungi causing considerable losses in the yield, especially leaf spot diseases (*cercospora personatum* and *C. arachidicola*). Soil borne pathogen such as *Rhizoctonia solani, Fusarium spp Sclerotium rolfsii, Macrophomina phaseolina* and *Aspergillus spp.* causing root and pod rot diseases during the growing season, which cause tremendous quantitative and qualitative losses in the yield allover the world [Abawi;and Pastor-Corrales, 1990, Ito *et al.*, 1992, Jacobi and Bakman, 1994 and Mehan *et al.*, 1995 a)reported that pod rot diseases caused by *sclerotium rolfsii* affect peanut in many contries. As regards *In vitro* experiment was studied by Metwally (1986) on *fusarium oxysporum* f.sp. *cepae* on onion. In field, leaf spot disease of peanut or other crops, were studied by Kannaiyan and Prasad (1979) and Metwally *et al.* 1994) on garlic, they found that spraying with some microelements gave the best control with garlic purple leaf blotch and downy mildew. On the other hand, the effect of microelements on some diseases of certain crops and root, pod rot diseases and yield were studied by Metwally (1980 and 1986) and Mostafta (1984). Their study concerned also, with controlling of basal rot disease caused by *F. oxysporium* f.sp. *cepea,*. They found that spraying transplants with microelements decreased the percentage of infection at all concentrations tested compared with the untreated. The influence of microelements on peanut diseases incidence were studied also by Murugesan and Mahadevan in 1987.They stated that watering peanut plant with solution of Cu gave the best control of rot caused by *Macrophomina phaseolina* followed by Mn and Zn. When the plants treated with mixture of microelements at the time of pod pegging were conducted, they resulted in a best effective control for pod rot diseases (Cheng 1989).

Also El-Korashy *et al.*, (1997) and Saliva & Pareak (1999) in their study on controlling of charcol rot caused by *M. phasolina*, they pointed that , all microelements (Zn, Cu, iron, Mn and boron) were effective in reducing the disease incidence. Also, the effect of microelements on yield was studied on many crops by Abd-El Mageid *et al.*(1989), El-Beheidi *et al.* (1990) on onion, Ibrahim *et al.* (1991) on garlic and Korashy *et al.* (1997) found that the soaking of peanut seeds before planting in Zn and Cu solutions, increased its yield as compared to the control.

The aim of this work was to study the effect of $MnSO_4$, $ZnSO_4$ and $CuSO_4$ on linear growth and sporulation or sclerotial formation for pod rot fungi under laboratory conditions. While, under field conditions leaf-spot, root, pod rot diseases and yield (g/plant) were studied.

MATERIALS AND METHODS

These experiments were carried out to evaluate the efficacy of three microelements,i.e. manganese,zinc and cupper as sulphates against certain soil borne fungi under laboratory conditios.

Also, field experiments were carried out at Ismailia and Behira Governorate (South-Tahrir)during 2003 season.

A-Laboratory Experiments:-

The effect of different microelements on fungal linear growth and sporulation or Sclerotial formation.

Macrophomina phaseolina,Sclerotium rolfsii, Fusarium moniliforme and *Asprgillus flavus* used in this study were isolated from naturally infected peanut roots and pods. Purification and identification of the aforementioned fungi were carried out on Onion, Garlic and Oil crops Diseases Department, Plant Pathology Research Institute, A.R.E., Giza Egypt.

The microelements ($MnSO_4$, $ZnSO_4$ and $CuSO_4$) at the concentrateions of 25, 50, 100, 250, 500 and 1000 ppm) were applied to study their effect on fungal linear growth and sporulation or sclerotial formation on the above mentioned fungi. Data tabulated and statistically analyzed according to Snedecor (1966).

Potato Dextrose Agar (PDA) medium was used and microelements with the above mentioned concentrations were added before solidification in conical flasks 100 ml and transferred to Petri-dishes. Petri-dishes were incubated with equal discs (0.5cm diam) taken from 7 days-old, cultures of the tested fungi. Four Petri-dishes free of microelements acted as control according to Sharvelle (1961) method. All disks were incubated at 27 ± 2° for 4-8 days. The linear growth was measured after 4-5 days for *Macrophomina phaseolina*, *S. rolfsii*, *A. flavus* and 8 days for *F. moniliform*. Number of sclerotia formed after 20 days of *M.pheseolani* in 10 microscopic fields per Petri-dish was counted, whereas, number of sclerotia formed of *S.rolfsii* was counted in each Petri-dish. Sporulation of *A.flavus* and *F.moniliforme* were counted after 10 days at inculation. A disc of 0.5 cm in diam. was transfered to sterilized 10 ml of distilled water in a sterilized test tube, then it was shaken for 2 minutes. Spores were counted using a haemocytometer slide.

