Factors affecting infection with peanut pod rot severity under field conditions

1-NPK fertilizers, irrigation and sowing time affecting peanut pod rot diseases under field conditions

By

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ABSTRACT

Fertilization with NPK fertilizers had a great effect on peanut pod rot infection during two successive seasons 2002 and 2003. Increasing K fertilizer level singly or in combination with P specially decreased the infection with pod rot. Meanwhile, using N fertilizer singly at the high level increased pod rot infection while, using P and K fertilizers with high level in combination with N fertilizer decreased pod rot infection to moderate levels. Moreover, no addition of K in presence of high levels of N increased the percentage of break down and brown rot as well as pink rot comparing with the treatments applied with K at high units. Addition of NPK fertilizers at all tested levels increased the yield of peanut pods. The best irrigation system was spray system where, it reduced the infection with total pod rot, pods break down, brown and pink rots. Drip irrigation system caused the highest total peanut pod rot especially in Sharkya and also increased pods with break down, brown and pink rots in this governorate. Early sowing of peanut during the 1st April decreased severity of pod rot and then reduced the infection of pods with break down, brown and pink pods in two governorates (Beheira and Sharkya) during two growing seasons (2002 and 2003). It is pronounced also that delaying the sowing time after 1st April. increased gradually the pod rot infection to reach their maximum infections during the two seasons in the two governorates at 1st June.

Key words: NPK fertilizers**,** peanut pod rot, sowing time, irrigation.

INTRODUCTION

Peanut is considered one of the most important export crops in Egypt. Peanut pod rot is a serious worldwide disease attacking fruits below the ground. The pods are subjected to attack with numerous soil borne pathogens such as *Fusarium* spp., *Sclerotium* sp., *Rhizoctonia solani Aspergillus* spp. *etc*. which causing different symptoms of pod rots (**Marei, 2000)**.

Hallock and Garren (1968) found that potassium sulphate increased pod rot of peanut caused by *Rhizoctonia solani*. They attributed this effect to the influence of plant nutrients on the Polygalacturonase activity in the infected hypocotyls. **Ahmed *et al.* (1983)** indicated that the highest percentage of survival peanut plants and yield were obtained by adding the highest rates of P and K fertilizers. **Csinos *et al.* (1984)** studied the role of nutrition and fungi in the peanut pod rot complex. It was found that, plots treated with Ca were generally higher in yield and sound mature seed and lower in pod rot (*Pythium*, *Rhizoctonia* and *Fusarium* spp.) than other treatments. There was a significant positive relation with most elements in fruits and pod rot except Ca, which had an inverse relation to pod rot. Most elements in fruits were

related inversely to Ca conc. It is suggested that fungi are secondary to the disease complex and nutritional deficiency or imbalance may be the primary cause. **EI-Wakil *et al.* (1984)** found that addition of NPK at 15-30-24 and 15-45-48 units, respectively, gave the least percentage of peanut pod rot accompanied with high yield. **El-Nagar (1987)** mentioned that the addition of the two fertilizers, potassium sulphate and calcium superphosphate in combination at different rates induced a clear reduction of disease incidence caused by *Aspergillus*. The minimum percentage of infection was found in treatment received 100 kg of potassium sulphate and 300 kg of superphosphate. **Filonow *et al.* (1988)** studied the effect of calcium sulfate on pod rot of peanut (*Pythium myriotylum* and *Rhizoctonia solani*) in steam-pasteurized soil and methyl bromide fumigated soil, artificially infested with *P. myriotylum*, *R. solani* or both, and $CaSO_4$ was applied as agricultural gypsum before pegging at different levels. There was no apparent relationship between Ca content in hulls and pod rot severity. **Walker *et al.* (1989)** mentioned that field experiments for 3 years, groundnut were given different levels of $MgSO_4$ and KCl with or without irrigation. Neither K or Mg application affected the number of plants attacked *by Sclerotium rolfsii* or the incidence of pod rot. **Chen (1991)** reported that clay content and exchangeable K, tended to reduce pod rot, while higher levels of total soil N and P tended to increase it. **Engelhard (1993)** reported that percentage of pod rots decreased by increasing the levels of P and K fertilizers. **Marei (2000)** showed that addition of K alone under field conditions tends to increase the percentage of pods with dry brown lesions. In contrast to P which reduced this percentage. Addition of N alone at the recommended level increased the percentage of pods with general breakdown. The highest percentage of healthy pods was recorded using a combination of P and K at the rate of 45- 48 respectively

