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EFFECT OF PHOSPHORUS FERTILIZER TREATMENTS ON INCIDENCE OF FUSARIUM ROOT-ROT/WILT DISEASE COMPLEX, AND ON YIELD COMPONENTS OF LUPINE, CHICKPEA AND LENTIL CROPS

[16]

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ABSTRACT

In greenhouse and field experiments, conducted in two successive winter seasons 2007/2009 the effect of phosphorus fertilizer treatments on incidence of wilt disease of lupine, chickpea and lentil, as well as yield and yield component was studied. Application of Phosphorus fertilizer (100 and 200 kg/fed; as super phosphate (15.5% P_2O_5) before planting) caused a reduction in incidence and severity of wilt diseases on plants of the three legume crops either in greenhouse and field experiments. In field experiments, results indicated that the most effective treatment was phosphorus at 100 and 200 kg / fed) respectively, which reduced the wilt diseases. Phosphorus fertilizer significantly increased yield characters i.e., plant height, number of branches, number of pods, seeds yield / plant and weight of 100 seeds.

INTRODUCTION

Damping-off, root-rot and wilt diseases are destructive diseases attacking legume crops worldwide, causing serious yield losses. These diseases are caused by several fungi i.e., *Rhizoctonia solani, Fusearium oxysporum, Fusarium solani* and *Sclerotium rolfsii* (**Abdallah, 1969; El-Garhy, 1994; Hassanein *et al* 1996 and Abou-Zeid *et al* 1997**). Specific *Fusarium oxysporum* forma specials cause wilt on legume crops, i.e. *F. oxysporum* f.sp. *lentis* on lentil, *F. oxysporum* f.sp. *ciceri* on chickpea and *F. oxysporum* f.sp. *lupine* on lupine (**Booth, 1971**). However, the major fungal disease problem of legume crops in Egypt is root-rot/wilt disease complex (**Salem *et al* 1990 and El-Awadi *et al* 1990**). The disease appears in most areas throughout the growing season in Egypt. **Taha *et al* (1969)** reported that Fusarium wilt caused by *Fusarium oxysporum* f.sp. *ciceri* is a major disease of chickpea.

Development of disease resistant varieties was the most economical mean of control. Phosphorus has been called "the key to life" because it is directly involved in most life processes. It exerts many and varied functions in plant metabolism and hence inadequate phosphate supply to the plant seriously affect numerous metabolic processes. **Singh *et al* (1981)** found that phosphorus applied at 60 and 90 kg/ha significantly increased yields in comparison with 30 kg P, when 4 levels of P (0, 30, 60 and 90 kg/ha) were applied. **Negm *et al* (1992)** reported that phosphorus application increased the number of branches and flowers per plant. **Jain *et al* (1999) and Khurana and Sharma (2000)** showed that the combined inoculation of Rhizobium and phosphate solubilizing bacteria increased nodulation, growth and yield parameters of chickpea. Increased germination, number of branches, nodulation and yield of pea and total biomass of chickpea compared with either individual inoculations or the uninoculated control (**Rudresh *et al* 2005**). This study was carried out in order to investigate the effect of phosphorus fertilizer on incidence of Fusarium root-rot / wilt disease complex and on yield component of lupine, chickpea and lentil crops.

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MATERIALS AND METHODS

This work has been carried out at Experimental Farm of Sers El-Layian Agricultural Research Station, Minufiya Governorate, Egypt. The mechanical and chemical properties of the experimental soil for the upper foot layer (0 – 30 cm) and available phosphorus of the experimental soil (Table 1) were determined before sowing in the two seasons according to the method described by **Chapman and Pratt (1961)** and presented in **Table (1)**.

Mechanical and chemical properties of the experimental sites revealed that the texture of the soil was sandy clay with a low P content in the two growing seasons **Table (1)**.

Isolation and identification of pathogens

Roots and basal stems of each of lupine, chickpea and lentil plants, showing typical symptoms of root-rot and wilt, were washed carefully with tap water, dried between two filter papers, then cut into small pieces. Pieces of infected roots were surface-sterilized in 3% sodium hypochlorite for 2 min., dried between two sterilized filter papers, then directly transferred to Petri dishes containing potato dextrose agar (PDA) medium, and incubated at 25°C for 5 days. The developed fungal hyphal were isolated, established in pure culture on PDA slants and finally purified by the single spore or hyphal tip techniques. The isolated fungal pathogens were identified as *Fusarium oxysporum* by the aid of Department of Mycology, Plant Pathology Institute, Agricultural Research Center, Giza, Egypt. Confirmation of pathogencity of these isolates was done on the host from which it was isolated. The pathogenicity tests revealed that these isolates were *Fusairum oxysporum* f.sp.

Effect of phosphorus fertilizer treatments

Greenhouse Experiment

Clay Pots (25 cm) were sterilized by dipping in 5% formation solution for 5 min and then left in open air till dryness. Soil sterilization was accomplished with 5% formalin solution, mixed thoroughly, covered with plastic sheet for one week and then the plastic sheet was removed in order to complete formalin evaporation for up to one month. Soil infestation with each individual *Fusarium* isolate was carried out at the rate of 5% of soil weight. Fungi were individually grown on sand-barley (SB) medium (25 g clean sand, 75 g barley and enough water to cover the mixture). Flasks contained sterilized medium were inoculated with each particular *Fusarium* isolate and incubated at 25°C for two weeks. Soil of control pots was mixed with the same amount of sterilized sand-barley (SB) medium. The phosphorus fertilizer rates (0, 100 and 200 kg/fa) was mixed with the top layer of the soil before sowing. Ten seeds of lentil (Giza 9), chickpea (Giza 3) and lupine (Giza 1) were sown in each pot, and three replicates were used for each treatment. Percentages of pre- and post-emergence damping-off as well as healthy survival plants in each treatment were determined 15 and 30 days after sowing, respectively using the next formula according to **El-Helaly *et al* (1970)**.

Disease severity: It was estimated using the following equation.

Disease severity = [(a × b ÷ N × K) x 100] (Soleman *et al* 1988).

a: Number of infected plants.
b: Grade of infection.
N: Number of total plants.
K: Maximum grade of infection

Infection types (IT): roots were rated for disease severity according to the scale adopted by **Aegerter *et al* (2000)** as follows:

0 : no symptoms.
1 : few lesions (covering < 10% of root), secondary root rot slight.
2 : rot of secondary roots or lesions covering approximately 25% of the root.
3 : lesions covering at least 50% of the root and dead secondary roots.
4 : general root rot, most of the root affected, also including (pre- and post-emergence damping-off).

Field experiments

Two field experiments were carried out in the Experimental Farm of Sers El-Layian, Agricultural Research Station, Minufiya Governorate, Egypt, during two winter seasons (2007/2008 and 2008/2009). Each experiment included three legume crops, *i.e.* lupine, chick-pea and lentil in the main plots, without application and foliar application of the foliar spray treatments were: a) control (spraying with water) and b) foliar spraying with phosphorus solution fertilizer in the split plots. Extraction solution of phosphorus fertilizer was prepared by dissolved calcium superphosphate 15.5% P_2O_5 as a rate of 50 g/liter in the stock pot then flipping exactly and leave it at 48 hours and look the solution after precipitation, filter through any good grade phosphate-free filter paper. Taked an a filtering solution for used in spraying the plants at the rate of 400 liter/feddan. The plants were

Table 1. