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STUDIES ON THE EFFECT OF SOME GROWTH REGULATORS ON THE INCIDENCE OF LEAF SPOT, ROOT AND POD ROT DISEASES AND YIELD OF PEANUT

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ABSTRACT

Growth regulators, *i.e.* Gibberellic acid (GA_3, Cicocel (CCC) and Indole Acetic acid (IAA) reduced the linear growth of *Sclerotium rolfsii* and *Fusarium moniliforme* and the reduction increased as the growth regulators concentration, was increased, on contrast with *Macrophomina phaseolina* and *Aspergillus flavus*. However, a reduction in sclerotial formation was noticed with all concentrations, compared with untreated control with *M. phaseolina* and *S. rolfsii*. *A. flavus* and *F. moniliforme* sporulation decreased as the concentrations of growth regulators increased and it was fluctuated with some increase at the rate of 1000 ppm of all tested growth regulators.

The growth regulators effect were investigated in field experiments under naturally infection conditions in South-Tahrir, Behira Governorate, during two successive seasons, 1999 and 2000.

Spraying peanut with growth regulators significantly reduced leaf spots disease compared with untreated control in both successive seasons. The same effect in reducing peanut root rot was noticed as well as yield increase (gram/plant).

Indole Acetic acid, Cicocel followed by Gibberellic acid were effective in reducing pod rots, brown lesions (*Rhizoctonia solani*), pink discoloration (*Fusarium moniliforme*) and breakdown caused by some soilborne fungi. Generally, IAA was the best in reducing leaf spots, root and pod rots followed by GA_3 then CCC which was the least effective one.

Keywords : Growth regulators, Leaf spot, Root and pod rots, Peanut.

INTRODUCTION

Peanut (*Arachis hypogaea* L.) is one of the most important leguminous crops in many parts of the world. It is a main world source of edible oil and protein. The seeds contain more than 40 % oil and 25-30 % protein. Furthermore, 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 exportation. Also, it is roasted for local direct human consumption and used for animal feeding. The total area cropped with peanuts in ARE is about 150.757 feddans in 2001 (Anonymous, 2001). It is expected that more areas in the newly reclaimed sandy soils will be added.

Numerous diseases caused by airborne pathogens such as *Cercospora personatum* and *C. arachidicola* which cause leaf spot disease.

Soilborne pathogens such as *Rhizoctonia solani, Fusarium* spp., *Sclerotium rolfsii, macrophomina phaseolina* and *Aspergillus* spp. causing root and pod rot diseases during the growing season and after harvesting which cause tremendous quantitative and qualitative losses for the yield all over the world (Jackson and Bell, 1969; Abawi and Pastor-Corrales, 1990; Ito *et al.*, 1992; Jacobi and Backman, 1994 and Mehan *et al.*, 1995a) reported that pod rot diseases caused by *Sclerotium rolfsii* affect peanut in many countries.

As regards, leaf spot disease of peanut or other crops, Dath (1975) studied the effect of growth regulators on *Piricularia oryzae*. He found that best results were obtained with indole-3-butyric acetic acid at 1 ppm followed by 2-naphthoxy acetic acid.

In Egypt, Abd El-Megied (1988) reported that spraying growth regulators (GA_3, CCC and NAA) affected disease prevalence severity and yield of garlic. Also, rust severity was decreased with increasing the number of spraying which resulted in an increase in the yield (ton/fed.). Also, Metwally *et al.* (1990) found that, garlic purple blotch and downy mildew was significantly reduced by applying growth regulators and also, an increase in yield (ton/fed.) was obtained.

On the other hand, many authors studied the effect of growth regulators on some diseases of certain crops and root rots and pod rot diseases and yield of peanut. Nadi and Mondal (1971) stated that four growth substances stimulated mycelial growth and sclerotial production by *Sclerotium rolfsii*.