As for the effect of irrigation and sowing time on pod rot incidence, **Walker *et al*. (1989)** mentioned that field experiments for 3 years on groundnut, neither irrigation, K or Mg application affected the number of plants attacked by *Sclerotium rolfsii* or the incidence of pod rot in two different soil types. **Sumner and Littrell (1989)** found that when chlorothalonil and diniconazole were applied to groundnuts in microplots through irrigation water with hand sprinklers or by conventional sprays in fields infested with *Sclerotium rolfsii* or *Rhizoctonia solani* anastomosis group 4 (AG-4) or was non-infested, populations of *R. solani* AG-4 in soil and the number of lesions on pods, pegs and stems were usually reduced by treatments with these fungicides but there were usually no differences between application methods. Chlorothalonil reduced the severity of pod rot in soil infested with *C. rolfsii*. **Yang *et al*. (2002)** reported that twenty groundnut cultivars were continuously cultivated in Taichung (China) for 4 cropping seasons in 2 years to study the effect of cropping season on pod rot disease. The cultivars, cropping seasons, and years significantly influenced pod rot severity. Disease occurrence was significantly correlated with autumn- and after autumn-sown groundnuts. The phenotype was positively correlated with pod rot severity. **Krishnakanth *et al.* (2003)** evaluated thirteen Spanish groundnut genotypes for resistance to stem and pod rot caused by *S. rolfsii* (*Corticium rolfsii*) in field experiments in Karnataka, India during post-rainy and rainy seasons. Results indicated to significant differences among the genotypes, seasons, genotype x season interaction for the disease, yield and yield components.

The study aimed to explain the role of nutrient elements, irrigation and sowing time on peanut pod rot diseases under field conditions.

MATERIALS & METHODS

1- Effect of NPK fertilizers:

This study was carried out to assess the efficacy of 27 different NPK fertilization treatments (**Table, 1**) for controlling the natural infection of peanut pods with different types of pod rots as well as on yield of peanut pods. The tested fertilization treatments including all combinations between 3 levels of each of N fertilizer (0, 15 and 30 unit/fed.), P fertilizer (0, 30 and 45 unit/fed.) and K fertilizer (0, 24 and 48 unit/fed.).

Table (1): Tested fertilizers levels (treatments) and their contents calculated as element units.

Fertilizers			Unites of fertilizers (Kg/fed.)		
Ammonium nitrate (33.5% N)	Calcium super phosphate (15% P_2O_5)	Potassium sulphate (48% KO_2)	N	P	K
N1	P1	K1	0	0	0
		K2	0	0	24
		K3	0	0	48
	P2	K1	0	30	0
		K2	0	30	24
		K3	0	30	48
	P3	K1	0	45	0
		K2	0	45	24
		K3	0	45	48
N2	P1	K1	15	0	0
		K2	15	0	24
		K3	15	0	48
	P2	K1	15	30	0
		K2	15	30	24
		K3	15	30	48
	P3	K1	15	45	0
		K2	15	45	24
		K3	15	45	48
N3	P1	K1	30	0	0
		K2	30	0	24
		K3	30	0	48
	P2	K1	30	30	0
		K2	30	30	24
		K3	30	30	48
	P3	K1	30	45	0
		K2	30	45	24
		K3	30	45	48

The required amounts (units) of the P fertilizer in form of calcium super phosphate (15% P_2O_5) was added as one dose before sowing during preparation of soil. Meanwhile, amounts of the N fertilizer in form of ammonium nitrate (33.5% N) and K fertilizer in form of potassium sulphate (48% KO_2) were divided into tow equal halves (doses). The first dose of N and K fertilizers was added at sowing time and 1 month after sowing while the second dose was added 1 and 2 months after sowing for the tow fertilizers, respectively.

This experiment was conducted in factorial split-split plot design with three replicates, in which the N levels were arranged in the main plots while P and K levels were distributed in the sub and sub-sub plots, respectively.

Peanut seeds (cv Giza-5) were sown as mentioned before and all the other farm practices were applied as usual. At harvest (120 days after sowing), Three hunderd pods of each sample of peanut treatment (three replicates for each one) were randomly collected and inspected for pod rot diseases as mentioned before. As well as, the yield of peanut pods per feddan was also determined as ton/feddan.

2- Effect of irrigation system:

This experiment was performed twice, each in a complete randomized blocks design with three replicates, during seasons 2002 and 2003 seasons to investigate effects of three irrigation systems (furrows, drip and sprinkler "spray") on the natural infection of peanut pods (cv. Giza 5) with different types of pod rots as well as on yield of peanut pods. All irrigation treatments were done in separate blocks as well as, the amount of irrigation water was estimated and added according to the recommended doses and intervals for each treatment during the growing season. Sowing and all other farm practices were applied as above mentioned. At harvest (120 days post sowing) pod rot diseases and yield were investigated and calculated as mentioned before.

3- Effect of sowing time:

This experiment was conducted during two successive seasons 2002 and 2003 in a complete randomized block design with three replicates. Peanut seeds cv Giza-5 were sown at five sowing dates, 1st April, 15th April, 1st May, 15th May and 1st June for each season as mentioned above. All other farm practices were applied as usual. At harvest, samples of peanut pods from each treatment were randomly collected and inspected for pod rot diseases as mentioned before.

Statistical analysis:

Statistical analysis was done according to procedures of ANOVA reported by **Snedecor and Cochran (1989).**

RESULTS

1 - Effect of NPK fertilizers on:

Data in **Table (2a &2b)** indicate that fertilization with N, P and K (NPK) fertilizers had a great effect on the infection with pod rots (total brown, pink and breakdown rots) and yield of peanut pods during the two successive seasons 2002 and 2003.

1.1 - Total infection with peanut pod rots

Applying N fertilizers particularly at N2 level significantly decreased total infection with pod rots during both seasons compared with the control (N0 level). Also, applying P fertilizer at P2 or P3 was significantly better than P1 level on decreasing the pod rot total infection during both seasons. The total infection with pod rots significantly affected by N x P interaction. The lowest significant decreases in averages of total infection were obtained by using N2P2 (8.3 & 9.6%), N1P2 (8.96 & 10.18%) and N2P3 (9.43 & 9.93%) compared with the check treatments received no fertilization (17.53 & 20.87% during both season, respectively.

The present results indicate that % total infection with pod rots was correlated negatively and significantly with the used K level. The highest K level resulted in the lowest average of total infection i.e. 12.18 & 14.0% compared with the lowest level (K1) that recorded 14.37 & 17.06% during 2002 & 2003 seasons, respectively. As for N x K interaction, the lowest significant decreases, in average, were attained by using

N2K3 and N2K2 which produce 8.86 & 9.26% in 2002 season and 10.1 & 10.31% in 2003 season, respectively. In both seasons, the total infection, however, was not significantly affected by P x K and N x P x K interactions.

1.2 - Brown pod rot infection

The present results prove that the highest reduction in the incidence of peanut brown rot i.e. 4.46 & 5.09 induced by applying N2 level comparing with 9.87 & 8.77% in the control treatments during 2002 & 2003 seasons, respectively. Applying P fertilizer significantly decreased brown rot infection comparing with the check (no P fertilization). The two P levels i.e. P2 and P3 were significantly equal in this respect. As for N x P interaction, the lowest significant decreases were obtained by using N2P2 (aver. 3.61 & 4.57%) and N2P3 (aver. 3.52 & 3.61%) compared with the control treatments received no fertilization (aver. 9.87 & 8.77%) during both season, respectively.

The brown rot infection was significantly affected by K fertilizer as well as by N x K interaction. Its average was significantly decreased by application of K3 (5.69%) and K2 (6.29%) comparing with the K1 level (6.76%) in 2002 season. However, K2 and K3 were significantly equal as they significantly decreased averages to 6.07 & 6.09%, respectively comparing with K1 (7.06%). As for N x K interaction, the lowest significant decrease in the brown rot incidence was produced by using N2K3 (3.6 & 4.18%), N1K3 (4.39 & 4.92%) and N2K2 (4.66 & 4.18%) in both 2002 & 2003 seasons, respectively.

The P x K interaction in both seasons and N x P x K interaction in 2003 season had no significant effects on the brown rot infection. While, in 2002 season the lowest significant decrease in that disease was produced by applying N2P2K3 (3.0%) and N2P3K1 (3.13%) comparing with 7.37% in the control (N1P1K1) treatment.

