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EFFECT OF DIFFERENT AGRICULTURE PRACTICES FOR CONTROLLING DAMPING-OFF, WILT AND PEANUT ROOT ROTS DISEASES

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ABSTRACT

Date of sowing, preceding crop, soil amendment and microelements nutrients were used as agriculture practices for controlling damping-off,wilt and peanut root rots under greenhouse conditions. Sowing peanut seed at 15^{th} May was the best date which gave the highest significant increase in the survival plants earlier of sowing led to increase in damping–off where delaying sowing date after 15^{th} May caused increase in wilt and peanut root rot diseases. Flax as preceding crop followed by both of garlic and rapeseed recorded the lowest percentage of damping-off, wilt and peanut root rot diseases while, faba-bean as preceding crop gave the highest percentage of damping-off, wilt and peanut root rot. Gypsum and sulphur had an important effect in reducing of damping – off, wilt and peanut root rot diseases and increase of gypsum and sulphur concentration was accompanied with decrease of damping-off, wilt and root rot infections. The microelements nutrients and their concentrations play an important role in reducing damping – off, wilt and peanut root rot diseases incidence, microelements mixture (Cu, Fe, Zn, and Mn) at 200 ppm followed by copper sulphate at 200 ppm gave the best effect on reducing of damping – off, wilt and peanut root rot diseases.

INTRODUCTION

Peanut, (*Arachis hypogaea* L.) is one of the most export and locally consumed crops in Egypt. Damping – off, wilt and root rot disease are among the most destructive diseases attacking peanut in Egypt (Yehia *et al.,* 1979). The use of chemicals to control the plant diseases has always been an expensive remedy and may also reduce populations of beneficial antagonistic microorganisms in soil, thus there is a need to develop alternative strategies to manage plant diseases which mainly to lean on use of agriculture practices. Date of sowing could play a role in controlling programs by providing unfavorable conditions to the soilborne diseases outbreak in addition to seed yield losses (Kolte, 1984 and Lomete and Khuspe, 1987). In peanut, Hilal *et al.,* (1994) found that, planting peanut on the 1^{st} of May gave generally the least percentage of damping–off as well as increase in the pod yield. The strategy of using the preceding crop for controlling soilborne diseases may depend on their root exudates, which had a suppression effect on the fungal propagules (Mohamed *et al.,* 1981 and Zeidan *et al.,* 1986). Population of certain pathogenic fungi have been affected by kind of growing crops such as faba-bean, garlic, lentil, onion, pea, soybean and wheat (El-Kasim *et al.,* 1991, El-Deeb *et al.,* 1998 and

Ramadan, 1999). Mahmoud, (2004) showed that, sowing wheat or onion as preceding crop for peanut, resulted the least incidence of peanut pod rot caused by *R. solani, M. phaseolina, Fusarium* spp, *S. rolfsii* and *Aspergillus* spp in two years trials. Although sowing faba–bean, as a preceding winter crop gave a little effect in reducing pod rot incidence.

Calcium nutrition in peanut has long been studied and is considered one of the most important nutritional aspects of peanut production (Burelle *et al.*, 1997). Naidu and Reddy (1996) found that, gypsum had high effect in reducing the incidence of dry root rot of groundnut caused by *M. phaseolina* specially when added with NPK and Zn. Application of gypsum at 500 kg/fed, reduced peanut pod rots caused by *R. solani, M. phaseolina, Fusarium* spp., *S. rolfsii, Aspergillus* spp. and colonization of pods by aflatoxigenic fungi (Mahmoud, 2004). Sulphur is one of the most important nutrients for plant especially oilseed crops such as peanut (kalyanasundaram *et al.*, 1996). Sahu *et al.*, (2001) found that, application of sulphur at 40 or 50 kg/ha through phosphogypsum produced significantly higher in pod yield and oil contents. In general sulphur has an important role in reduction of soil pH which occurs when sulphur is oxidized and that causing suppression of many soilborne pathogens. (Adams, 1975, Reichard and Wenzl, 1976, Huber 1978 and Ries *et al.*, 1982).