Mathur and Chauchan (1976) studied the effect of growth regulators on *F. oxysporum* f.sp. *ciceri, R. solani* and *S. rolfsii* isolated from grain (*Cicer arietinum*). Catechol and indole acetic acid were effective on pathogen growth, colony diameter, dry mycelium weight and percentage of germination of spores at concentrations of 10, 50 and 100 ppm. Prasad and Chaudhary (1978), Pospisilova and Janyska (1978), Mahadevan (1982), Saeed (1983), Metwally (1986), Ali *et al.* (1994), Ramrag *et al.* (1997), Marei, Thanaa (2000) reported that, all growth substances tested greatly reduced pod rots of peanut, IBA followed by ATP, at 100 ppm were the best treatments in reducing pod rots having general breakdown.

The aim of this research was to study the effect of GA_3, CCC and IAA on leaf spot, root and pod rot diseases that attack peanut and their effects on the yield.

MATERIAL AND METHODS

These experiments were carried out to evaluate the efficiency of three growth regulators, *i.e.* Gibberellic acid 10 % (GA_3), Cicocel 40 % (CCC) and Indole acetic acid 10 % (IAA) against certain soilborne fungi under laboratory conditions. Also, field experiments were carried out at South-Tahrir (Behira Governorate), during the summer of two successive seasons 1999 and 2000.

A- Laboratory experiments :

Effect of different growth regulators on fungal linear growth and sporulation or sclerotial formation :

Macrophomina phaseolina, Sclerotium rolfsii, Fusarium moniliforme and *Aspergillus flavus* used in this study were isolated from naturally infected peanut roots and pods. Purification and identification of the aforementioned fungi were done in Onion, Garlic and Oil Crops Diseases Department, Plant Pathology Research Institute, A.R.C., Giza, Egypt and their pathogenicity was confirmed by Khalil (1991), under controlled conditions. The growth regulators (GA_3, IAA and CCC at the rates of 25, 50, 125, 250, 500 and 1000 ppm) were used to study their effect on fungal linear growth and sporulation or sclerotial formation on the aforementioned fungi. Data tabulated and statistically analyzed according to Snedecor (1966).

Potato Dextrose Agar (PDA) medium was used and growth regulators with the forementioned concentration were added before solidification in conical flasks 100 ml and transferred to petri-dishes. petri-dishes were inoculated with equal discs (0.5 cm diam.) taken from 7-day-old cultures of the tested fungi. Four petri- dishes were used for each concentration of each growth regulators and four petri-dishes free of growth regulators acted as control according to Sharvelle (1961) method. All dishes were incubated at 27±2°C for 4-8 days. The linear growth was measured after 4 and 5 days for *M. phaseolina, S. rolfsii, A. flavus* and 8 days for *F. moniliforme*. Number of sclerotia formed after 20 days of *M. phaseolina* 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 assessed after 10 days of inoculation. A disc of 0.5 cm in diameter was added to 10 ml sterilized distilled water in a sterilized test tube, then it was shaken for 2 min. spores were counted using a haemocytometer slide.

B- Field experiments :

The effect of spraying peanut with growth regulators on leaf spot disease severity, root and pod rots :

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

Gibberellic acid (GA_3) was used at the concentrations 100, 200 and 400 ppm, whereas Cicocel (CCC) and Indole Acetic Acid (IAA) were used at 125, 250 and 500 ppm. Peanut plants were sprayed twice with growth regulators at 60 and 90 days after sowing. The experiment was arranged in a complete randomized block design with plots of 3.0 x 3.5 meters and four replicates per each treatment was used. 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 plot (Horsfall and Barratt, 1945).

At harvesting, percentages of diseased plants and pods were recorded. Three categories for apparent symptoms of pod rots were adopted according to Satour *et al.* (1978) : (a) *Rhizoctonia* rot, pods with dry brown lesions, (b) *Fusarium* rot, pods with pink discoloration, and (c) complex rot, pods with general breakdown resulting from many fungi which differed in their frequencies after harvest. On the other hand, pod yield of 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 GA_3 had no effect on the linear growth of *M. phaseolina, S. rolfsii, A. flavus* and *F. moniliforme* except the rate of 1000 ppm which significantly reduced the linear growth. The growth regulator, IAA reduced the linear growth of the forementioned fungi as the concentration increased and the high reduction was observed when it was used with the rate of (500 and 1000 ppm). The growth regulator, CCC had no effect on the fungal linear growth at all concentrations tested on linear growth at all concentrations tested on *M. phaseolina*, whereas little effect was observed at 500 ppm and 1000 ppm when tested on *S. rolfsii, A. flavus* and *F. moniliforme*. These results are in agreement with results mentioned by Mathur and Chauchan (1976) on *F. oxysporum* f.sp. *ciceri* as well as Mahadevan (1982) reported that both IAA and IBA decreased the linear growth of *F. solani* and *S. rolfsii.* The different concentrations of the used growth regulators greatly reduced the sclerotial formation of *M. phaseolina* and *S. rolfsii* and the reduction increased as the growth regulators concentration increased. Concentrations of 500 and 1000 ppm were the most effective in sclerotial formation reduction.