1.3 - Pink pod rot infection

The infection with pink rot was the relatively low in both seasons and affected significantly by all tested N, P and K fertilizers as well as by all possible combinations between them. Average infection was significantly decreased by applying N1 (0.583 & 0.674%), N2 (0.66 & 0.531%) and (0.63 & 0.715%) comparing with the control (1.0 & 1.433%) in both 2002 and 2003 seasons, respectively. Regarding N x P interaction, the lowest average infection was produced by applying N1P2 (0.433%), N3P3 (0.5%) and N2P2 (0.533%) in 2002 season and N2P2 (0.433%), N2P3 (0.439%) and N3P3 (0.522%) in 2003 season.

The pink rot infection was affected significantly by K and P x K interaction. The K2 and K3 levels decreased the pink rot to 0.681 & 0.696% in 2002 season and 0.797 & 0.704% in 2003 season comparing with K1 (0.778 & 10.014%) in both seasons, respectively. The lowest average infection, however, was produced by applying P2K2 and P2K3 (0.575%) in the first season and P3K3 (0.621%) in the second one.

Concerning N x K interaction, applying N1K2 and N1K3 in 2002 season were the best for minimizing pink rot infection (0.489 & 0.494%) while N2K3, N1K3 and N2K2 were the best in 2003 season as they decreased infection to 0.428, 0.433 and 0.456%, respectively comparing with the N1K1. As for N x P x K interaction, the highest decrease in the infection with pink rot was induced by using N2P2K3 (0.33%) followed by N2P2K2, N2P3K1 and N1P3K3 (0.4%) in 2002 season in comparison with the other treatments.

1.4 - Breakdown pod rot infection

Peanut pods seemed to be affected by the infection with breakdown rot more than by the other two types of rots (brown and pink rots). Incidence of breakdown rot

was significantly affected by all tested N, P and K fertilizers as well as by all possible interactions between them. Average of breakdown rot % was significantly decreased by using N1 (5.72%) and N2 (5.22%) but significantly increased by using N3 (7.26%) comparing with the unfertilized control (6.33%) in 2002 season.

Table (2a): Effect of different levels of NPK fertilizers on pod rot infections % and peanut yield during 2002 growing season.

Fertilizers			Total infection %	% Infection with			Yield (ton/fed.)
N	P	K		Brown rot %	Pink rot %	Break-Down %	
N1	P1	K1	14.20	6.17	0.70	7.33	1.229
		K2	13.19	5.43	0.63	7.13	1.239
		K3	12.12	4.47	0.72	6.93	1.261
	P2	K1	11.39	4.73	0.53	6.13	1.268
		K2	10.06	5.33	0.40	4.33	1.287
		K3	8.73	4.03	0.37	4.33	1.303
	P3	K1	13.34	7.00	1.07	5.27	1.308
		K2	10.53	5.43	0.43	4.67	1.310
		K3	10.44	4.67	0.40	5.37	1.306
N2	P1	K1	16.61	7.83	1.01	7.77	1.327
		K2	12.17	6.47	0.70	5.00	1.329
		K3	10.76	4.43	0.83	5.50	1.353
	P2	K1	11.27	4.40	0.87	6.00	1.358
		K2	6.53	3.43	0.40	2.70	1.359
		K3	7.10	3.00	0.33	3.77	1.329
	P3	K1	10.53	3.13	0.40	7.00	1.331
		K2	9.070	4.07	0.80	4.20	1.342
		K3	9.040	3.37	0.60	5.07	1.316
N3	P1	K1	16.93	6.10	0.53	10.30	1.332
		K2	14.20	5.53	1.00	7.67	1.315
		K3	13.44	5.77	1.00	6.67	1.322
	P2	K1	15.40	6.40	0.53	8.47	1.325
		K2	12.10	6.10	0.50	5.50	1.327
		K3	11.53	4.53	0.60	6.40	1.332
	P3	K1	13.37	5.70	0.70	6.97	1.336
		K2	11.57	4.07	0.30	7.20	1.337
		K3	11.07	4.40	0.50	6.17	1.345
Control			17.20	9.87	1.00	6.36	1.261
LSD at 5% for: N			0.258	0.063	0.020	0.096	0.011
P			0.098	0.044	0.007	0.030	0.001
N x P			0.394	0.174	0.027	0.121	0.006
K			0.121	0.041	0.007	0.035	NS
N x K			0.482	0.165	0.028	0.140	NS
P x K			NS	NS	0.021	0.105	NS
N x P x K			NS	0.495	0.083	0.419	NS