The effect of micronutrients on infections of peanut plants with several pathogens has been demonstrated; Murugesan and Mahadevan (1987) showed that, watering peanut plants with solution of Cu gave control of rot caused by *Macrophomina phaseolina,* followed by Mn and Zn, while boron was the least effective. Meanwhile, pre-soaking peanut for different periods in solution of copper sulfate (Cu) or zinc sulfate (Zn) at 150 and 300 ppm., respectively before planting showed reduction in percentage of infection with damping–off, root rot, pod rot diseases caused by *Rhizoctonia solani, Macrophomina phaseolina, Sclerotium rolfsii* and *Fusarium* sp. (El-Korashy *et al.*, 1997). Foliar spraying of peanut plants with different microelements Cu, Fe, Mn, Zn as sulphate form and their mixtures, significantly affected incidence of peanut pod rot caused by *R. solani, M. phaseolina, S. rolfsii, Aspergillus* spp. and *Fusarium* spp. especially in gypsum treated soil. However microelements mixture followed by copper sulphate at 200 ppm was the best treatment in reducing all types of pod rot (Mahmoud, 2004).

The aim of this research is an attempt to study the role of some agriculture practices for controlling damping-off, wilt and peanut root rots.

MATERIAL AND METHODS

1. Isolation and purification of the causal organism (s):

Peanut plants showing symptoms of root rot disease were collected from different Governorates *i.e.* Beni-Suef, Giza, Ismailia and Nobaria. The infected roots were washed thoroughly with tap water, cut into small pieces (1 cm.) each surface disinfested with sodium hypochlorite 2 % for two min., re- washed several times with sterilized water, dried between folds of sterilized filter paper, and were placed onto potato dextrose agar plates (PDA) supplemented with streptomycin-sulfate (100 µg/ml). Petri dishes were incubated at 28°C for five days. The growing fungi were purified using the hyphal-tip and single spore techniques.

2. Identification of causal organism (s):

Identification of the isolated fungi was carried out based on taxonomic criteria for these fungi as described by Barentt and Hunter (1977) for the genera of imperfect fungi, Ellis (1976) for *Macrophomina phaseolina*, Booth (1977) for *Fusarium* spp. Maren and Johan (1988) for *Aspergillus* spp. and Sneh *et al.,* (1992) for *Rhizoctonia solani.*

3. Preparation of fungal inoculum:

Inocula of isolates of *F. solani*, *M. phaseolina*, *R. solani*, *F. oxysporium* and *Sclerotium rolfsii* were prepared using sorghum - coarse sand - water (2:1:2 v/v) medium. The ingredients were mixed, bottled and autoclaved for 2 hours at 1.5 air pressure. The sterilized medium was inoculated using agar discs, obtained from the periphery of 5-day-old colony of each of the isolated fungi. The inoculated media were incubated at 28°C for 15 days and were then used for soil infestation.

4. Soil Infestation:

Inoculum of each isolate of *F. solani, F. oxysporium M. phaseolina, R. solani* and *S. rolfsii* was mixed thoroughly with the soil surface of each pot, at the rate of 2% w/w , and was covered with a thin layer of sterilized soil. The infested pots were irrigated and kept for 7 days before sowing.

6. Experiments implementation:

All experiments were carried out at Agriculture Research Center, Giza. Peanut seeds, cv. Giza 5, were used for sowing in 50 cm-diameter pots containing soil previously infested with mixture of *R. solani, F. solani, F. oxysporium S. rolfsii* and *M. Phaseolina* (2% w/w). Ten seeds were sown per each pot. Five replicate pots were used for each tretments. Disease assessment was recorded as percentage of damping- off, wilt, root rot and survival plants at 15, 45 days and during the harvesting time.