As regards, sporulation of *A. flavus* and *F. moniliforme* reduced as the concentrations of the growth regulators increased and it was fluctuated with some increase at the rate of 1000 ppm of all the tested growth regulators. This could be attributed to the fungistatic effect of these compounds at certain concentration and versus trend of sporulation was observed as the concentration was increased as the fungi become tolerant to the growth regulators effect on sporulation. These results are in similar trend with results obtained by Prasad and Chaudhary (1978) who reported that macroconidial sporulation of *F. oxysporum* f.sp. *unudum*, inhibited by CCC. Macroconidial production decreased with increasing concentrations, also Ali *et al.* (1994) found that some growth regulators affected both fungal growth and sclerotial formation of *S. cepivorum.* ATP caused reduction in the number of formed sclerotia at 100 ppm and 200 ppm.

Table (1) : Effect of growth regulators on linear growth and sporulation or sclerotial formation of some fungi.

Growth regu-lator	Conc. in ppm	Linear growth (cm)				No. of sclerotia		No of spores*	
		M. phas.	*S. rolfsii*	*A. flavus*	*F. moni.*	*M. Phas.*	*S. rolfsii*	*A. flavus*	*F. moni.*
GA_3	0.0	8.30	8.30	8.50	8.30	192.5	370.0	87.75	5.15
	25	8.80	8.18	8.58	8.25	123.8	298.8	24.95	4.13
	50	8.90	7.78	8.70	8.20	123.3	307.5	28.20	3.13
	125	8.43	7.73	8.80	8.20	107.0	247.5	27.83	2.75
	250	8.85	7.78	9.00	8.10	104.5	232.5	27.25	1.63
	500	8.23	7.35	9.00	8.05	102.5	126.3	31.83	3.20
	1000	4.15	5.50	8.38	7.95	92.5	60.0	57.45	4.95
IAA	0.0	8.30	8.30	8.50	8.30	192.5	370.0	87.75	5.15
	25	8.03	9.93	8.20	7.90	189.3	362.5	55.38	3.00
	50	7.85	7.05	7.90	7.65	181.5	353.8	29.75	2.75
	125	7.25	5.75	7.90	7.15	139.0	326.3	24.45	2.75
	250	7.15	4.18	7.25	6.90	114.5	200.0	28.45	2.58
	500	4.88	3.68	5.40	6.65	109.5	162.5	27.25	4.45
	1000	2.00	2.83	3.15	3.18	107.0	83.8	46.00	7.08
CCC	0.0	8.30	8.30	8.50	8.30	192.5	370.0	87.75	5.15
	25	8.95	8.30	8.75	7.70	159.0	277.5	32.58	5.20
	50	9.00	8.25	8.60	7.65	132.8	271.3	31.13	5.08
	125	8.88	8.28	8.35	7.50	124.8	228.8	30.20	4.63
	250	9.00	8.05	8.25	7.43	119.8	248.3	36.83	2.13
	500	9.00	7.83	8.00	7.10	110.3	183.8	44.13	4.25
	1000	9.00	7.63	7.30	6.90	101.5	168.5	44.75	7.33
L.S.D. at 1 % for :									
G.reg. (G)		0.196	0.246	0.188	0.142	10.53	41.4	4.368	0.253
Conc. (C)		0.299	0.376	0.287	0.217	16.092	63.2	6.683	0.385
G. x C.		0.519	0.652	0.498	0.376	27.872	109.41	11.558	0.665

* No. of spores x 10^6

As shown in Table (2), all the growth regulators used, significantly reduced the leaf spot disease severity caused by *Cercospora personatum* and *C. arachidicola*. The reduction increased as the concentration of the growth regulators used was increased. The reduction reached its maximum at 400 ppm for GA_3 and 250 ppm for CCC and IAA, respectively.