However, applying N1, N2 and N3 levels significantly decreased average breakdown rot to 6.4, 6.62 and 7.89 comparing with the control (10.67%). Also, the disease average was significantly decreased in both seasons by using P2 (5.55 & 7.01%) and P3 (5.91 & 7.83%) comparing with P1 (6.94 and 8.84%) in both seasons, respectively. Regarding N x P interaction, the lowest average infection with the breakdown rot was

produced by applying N2P2 (4.16%) and N1P2 (4.93%) in 2002 season and N1P2 (4.8%) in 2003 season.

Table (2b): Effect of different levels of NPK fertilizers on pod rot infections % and peanut yield during 2003 growing season.

Fertilizers			Total infection %	% Infection with			Yield (ton/fed.)
N	P	K		Brown rot %	Pink rot %	Break-Down %	
N1	P1	K1	15.77	7.37	1.07	7.33	1.242
		K2	14.23	6.20	0.70	7.33	1.221
		K3	13.83	6.43	0.40	7.00	1.264
	P2	K1	10.20	4.53	0.87	4.80	1.288
		K2	10.63	5.37	0.63	4.63	1.297
		K3	9.70	4.20	0.53	4.97	1.315
	P3	K1	14.76	5.83	0.80	8.13	1.328
		K2	13.16	5.43	0.70	7.03	1.332
		K3	10.90	4.13	0.37	6.40	1.345
N2	P1	K1	21.60	8.60	1.00	12.00	1.350
		K2	14.57	6.70	0.47	7.40	1.358
		K3	13.73	5.93	0.70	7.10	1.404
	P2	K1	13.96	6.43	0.60	6.93	1.409
		K2	6.93	2.73	0.30	3.90	1.434
		K3	9.56	4.53	0.40	4.63	1.433
	P3	K1	11.36	4.30	0.53	6.53	1.439
		K2	9.43	3.10	0.60	5.73	1.403
		K3	8.98	3.43	0.18	5.37	1.417
N3	P1	K1	20.20	7.97	1.40	10.83	1.372
		K2	15.24	6.87	1.00	7.37	1.365
		K3	15.43	7.03	0.63	7.77	1.363
	P2	K1	16.70	6.93	0.90	8.87	1.364
		K2	11.60	4.57	0.50	6.53	1.369
		K3	12.33	5.07	0.43	6.83	1.380
	P3	K1	16.10	6.40	0.70	9.00	1.385
		K2	13.37	5.60	0.37	7.40	1.388
		K3	12.90	6.03	0.50	6.37	1.391
Control			20.87	8.77	1.433	10.67	1.272
LSD at 5% for: N			0.173	0.131	0.074	0.137	0.011
P			0.122	0.063	0.007	0.027	0.002
N x P			0.490	0.251	0.027	0.110	0.007
K			0.150	0.068	0.007	0.042	NS
N x K			0.600	0.272	0.027	0.167	NS
P x K			NS	NS	0.020	0.125	NS
N x P x K			NS	NS	0.081	0.500	NS

Applying K as well as P x K interaction expressed significant effects on the incidence of breakdown rot. Applying K fertilizer either at K2 or K3 levels significantly decreased average percentage of breakdown rot to 5.62 & 5.77% in 2002 season and 7.44 & 7.37% in 2003 seasons comparing with K1 that recorded 7.02 & 8.87% in both seasons, respectively. Among all P x K interactions, applying P2K2 resulted in lowest incidence of breakdown rot in seasons 2002 (4.72%) and 2003 (6.43%). Concerning N x K interaction, applying N2K2 and N2K3 were the best treatments for minimizing average of

breakdown rot in seasons 2002 (3.97 & 4.78%) and 2003 (5.68 & 5.7%) comparing with the other treatments.

In general, the least total pod rot infection (brown, pink and breakdown) was recorded by using N2P2K2 in both 2002 & 2003 seasons in addition to treatments of N2P2K3, and N1P2K3 in the 1st season and N1P3K3 in the 2nd one. Meanwhile, the highest pod rot infections were recorded by using N3P1K1, N2P1K1 and control (unfertilized) treatments in 1st season and N2P1K1, N3P1K1 and check in the 2nd season.