7. Effect of sowing date:

Giza 5. peanut seeds were seeded at six successive dates *i.e.* 1st and 15th of each April, May and June, under artificial inoculation in greenhouse as mentioned before to study the effect of sowing date on aforementioned diseases. Disease assessment was accomplished as previously described.

8. Effect of winter preceding crop:

The effect of winter preceding crops, *i.e.* faba-bean, flax, garlic, onion, rapeseed and wheat on incidence of peanut root rot and wilt were carried out under greenhouse condition. The winter preceding crops were sown in the winter season and then peanut was sown in the pots which infested with mixture of pathogenic fungi as previously mentioned. Five replicates pots were used for each treatment. Disease assessments were recorded as shown before.

9. Effect of soil amendments with gypsum and sulphur:

Gypsum at 250, 500, 750 Kg / fed. and sulphur at 50, 100, 200 Kg / fed. were used to study their effects on the root rot incidence and wilt under greenhouse conditions using artificial inoculation by mixture of the pathogenic fungi. Pots were treated with soil amendment and then ten seeds of cv. Giza 5 were sown in each pot. Disease assessments were recorded as shown before.

10. Effect of microelements:

To assess the effectiveness of microelements, as seed soaking on incidence of root rot and wilt, Giza 5 cv. seeds were soaked for 4 hours in solution of copper (Cu), iron (Fe), zinc (Zn), manganese (Mn) as sulphate form and their mixtures at 0,100 and 200 ppm, the wetted seeds were left in air cabinet for 24 hours before sowing. Treated seeds were sown in pots (Ten seeds for each pot) containing soil previously infested with a mixture of pathogenic fungi. Five replicate pots were used for each treatment and disease assessments were recorded.

11. Statistical analysis:

The data were statistically analyzed by analysis of variance (ANOVA) using the statistical Analysis System (SAS Institute, inc, 1996). Means were separated by least significant difference (L.S.D.) Test at $P \leq 0.05$ levels.

RESULTS

1. Effect of sowing date:

Percentage of damping-off (Pre and post emergence), wilt, root rot infection and healthy survival peanut plants varied according to the sowing date (Table 1). In general when peanut was seeded on the 15^{th} May it gave the highest significant increase in the survival plants. Regarding to damping-off, sowing at the 1^{st} and 15^{th} June recorded the lowest infection compared to 1^{st} and 15^{th} May, while sowing at the 1^{st} and 15^{th} April gave the highest infection of damping-off. When peanut was sown on the 15^{th} May caused decrease of wilt while, on the 1^{st} and 15^{th} April caused increase of wilt disease. On the other hand seeded peanut on the 15^{th} May gave the lowest percentage of root rot diseases while, sowing on 1^{st} and 15^{th} June recorded the highest percentage of infection.

Fig (1) showed the relationship between date of sowing and the incidence of damping-off, wilt and root rot infections of peanut plant. In this respect delaying sowing date caused a decrease in damping-off infection. On the other hand delaying date of sowing caused a decrease in both wilt and root rot infection until 1^{st} and 15^{th} May where the disease tended to increase.

Table (1): Effect of date of sowing on damping-off, wilt, and root rot of peanut cv. Giza 5 under greenhouse conditions in artificially infested soil [z].

Date of sowing	Disease incidence (%)			Survival (%)
	Damping-off	Wilt	Root rot	
1st Apr	26	20	20	34
15th Apr	24	18	18	40
1st May	18	12	16	54
15th May	16	6	18	60
1st Jun	12	12	24	52
15th Jun	12	16	28	44
L.S.D.	5.94	7.54	5.59	8.00

z) Soil in each pot was infested with a mixture of pathogenic fungi at the rate of 2% (w/w).