The reduction in leaf spot disease incidence may be due to the effect of these growth regulators on peanut growth and consequently give them the chance to resist or escape from the disease infection. Also, the decrease in disease severity reveals the growth regulators effect on the physiological processes of the interaction between the causal pathogen and the host plant. Similar results were recorded by Dath (1975) obtained good results with indole-3-butyric acid and 2- naphthoxy acetic acid against *Piricularia oryzae*. Also, Abd El-Megied (1988) found a reduction in disease severity and percentage of infection with garlic rust disease when growth regulators were applied. Metwally *et al.* (1990) reported that garlic purple leaf blotch and downy mildew were significantly reduced by applying growth regulators.

Root rot disease cause serious losses to peanut yield (Zayed *et al.*, 1986). Data in Table (3) clearly show that the percentage of root rot disease incidence in both two successive seasons decreased by using GA_3, CCC and IAA growth regulators. The reduction of the root rot disease incidence was very high when growth regulators was used compared with the untreated control. No significant differences in the reduction of root rot disease incidence with the different concentrations of GA_3 and CCC but for IAA the reduction was very high at 250 and 500 ppm, respectively. These results are in harmony with those mentioned by Metwally (1986) who mentioned that all growth regulators, at most tested concentrations, decreased the infection with basal rot disease of onion caused by *F. oxysporum* f.sp. *cepae*. On the other hand, peanut yield (gm/plant) increased in both successive seasons when the growth regulators were applied compared with the untreated one. In general, GA_3 and CCC treatments were the best treatments, respectively, in both seasons. Such results may be due to the stimulatory effect of growth regulators especially GA_3 and cell division and elongation. Ramrag *et al.* (1997) tested the brrasinosteroids that have been shown to have remarkable plant growth promoting activity. Generally, treatments significantly increased the pod yields compared with the control.

As regards for 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 GA_3, CCC and IAA growth regulators and the reduction increased as the concentration of the growth regulator was increased. As for GA_3, 200 ppm, 250 ppm for CCC and 500 ppm for IAA were the best concentration for reducing pod rot diseases severity in both the two successive seasons. Similar results in decreasing pod rot diseases by using growth regulators were reported by Marei, Thanaa (2000) reported that all tested growth substances, reduced pod rot of peanut, IBA followed by ATP, at 100 ppm were the best treatment in reducing pod rots having general breakdown.

Table (2) : Effect of some growth regulators on leaf spot disease severity of peanut caused by *Cercospora* spp. in two successive seasons 1999 and 2000.

Growth Regulators	Conc. in ppm	% Disease severity		
		Season 1999	Season 2000	Mean
GA_3	100	28.4	19.3	23.85
	200	28.2	19.6	23.90
	400	23.3	14.8	19.05
CCC	125	42.6	31.8	37.20
	250	38.4	28.7	33.55
	500	38.5	29.6	34.05
IAA	125	43.3	36.2	39.75
	250	35.6	27.8	31.70
	500	35.5	26.5	31.00
Control		63.6	48.1	55.85
L.S.D. at 5 % for treatment		3.04	4.02	-

Table (3) : Effect of some growth regulators on root rot disease and yield (gm/plant) in two successive season 1999 and 2000.

Growth regulators	Concin ppm	% Infection			Pod yield (gm/plant)		
		Season 1999	Season 2000	Mean	Season 1999	Season 2000	Mean
GA_3	100	32.6	33.8	33.20	78.3	63.8	71.05
	200	32.3	36.4	34.35	88.3	75.6	81.95
	400	36.0	35.1	35.55	88.0	78.8	83.40
CCC	125	32.4	24.8	28.60	71.7	62.1	66.90
	250	30.6	21.9	26.25	69.8	66.6	68.20
	500	30.7	23.2	26.95	76.7	71.0	73.85
IAA	125	26.9	36.2	31.5	58.3	60.6	59.45
	250	18.3	21.4	19.85	59.6	62.4	61.00
	500	11.4	16.8	14.10	61.0	64.8	62.90
Control		43.8	44.5	44.15	56.6	61.0	58.80
L.S.D. at 5 % for treatment		7.38	6.19	-	11.16	6.74	-

Table (4) : Effect of some growth regulators on pod rots disease incidence in two successive seasons 1999 and 2000 under field condition.