1.5 - Yield of peanut pods

The yield of peanut pods was significantly affected by N and P fertilizers as well as by the interaction between them while, K fertilizer and N x K, P x K and N x P x K interaction had no significant effects in this respect. With regard to N fertilization, yield of peanut pods (ton/feddan) was significantly increased in both seasons by applying the three N levels i.e. N1 (1.279 & 1.292 tons), N2 (1.338 & 1.405 tons) and N3 (1.33 & 1.375 tons) comparing with 1.261 & 1.272 tons in the control (N0) for both seasons, respectively.

As for P fertilization, applying P3 level produces the highest significant increase in the yield of peanut pods in both seasons (aver. 1.31 & 1.354 tons) followed by P2 (aver. 1.306 & 1.342 tons) compared with aver. 1.291 and 1.313 tons in the controls (P1) during both seasons, respectively. However, applying N2P2 caused the highest significant increase in average of peanut yield in both seasons i.e. 1.349 and 1.426 tons, respectively.

2 - Effect of irrigation system

Effects of three different irrigation systems on infection of different types of pod rots as well as on yield of peanut pods at two different locations during two successive growing seasons were determined **(Table, 3)**. Regardless irrigation systems, averages of infection with all types of pod rots were significantly higher during 2002 season in Shrkyia than Beheira governorate. Averages of total pod rots, brown, pink and breakdown rots in 2002 season were 11.82, 5.35, 0.627 and 5.84% in Sharkia compared with 9.38, 4.32, 0.504 and 4.55%, respectively in Beheira governorate. The same trend was noticed in 2003 season except pink rot which was significantly higher (aver. 0.822%) in Beheira then in Shrkyia governorate (aver. 0.494%). Yield of peanut pods was significantly higher in Beheira than Sharkia in 2002 season whereas the reverse was noticed in 2003 season. The averages (ton/fed.) for both governorates, respectively were 1.294 and 1.269 in 2002 seasons and 1.31 and 1.321 in 2003 season.

Among irrigation systems tested, the spray one was the best for minimizing averages of total pod rots (6.6%), brown rot (3.35%), pink rot (0.303%) and breakdown rot (2.95%) followed by drip irrigation system with clear significant differences between them. The drip irrigation system was the inferior in this respect as it recorded the highest averages for incidence of different types of pod rots. This trend was approximately the same in both 2002 & 2003 seasons. On contrast with pod rots, the drip system resulted in the highest significant increase in the average yield of peanut pod during both seasons i.e. 1.313 and 1.354 ton/feddan while, the spray system produced the lowest average yield i.e. 1.249 & 1.284 ton/feddan in both seasons, respectively. The dip system occupies intermediate position between drip and spray systems with clear significant differences between all. Both pod rots and yield were affected in similar ways by the interaction between locations and irrigation systems.

Table (3): Effect of different irrigation systems on percentages of pod rot infections and peanut yield during 2002 and 2003 growing seasons.

Seasons / Locations		Irrigation system	Total infection %	% Infection with: Brown rot %	Pink rot %	Break-Down %	Yield (ton/fed.)
2002 season	Beheira	Spray	6.17	2.71	0.37	3.09	1.261
		Drip	12.39	5.52	0.73	6.13	1.329
		Dip	9.58	4.73	0.41	4.43	1.292
	Sharkyia	Spray	7.04	4.00	0.24	2.80	1.237
		Drip	15.33	5.69	0.97	8.67	1.298
		Dip	13.09	6.37	0.67	6.06	1.273
2003 season	Beheira	Spray	7.98	2.75	0.53	4.70	1.285
		Drip	14.61	5.11	1.10	8.40	1.339
		Dip	12.73	4.39	0.83	6.83	1.305
	Sharkyia	Spray	9.45	2.95	0.40	6.10	1.283
		Drip	15.72	6.77	0.42	8.53	1.369
		Dip	16.08	7.70	0.67	7.71	1.312
LSD at 5% for							
2002 season	Location		0.138	0.143	0.030	0.173	0.010
	System		0.207	0.215	0.045	0.260	0.015
	Interaction		0.415	0.429	0.091	0.520	NS
2003 season	Location		0.172	0.142	0.029	0.229	NS
	System		0.258	0.213	0.044	0.343	0.015
	Interaction		0.516	0.427	0.087	NS	NS

3 - Effect of sowing time

Results in **Table (4)** reveal that the sowing date had a significant effects on the total pod rots (brown, pink and breakdown rots) and yield of peanut pods. The early sowing of peanut (1st April) in both growing seasons decreased total infection with pod rots (brown, pink and break down rots).