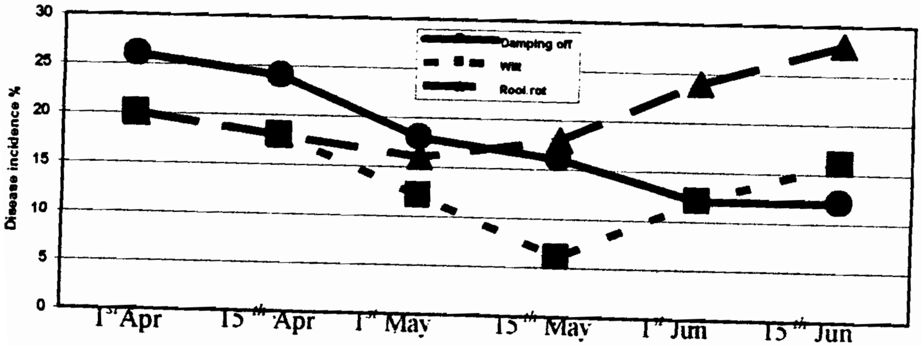

Fig (1): Relationship between delaying of sowing date and incidence of damping-off, wilt, and root rot of peanut cv. Giza 5 grown under greenhouse conditions in artificially infested soil.

2. Effect of winter preceding crop:

Data presented in Table (2) showed that incidence of damping-off, wilt and root rot of peanut were significantly affected by type of the winter preceding crop. Sowing flax or wheat as winter preceding crop before peanut, resulted in the least incidence of damping-off, while faba-bean as a preceding crop gave the highest incidence of damping-off and root rot. Garlic beside flax also gave the highest effect in reducing peanut wilt and root rot while faba-bean and wheat were comparatively less effective. Flax as preceding crop followed by both of garlic and rapeseed recorded the highest percentage of survival peanut plants; on the contrary faba-bean gave the lowest of survival peanut plants.

Table (2): Effect of preceding crops on damping-off, wilt, and root rot of peanut cv. Giza 5 under greenhouse conditions in artificially infested soil [z].

Preceding crops	Disease incidence (%)			Survival (%)
	Damping-off	Wilt	Root rot	
Faba bean	28	12	30	30
Flax	10	6	18	66
Garlic	14	6	20	60
Onion	16	10	26	48
Rapeseed	12	8	22	58
Wheat	10	12	26	52
L.S.D.	6.00	5.41	5.34	6.29

z) Soil in each pot was infested with a mixture of pathogenic fungi at the rate of 2% (w/w).

3. Effect of soil amendments with Gypsum and Sulpher:

Three concentrations of gypsum (250,500 and 750 kg / fed) and sulpher (50,100 and 200 kg / fed) were used to study their effects on damping-off, wilt and root rot of peanut under greenhouse conditions in artificial infested soil. Table (3) indicated that, gypsum at 750 and sulphur at 200 kg/fed recorded the highest significant reduction in damping-off and root rot compared to the control while, sulpher at 200 kg/fed recorded the lowest percentage of infection with wilt. In general the gypsum at 750 kg/fed followed by sulphur at 200 kg/fed gave the highest percentage of healthy survival plants.

4. Effect of microelements:

Two experiments were curried out under greenhouse conditions in artificially infested soil to assess the effectiveness of microelements (as seed soaking) on incidence of damping-off, wilt and root rot. Data in Table (4) indicated that, peanut seed soaked in different microelement *i.e.* Cu, Fe, Mn and Zn as sulphate form and their mixtures significantly affected in incidence of damping-off, wilt and root rot.

Table (3): Effect of soil amendments with gypsum and sulphate on damping-off, wilt, and root rot of peanut cv. Giza 5 under greenhouse conditions in artificially infested soil [y].

Soil amendments	Conc. (kg/fed.)	Disease incidence (%)			Survival (%)
		Damping-off	Wilt	Root rot	
Gypsum [z]	250	24	16	22	38
	500	20	12	20	48
	750	16	10	10	64
Sulphur	50	26	16	24	34
	100	22	10	20	48
	200	20	8	14	58
Control		28	16	24	32
L.S.D.		5.16	5.45	6.00	5.97

y) Soil in each pot was infested with a mixture of pathogenic fungi at the rate of 2% (w/w).

z) Gypsum and sulphur were used as soil amendments before sowing.