B- Field Experiments:-

The effect of spraying peanut with microelements on leaf spot disease severity, root and pod rot diseases incidence.

The aforementioned concentrations in field experiment to study their effect on disease severity of peanut leaf spots, caused by *Cercospora personatum* and C. *arachidicola* and percentage of infection of root and pod rots as follows:-

Manganese sulphate($MnSO_4$), zinc sulphate($ZnSO_4$ and cupper sulphate($CuSO_4$) were used at concentrations 250,500, and 1000 ppm. Peanut plants were sprayed twice with microelements at 60 and 90 days after sowing. The experiments were carried out in a complete randomized block design with plots of 3.0 x 3.5 meters and four replicates for each treatment were used and fertilization and irrigation were applied as the normal cultivation. Disease severity of leaf spot was recorded in the growing season, using a randomized sample of a hundred leaves from every plant (Horsfall and Barratt 1945).

At harvesting, percentages of diseased plants and pod rots were recorded. Three categories for apparent symptoms of pod rot were adopted according to Satour et al (1978): (a) Rhizoctonia rot, pod with dry brown lesions, (b) Fusarium rot pod with pink discoloration, and (c) complex rot, pod with general breakdown resulting from many fungi which differed in their frequencies after harvest. On the other hand, pod yield at each plot (10.5 m^2) was recorded immediately after harvesting. Data were tabulated and statistically analyzed according to Snedecor (1966).

RESULTS AND DISCUSSION

Data in Table (1) show clearly that the linear growth of the tested fungi except *Aspergillus flavus* increased by increasing the concentration of all applied microelements then decreased afterwards (at higher concentrations). Linear growth of *A. flavus* decreased by increasing the concentration of all tested microelements. Cupper sulphate was the most effective as no growth was observed at concentrations; (250, 500 and 1000 ppm) with *Macrophomina phoseolina* and *Fusarium moniliforme*, while, it was effective at 1000 ppm with other fungi. Also, $ZnSO_4$ at 1000 ppm concentration was completely inhibitive to *M.phaseolina*, *S. rolfsii* and *F. moniliforme*.

Table (1): Effect of some microelements on linear growth and sporulation or sclerotial formation of some fungi under laboratory conditions:-

Micro-element	Conc. in ppm	Linear growth (mm)				No. of sclerotia		No. of spores*	
		M. Phase.	*S. rolfsii*	*A. Flavus*	*F. monili*	*M. Phase.*	*S. rolfsii*	*A. Flavus*	*F. monili*
$MnSO_4$	0.0	67.5	60.0	80.0	65.0	23.8	147.5	4.06	3.38
	25	85.0	85.0	80.0	85.0	28.0	166 0	8.00	2.81
	50	85.0	83.8	79.5	83.0	44.0	38.9	8.89	3.75
	100	85.0	81.3	75.8	76.8	32.7	35.8	7.51	2.88
	250	66.0	6 3.5	71.3	59.6	33.2	35.6	3.83	3.13
	500	32.8	51.6	70.3	50.5	21.6	13.7	4.03	2.18
	1000	20.3	32.8	60.5	36.8	14.7	8.0	2.50	2.21
$ZnSO_4$	0.0	67.5	60.0	80.0	65.0	23.8	147.5	4.06	3.38
	25	85.0	85.0	75.2	85.0	35.8	156.0	7.62	3.93
	50	85.0	83.0	70.8	81.3	36.9	140.6	6.20	4.12
	100	70.0	76.3	66.2	69.0	18.3	85.3	5.71	3.06
	250	45.0	53.6	56.4	37.9	18.0	63.6	4.23	3.26
	500	8.0	40.2	50.0	0.0	17.2	20.8	3.32	0.00
	1000	0.0	0.0	41.8	0.0	0.0	0.0	2.73	0.00
$CuSO_4$	0.0	67.5	60.0	80.0	65.0	23.8	147.5	4.06	3.38
	25	83.8	85.0	79.0	85.0	27.8	162.0	7.32	3.96
	50	68.3	71.6	76.0	80.6	12.3	128.0	4.53	2.62
	100	17.6	47.8	70.0	56.4	6.0	104.6	2.95	1.32
	250	0.0	40.0	28.3	0.0	0.0	67.8	0.87	0.00
	500	0.0	7.8	16.2	0.0	0.0	21.2	0.61	0.00
	1000	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
L.S.D.at 1%for:									
M. elements		1.43	2.26	3.53	1.70	1.39	4.91	0.47	0.40
Conc. Mm		2.18	3.57	5.32	2.60	2.13	7.50	0.73	0.61
M.x C.		3.77	6.18	9.34	4.51	3.68	12.99	1.26	1.05