It is pronounced also that the total pod rot infection increased gradually by delaying the sowing time after 1st April and reached maximum in plantations sowing at 1st. Juni. The later sowing time seems unfavorable and increased infection with pod rots particularly break down and pink rots as well as decreased the pod yield .

The pink rot only was significantly affected by location in the first season. Its incidence average was significantly lower in Beheira governorate (0.707%) than Sharkia governorate (0.787%). It was affected also by interaction between location and sowing dates in both seasons. In 2002 season, the lowest average pink rot infection was recorded in the peanut crop sowing at 15th (0.13%) and 1st April (0.23%) whereas, the highest values were recorded in crops sown at 1st April (0.67%) and 15th May (0.8%) in Beheira and Shrkyia governorates, respectively. In 2003 season, its lowest and highest infections in 2003 season were recorded in crops sown at 1st May and 1st June, respectively in both governorates.

Table (4): Effect of different sowing dates on percentages of pod rot infections and yield during 2002 and 2003 growing seasons.

	Sowing	Total	% Infection with			Yield

				Brown rot %	Pink rot %	Break-Down %	
2002 season	Beheira	1st April	11.71	6.92	0.67	4.12	1.238
		15th April	14.10	9.60	0.13	4.37	1.288
		1st May	13.94	9.37	0.57	4.00	1.235
		15th May	15.07	7.90	0.40	6.77	1.202
		1st June	15.57	7.07	0.57	7.93	1.171
	Sharkyia	1st April	13.47	7.37	0.23	5.87	1.228
		15th April	14.21	10.07	0.47	3.67	1.264
		1st May	14.24	9.87	0.30	4.07	1.248
		15th May	15.30	8.37	0.80	6.13	1.212
		1st June	16.07	7.57	0.57	7.93	1.193
2003 season	Beheira	1st April	12.86	7.80	0.43	4.63	1.242
		15th April	13.57	8.37	0.67	4.53	1.301
		1st May	14.77	9.07	0.43	5.27	1.271
		15th May	14.97	8.87	0.50	5.60	1.241
		1st June	16.40	7.73	1.50	7.17	1.203
	Sharkyia	1st April	13.24	8.27	0.90	4.07	1.243
		15th April	13.44	8.37	0.67	4.40	1.305
		1st May	15.07	8.60	0.37	6.10	1.262
		15th May	15.30	8.37	0.70	6.23	1.239
		1st June	16.43	7.33	1.30	7.80	1.209
LSD at 5% for							
2002 season	Location		NS	NS	NS	NS	NS
	Date		0.490	0.453	0.040	0.197	0.016
	Interaction		NS	NS	0.080	0.393	NS
2003 season	Location		NS	NS	0.019	NS	NS
	Date		0.511	0.303	0.047	0.295	0.009
	Interaction		NS	NS	0.093	NS	NS

Regardless infection with different types of pod rots, peanut crops sown at 15th April produced the highest increase in the peanut pods followed by those sown at 1st May while, the lowest yields were associated with crops sown at 1st June. This trend holds fairly in both governorates.

DISCUSSION

Fertilization with NPK fertilizers had a great effect on peanut pod rot infection during two successive seasons 2002 and 2003. Also, it is pronounced from the results that increasing K fertilizer level singly or in combination with P specially decreased the infection with pod rot. Meanwhile, using N fertilizer singly at the high units increased pod rot infection while, using P and K fertilizers with high units in combination with N fertilizer decreased pod rot infection to moderate levels. Moreover, no addition of K in presence of high levels of N increased the percentage of break down and brown rot as well as pink rot comparing with the treatments applied with K at high units. Also, addition of NPK fertilizers at all tested levels increased the yield of peanut pods comparing with un-treated ones. These results could be interpret in light the findings of **Ahmed *et al.* (1983)** who, indicated that the highest percentage of survival peanut plants and yield were obtained by adding the highest rates of P and K fertilizers. While, **El-Wakil *et al.* (1984)** found that addition of NPK at 15-30-24 and 15-45-48 units, respectively, gave the least percentage of

peanut pod rot accompanied with high yield. Meanwhile, **Chen, (1991)** reported that clay content and exchangeable K, tended to reduce pod rot, while higher levels of total soil N and P tended to increase it. Also, **Marei, (2000)** showed that addition of K alone under field conditions tends to increase the percentage of pods with dry brown lesions. In contrast to P which reduced this percentage. Addition of N alone at the recommended level increased the percentage of pods with general breakdown. The highest of healthy pods was recorded using a combination of P and K at the rate of 45- 48, respectively.