Growth regulator	Conc. in ppm	% Infection pod rots							
		Season, 1999				Season, 2000			
		Brown rot	Pink rot	Break-down	Mean	Brown rot	Pink rot	Break-down	Mean
GA_3	100	9.8	2.8	18.8	10.63	7.4	1.6	15.8	8.27
	200	4.8	2.1	15.9	7.80	5.8	0.2	13.9	6.63
	400	5.0	1.7	16.5	7.73	5.3	0.4	11.6	5.77
CCC	125	13.0	1.9	17.4	10.57	10.5	0.8	15.4	8.90
	250	8.5	0.6	12.9	7.33	8.6	0.6	10.3	6.50
	500	8.3	0.7	12.4	7.13	6.1	0.7	11.8	6.20
IAA	125	10.9	2.0	11.3	8.07	9.6	0.9	9.3	6.60
	250	10.0	1.5	10.0	7.17	5.2	1.3	7.6	4.70
	500	5.8	0.0	7.7	4.50	3.4	0.8	6.8	3.67
Control		15.8	3.7	22.1	14.03	14.2	2.2	20.2	12.20
L.S.D. at 5 % for treatment		3.16	0.65	3.87	-	4.28	0.78	4.92	-

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دراسات على تأثير بعض منظمات النمو على الإصابة بـــأمراض تبقعـــات الأوراق وأعفان الجذور والثمار والمحصول فى الفول السودانى

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- أدى إستخدام منظمات النمو (حمض الجبريلليك، السيكوسيل، إندول حمض الخليك) بتركيزات مختلفة إلى خفض معدل النمو الفطرى لفطرى إسكليروشيم رولفزياى وفيوزاريوم مونيليفورم، وقد زاد نقص النمـــو الفطرى بزيادة تركيزات منظمات النمو. أما بالنسبة للفطرين ماكروفومينا فاسيولينا و أسبرجيللس فلافس فقد ظهر عكس ذلك.
- أدى إستخدام منظمات النمو بالتركيزات المختلفة إلى إنخفاض فى تكوين الأجسام الحجرية مقارنة بـــالغير معامل لفطرى ماكروفومينا فاسيولينا و إسكليروشيم رولفزياى، كما إنخفض معـــدل التجرثـــم لفطـــرى أسبرجيللس فلافس وفيوزاريوم مونيليفورم كلما زاد تركيز منظمات النمو، بينما زاد معدل التجرثم عنـــد إستخدام منظمات النمو بتركيز ١٠٠٠ جزء فى المليون بدرجات متذبذبة.
- وبدراسة تأثير الرش بمنظمات النمو فى الحقل تحت ظروف الإصابة الطبيعية بمنطقة جنـــوب التحريـــر (محافظة البحيرة) فى موسمين متتاليين ١٩٩٩ و ٢٠٠٠ دلت النتائج على أن رش نباتات الفول السودانى بمنظمات النمو أدت إلى خفض شدة الإصابة بتبقعات الأوراق بدرجة معنوية فى كـــلا الموسـمين. كما أدت إلى خفض الإصابة بأعفان الجذور وزيادة فى محصول الفول السودانى (جم/نبات)
- أدى إستخدام منظمات النمو المذكورة إلى تقليل الإصابة بالعفن البنى لثمـار الفول السودانى المتسبب عن الفطر ريزوكتونيا سولانى وكذلك العفـن الـوردى المتسبب عن الفطـر فيوزاريـوم مونيليفـورم ومجموعـة الأعفان الأخرى المتسببة عن مجموعة فطريات مختلفة بالتربة.
- وعموما وجد أن إندول حمض الخليك أفضل منظمـات النمـو المستخدمة فـى تقليـل شـدة الإصـابـة بتبقعـات الأوراق ونسبة الإصابة بأعفان الجذور والثمار يليه حمض الجبريلليك، بينما كان السيكوسـل أقـل منظمـات النمو المستخدمة تأثيرا فى هذا المجال.