* No. of spores x 10^{6}

On the other hand, sporulation and sclerotial formation of the tested fungi and all microelements increased by increasing the concentration then decreased at higher concentrations (250, 500 and 1000 ppm). Generally, cupper sulphate followed by zinc sulphate,was the most effective in this respect,especially at the higher concentrations with all tested fungi.(No sclerotia were formed at 250, 500 and 1000 ppm $CuSO_4$ by *M.phaseolina* and also no spores were formed at the same concentrations by *F.moniliforme*). These results are in agreement with results reported by Sharma *et al* (1976) who found that zinc and manganese completely inhibited *in vitro* the growth of *Corticium rolfsii* at 10 ppm . As regards sclerotial formation and sporulation with all microelements and tested fungi, observed that the number increased by increasing the concentration, then decreased (at higher concentrations above 250 ppm). Sclerotial formation was completely inhibited at 1000 ppm with $ZnSO_4$ and $CuSO_4$, whereas sporulation was completely inhibited at 500 and 1000 ppm with $ZnSO_4$ and 250 up to 1000 ppm with $CuSO_4$ for *F.moniliforme*. It is well known that these elements are necessary for the growth "sporulation and sclerotial formation of different fungi but after exceeding a certain concentration they inhibit both, growth sporulation and sclerotial formation and thus they are used as fungicides.

Metwally (1986) who found that the microelements Zn, Mn and Cu as sulphates decreased the linear growth and sporulation of all tested isolates of *F.oxysporum F.sp. cepae*.

Table(2): Effect of some microelements on leaf spot disease severity of peanut caused by *Cercospora* spp. In two locations during season 2003.

Micro-Element	Conc.In ppm	Ismailia Govern.		Behera Govern.		Mean	
		Disease severity	Efficacy*	Disease severity	Efficacy*	Disease severity	Efficacy*
$MnSO_4$	250	39.70	37.58	48.60	45.82	44.15	42.40
	500	30.60	51.89	45.10	49.72	37.85	50.62
	1000	24.50	61.48	38.40	57.19	31.45	58.97
$ZnSO_4$	250	38.90	38.84	52.80	41.14	45.85	40.18
	500	27.10	57.39	40.30	55.07	33.70	56.03
	1000	26.20	58.81	33.60	62.59	29.90	60.99
$CuSO_4$	250	32.60	48.74	36.80	58.97	34.70	54.73
	500	26.70	58.02	24.70	72.46	25.70	66.47
	1000	18.30	71.23	21.10	76.48	19.70	74.30
Control		63.60		89.70		76.65	
L.S.D. at 5% for treatment		4.51		6.13			

$$\text{* Efficacy} = \frac{\text{treatments} - \text{control}}{\text{control}} \times 100$$

As shown in table (2),all the microelements sprayed at all concentrations as foliar treatments reduced disease severity of leaf spot compared to the control of both the two locations.The lowest disease severity were obtained with $CuSO_4$ at 1000 ppm. Generally,disease severity of leaf spot was higher in Behera Governorate compared to Ismailia Governorate, at all treatments, this could be attributed to the highest rate of atmospheric moisture in Behera than that in Ismailia Governorate .Disease severity in all treatments decreased by Increasing the concentration of the applied microelements within the range (250-1000 ppm). This may be attributed to fungicidal effect of these microelements when their concentrations exceeds than certain limit. Mahnshi and Strndhana (1988) concluded that zinc and cupper (applied 45 and 80 days after sowing) significantly reduced downy mildew disease, caused by *pseudopernospora cubensis*. Also, Sarhan and Jalal (1989) found that, Cu and Zn significantly reduced symptoms caused by *Helminthosporium sativum* on barley and there were significant increase in both dry weights of plants. Root rot disease caused serious losses to peanut yield (Zayed *et al.*, 1986).