Treatment with mixtures of microelement at 200 ppm was the best treatment in reducing damping-off, wilt and root rot and increased healthy survival plant followed by Cu and Fe at 200 ppm compared to other treatments and control.

DISCUSSION

Under greenhouse conditions, the effect of sowing date on damping – off, wilt and peanut root rot diseases were investigated. Results indicated that, sowing at 15th May gave the highest significant increase in the survival plants. Delaying sowing date caused a decrease in damping-off infection. On the other hand delaying date of sowing caused a decrease in both wilt and root rot infection until 1st and 15th May where the disease tended to increase. This is in agreement with Hilal *et al.,* (1994).therefore it may be stated that, date of sowing could play a role in controlling programs by providing unfavorable conditions to the soilborne diseases outbreak in addition to seed yield losses (Kolte, 1984 and Lomete and Khuspe, 1987).

The results showed that, when flax, garlic and rapeseed were sown as the winter preceding crops, a significant reduction in effect on damping – off, wilt and peanut root rot incidence was recorded, while faba-bean was less effective in this respect. This is in agreement with El-Kasim *et al.,* (1991), El-Deeb *et al.,* (1998), Ramadan, (1999) and Mahmoud, (2004). It is well documented that pathogenic fungi are affected by kind of growing crop (El-Kasim *et al.*, 1991; El-Deeb *et al.*, 1998 and Ramadan, 1999).

Table (4): Effect of microelements, as seed soaking treatment, on damping-off, wilt, and peanut root rot under greenhouse conditions in artificially infested soil [y].

Micro-elements	Conc. (ppm)	Disease incidence (%)			Survival (%)
		Damping-off	Wilt	Root rot	
Cu [z]	100	16	12	20	52
	200	14	10	16	60
Fe	100	16	12	24	48
	200	14	12	20	54
Mn	100	18	14	24	44
	200	14	12	22	52
Zn	100	20	16	22	42
	200	16	14	20	50
Mixture	100	12	12	16	60
	200	10	8	14	68
Control		22	18	26	34
L.S.D.		6.04	6.62	5.34	6.27

y) Soil in each pot was infested with a mixture of pathogenic fungi at the rate of 2% (w/w).

z) Microelements were used as seed soaking treatment for 4 hr. before sowing.

Root exudates of wheat and onion, reduced growth of *R. solani* and *F. oxysporum* , respectively (Mohmed *et al.*, 1981), and *S. rolfsii* (Zeidan *et al.,* 1986). Faba-bean roots produce higher amounts of nitrogen compounds that may lead to increase all type of microbial populations (El-Kasim *et al.*, 1991). This may explain that sowing faba-bean as winter preceding crop has no significant effect on incidence of damping – off, wilt and peanut root rot (Tuner; 1971 and El-Kasim *et al.*, 1991).

The obtained results clearly showed that, Gypsum and sulpher had an important effect in reducing damping – off, wilt and peanut root rot diseases. Increase of gypsum and sulpher concentration was accompanied with decrease of damping-off, wilt and root rot infections. This is in agreement with Csinos *et al.,* (1984), Grichar and Boswell (1990), Burelle *et al.,* (1997), Sahu *et al.,* (2001) and Mahmoud, (2004). This is may be due to the role of calcium in regular the uptake and absorbed of ion in peanut plants (Frank, 1972; Garicia and Mitchell, 1975 and Porter *et al.,* 1990). Moreover, generally calcium has a critical metabolic role in carbohydrates removal, cell wall deposition and formation of pectates in the middle lamella (Engelhard, 1993). While, sulphur is incorporated into amino acids proteins, vitamins, aromatic oils and ferredoxins (Huber, 1978). Meanwhile it has an important role in reduction of soil pH which occurs when sulphur is oxidized and that cause suppression of many soilborne pathogens. (Adams, 1975, Reichard and Wenzl, 1976, Huber 1978 and Ries *et al.,* 1982).