The results revealed that irrigation system had a great role on incidence of pod rot infection when tested during the growing seasons 2002 and 2003 in two Egyptian governorates. The results of first and second season indicated that the best irrigation system was spray system when applied in Beheira and Sharkya governorates where, it reduced the infection with total pod rot and then reduced also the infections of pods with break down, brown and pink rots. Also, drip irrigation system caused the highest total peanut pod rot infection specially in Sharkya and then increased the infection of pods with break down, brown and pink rots in this governorate. The results revealed that the early sowing of peanut during the 1st. April decreased the infection with pod rot infection and then reduced the infection of pods with break down, brown and pink pods comparing to the other tested sowing dates in two governorates (Beheira and Sharkya) during two growing seasons (2002 and 2003). It is pronounced also that delaying the sowing time after 1st. April increased gradually the pod rot infection to rich their maximum infections during the two seasons in the two governorates at 1st. June. In this respect, little number of studies deals with the effect of irrigation and time of planting on peanut pod rot disease was found in literatures. However, the obtained results are in opposite to the obtained findings of **Walker *et al.* (1989)** who found in three years of field experiments on groundnut, that neither irrigation, K or Mg application affected the number of plants attacked by *Sclerotium rolfsii* or the incidence of pod rot on two different soil types.

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العوامل المؤثرة على إصابة الفول السودانى بأمراض عفن القرون تحت ظروف الحقل

2- المقاومة الكيماوية والبيولوجية والمتكاملة لأمراض عفن قرون الفول السودانى تحت ظروف الحقل

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الملخص العربى

لقد كان للتسميد بمسمدات الـ NPK تأثير كبير على الإصابة بعفن قرون الفول السودانى تحت ظروف الحقل خلال موسمى 2003/2002. فقد أدت الزيادة فى معدلات السماد البوتاسى منفردا أو متحدا مع السماد الفوسفاتى إلى تقليل الإصابة بعفن القرون. وفى نفس الوقت فقد أدت زيادة التسميد النتروجينى بوحدات عالية إلى زيادة الإصابة بعفن القرون بينما أدى إستخدام التمسيد البوتاسى والفوسفاتى بوحدات عالية فى وجود السماد النتروجينى إلى تقليل الإصابة بعفن القرون لمستويات متوسطة. فضلا عن ذلك فقد أدى عدم إضافة السماد البوتاسى فى وجود التسميد بوحدات عالية من السماد النتروجينى إلى زيادة نسبة الإصابة بعفن القرون العام والبنى والوردى مقارنة بمعاملات التسميد البوتاسى بالمعدلات العالية. وقد زودت أيضا كل معاملات التسميد بمسمدات الـ NPK من محصول القرون مقارنة بغير المعامل. وكان أفضل نظام للرى هو الرش حيث إنخفضت نسبة الإصابة بعفن القرون الكلى ومن ثم قلت الإصابة بعفن القرون العام والبنى والوردى. وقد أدى الرى بالتنقيط إلى زيادة نسبة الإصابة بعفن القرون الكلى خاصة فى محافظة الشرقية ومن ثم زيادة الإصابة بعفن القرون العام والبنى والوردى فى تلك المحافظة. كما خفضت الزراعة المبكرة فى الأول من أبريل من الإصابة بعفن القرون الكلى ومن ثم خفضت الإصابة بعفن القرون العام والبنى والوردى مقارنة بمواعيد الزراعة الأخرى فى محافظتى البحيرة والشرقية خلال موسمى 2003/2002. وقد كان واضحا أيضا أن تأخير موعد الزراعة إلى ما بعد الأول من أبريل قد أدى إلى زيادة تدريجية فى الإصابة بعفن القرون لتصل أعلى مستوى لها خلال موسمى النمو فى المحافظتين عند الأول من يونية.