Data in Table (3) show that spraying peanut plants with the above mentioned microelements decreased the percentages of infection with all treatments in two locations by increasing the concentration. The reduction of the root rot disease incidence was very high when microelements were used compared to the untreated control. The lowest disease incidence were obtained with $ZnSO_4$ and $CuSO_4$ at 1000 ppm respectively. Percentages of Infection in Ismailia Governorate was higher than in Behera Governorate (South Tahrir) at all tested treatments. Results are similar to those obtained by Metwally (1986) who found that spraying transplants with microelements aforementioned decreased the percentages of infection at all concentrations tested. Zinc sulphate gave the best results in this respect.

Table(3): Effect of some microelements on root rot disease of peanut in two locations during season 2003 under field conditions

Micro-element	Conc.in ppm	Ismailia Govern.		Behera Govern.		Mean	
		% of infection	Efficacy*	% of infection	Efficacy*	% of infection	Efficacy*
$MnSO_4$	250	45.20	7.00	38.00	4.76	41.60	5.99
	500	43.80	9.88	36.20	9.27	40.00	9.61
	1000	36.10	25.72	26.90	32.58	31.50	28.81
$ZnSO_4$	250	40.60	16.46	33.60	15.79	36.80	16.84
	500	30.80	36.63	26.80	32.83	28.80	34.92
	1000	23.50	51.65	18.90	52.63	21.20	52.09
$CuSO_4$	250	37.50	22.84	39.50	1.00	38.50	12.99
	500	33.90	30.25	31.10	22.06	32.50	26.55
	1000	26.30	45.88	24.10	39.60	25.20	43.05
Control		48.60		39.90		44.25	
L.S.D. at 5% for treatment		6.63		5.44			

Also, the same trend of results were reported by El-Korashy *et al.*, (1997).

As regards to pod rot diseases incidence, data in Table (4) show clearly that the percentage of infection with brown rot, Pink rot and breakdown decreased by using $MnSO_4$, $ZnSO_4$ and $CuSO_4$ microlements and the reduction increased as the concentration of the applied microelements increased.

AS for $MnSO_4$, 500 and 1000 ppm and 500 and 1000 ppm for $CuSO_4$ were the best concentrations for reducing pod rot diseases the two locations. Results also showed that, percentages of infection with pod in rot in Ismailia Governorate was higher than that in Behera Governorate (South Tahrir). Similar results on decreasing pod rot diseases by using microelements were reported by Murugesan and Mahadevan (1987) and El-Korashy *et al.*, (1997) who found that Zn at 300 ppm recorded the lowest percentage of infection with pod rot diseases followed by Cu at 300 ppm.

Table(4): Effect of some microelements on pod rots diseases incidence in two locations during season 2003, under field conditions:

Micro-elements	Conc. ppm	% Infection pod rots									
		Ismallia g.					Behera g.				
		Brown rot	Pink rot	Break down	Mean	Efficacy	Brown rot	Pink rot	Break down	Mean	Efficacy
$MnSO_4$	250	21.0	3.6	14.0	12.87	20.21	12.3	2.6	19.0	11.3	23.49
	500	13.1	2.0	10.0	8.37	48.11	10.6	1.8	14.5	8.97	39.27
	1000	12.0	0.0	11.2	7.73	52.08	10.3	1.2	11.3	7.60	48.54
$ZnSO_4$	250	20.4	2.9	22.8	15.37	4.71	15.1	2.7	26.0	14.35	2.84
	500	19.6	3.1	18.5	13.73	14.88	12.8	2.1	20.7	11.87	19.63
	1000	14.3	2.5	15.0	10.60	34.28	10.7	1.1	13.5	8.43	42.92
$CuSO_4$	250	15.2	1.5	17.3	11.33	29.76	13.8	1.4	15.6	10.27	30.47
	500	10.6	1.6	18.2	10.13	37.20	10.1	0.8	10.3	7.07	52.13
	1000	7.6	0.0	15.2	7.60	52.88	7.2	0.0	8.1	5.10	65.42
Control		19.8	4.9	23.7	16.13	-	14.9	3.1	26.3	14.77	-
L.S.D. at 5% for treatments		1.78	0.54	2.16			1.92	0.61	3.14		

Data in Table (5) show that yield increased by increasing the concentrations of all applied microelements, compared to the control.