The results of this study provide that, the microelements nutrients and their concentrations play an important role in reducing damping – off, wilt and peanut root rot incidence. This is in agreement with Hassan and Frederick, (1995) El-korashy *et al.,* (1997), Savita, and Pareek, (1999) and Mahmoud, (2004). Microelements mixture at 200 ppm followed by copper sulphate at 200 ppm gave the best effect in reducing damping – off, wilt and peanut root rot diseases. This is in agreement with Murugesan and Mahadevan, (1987), El-korashy *et al.,* (1997) and Mahmoud, (2004). Results also clearly showed that the mixture of the microelements with the gypsum gave more effect in reducing the incidence of damping-off, wilt root rot and increased healthy survival plants and this is in agreement with Mahmoud, (2004).

Treatment with microelements increase phenols levels in peanut plants and generally decreased total and reducing sugars, while amino N and protein increased, particularly in dispensed plants (Murugesan and Mahadevan, 1987). Ascorbic acid oxidase and peroxidase markedly increased in treated plants with microelements (Murugesan and Mahadevan, 1987). Moreover, microelements interacts with N metabolism and is intimately involved in carbohydrate synthesis, photosynthesis, coenzymes to many of plant enzymes and synthesis of other compounds associated with the defense of plant against pathogens like phytoalexins and lignin (Huber, 1989). Moreover copper sulphate has an important role in the lignifications process, which is important in plant defense, beside its fungistatic effect (Bussler, 1981 and Grham, 1983).

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تأثير العمليات الزراعية المختلفة في مقاومة أمراض موت البادرات و الذبول و أعفان الجذور في الفول السوداني.

مصطفى محمد فهيم[1] ، أحمد حسن متولي[2]، سامية يحي محمود شكري[3] و زينب نصر الدين حسين[2]
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٣- معهد البحوث والدراسات الأفريقية - جامعة القاهرة- الجيزة.

تم دراسة تأثير كلا من مواعيد الزراعة و المحاصيل الشتوية السابقة ومحسنات التربة والتغذية بالعناصر الصغري علي خفض الإصابة بأمراض موت البادرات و الذبول وأعفان الجذور في الفول السوداني تحت ظروف الصوبة وقد أوضحت الدراسة أن الزراعة في ١٥ مايو كانت الأفضل حيث أعطت أعلي نسبة من النباتات السليمة، وبينت النتائج أن التبكير في الزراعة يؤدي إلي زيادة الإصابة بموت البادرات بينما تأخير الزراعة عن ١٥ مايو يزيد الإصابة بأعفان الجذور و الذبول في الفول السوداني. كما أوضحت الدراسة أن تأثير الكتان وكلا من الكانولا و الثوم كمحاصيل شتوية منزرعة قبل الفول السوداني سجلوا أعلى تأثيرفي خفض الإصابة بموت البادرات و أعفان الجذور والذبول في الفول السوداني بينما كان تأثير الفول البلدي ضئيل.

أعطت المعاملة بالجبس الزراعي والكبريت تأثيرا عاليا في إنقاص الإصابة بموت البادرات و أعفان الجذور والذبول في الفول السوداني، كما أن فاعليتهم زادت بزيادة تركيز المعاملة. إلي جانب هذا أوضحت الدراسة مدي أهمية دور العناصر الصغرى وتركيزها في خفض الإصابة بموت البادرات و أعفان الجذور والذبول في الفول السوداني وكانت أفضل المعاملات تأثيرا في خفض نسبة الإصابة هي المعاملة بمخلوط العناصر"النحاس، الحديد، الزنك و المنجنيز" عند تركيز ٢٠٠ جزء في المليون متبوعا بالمعاملة بالنحاس عند التركيز ٢٠٠ جزء في المليون.