This increase in the yield of pods might be due to the increase in accumulation of the dry matter due to foliar application of microelements during vegetative growth of peanut. Abou El-Saleheen (1983) reported that onion plant growth and the dry matter content were increased by foliar application of microelements. Also, the same trend of results was obtained by El-Ghamriny (1991) on garlic plant, and El-Korashy *et al.*, (1997) who reported that Cu at 300 ppm gave the higest pods yield (gm/plant) of peanut followed by Zn at 300 ppm, Cu at 150 ppm and Zn at 150 ppm respectively. Seed soaking in microelements solutions for twelve hours was better than for six hours in this respect.

Table(5): Effect of some microelements on yield(gm/plant) of peanut in two locations during season 2003 under field conditions

Micro-element	Conc.in ppm	Weight of yield (gm/plant)			
		Ismailia G.	Behera G.	Mean	Efficacy*
$MnSO_4$	250	55.0	61.3	58.15	11.93
	500	61.7	65.9	63.80	22.81
	1000	66.7	71.3	69.00	32.82
$ZnSO_4$	250	78.3	79.5	78.90	51.88
	500	80.7	82.6	81.65	57.17
	1000	88.3	87.3	87.80	69.01
$CuSO_4$	250	63.7	66.4	65.05	25.22
	500	75.0	73.8	74.40	43.21
	1000	85.0	83.6	84.30	62.27
Control		48.6	55.3	51.95	
L.S.D. at 5% for treatment		7.68	8.13		

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استخدام العناصر الصغرى رشا على المجموع الخضرى ودورها فى مقاومة الإصابه بأمراض تبقعات الأوراق وأعفان الجذور والثمار والمحصول فى الفول السودانى

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- لوحظ زيادة النمو الفطرى لفطريات ماكروفومينا فاسولينا، سكليروشيم رولفزياى، فيوزاريم مونيليفورم بزيادة التركيز (٢٥-١٠٠ جزء فى المليون) مع كل العناصر المختبره (كبريتات المنجنيز - الزنك - النحاس) ثم بدأ التناقص الشديد فى النمو بعد ذلك على تركيزات ٢٥٠-١٠٠٠ جزء فى المليون مقارنة بالكنترول، بينما فى حالة الفطر أسبرجلس فلافس نقص النمو الفطرى بزيادة التركيز مقارنة بالكنترول.
- زادت أعداد الجراثيم والأجسام الحجريه بزيادة التركيز حتى تركيزى ٥٠٠، ١٠٠٠ جزء فى المليون ثم تناقص الأعداد بدرجه معنويه وتم التثبيط فى المعاملات التى لم تعطى نمو فطرى ميسليومى.
- تحت ظروف الحقل فى منطقتى الإسماعيليه والبحيره(جنوب التحرير) موسم ٢٠٠٣ أدى الرش مرتين بعد ٦٠ ، ٩٠ يوما من الزراعه بنفس العناصر السابقه ثلاث تركيزات ٢٥٠،٥٠٠ ، ١٠٠٠ جزء فى المليون إلى خفض شدة الإصابه بتبقعات الأوراق بدرجه معنويه فى كلا المنطقتين وكذلك نسبة الإصابه بأعفان الجذور.
- كما أدى الرش إلى خفض نسبة الإصابه بأعفان الثمار(سواء العفن البنى او الوردى او الأعفان الأخرى) . وكانت أفضل المعاملات هى الرش بتركيزى ١٠٠٠ ، ٥٠٠ جزء فى المليون على التوالى لكل العناصر المستخدمه.
- أدى الرش إلى زيادة محصول الثمار لكل نبات وبالتالى للفدان بدرجه معنويه لكل المعاملات مقارنة بالكنترول وزاد المحصول بزيادة التركيز فى كل العناصرز
- كانت كبريتات النحاس يليها الزنك وأخيرا المنجنيز الأفضل فى هذا المجال.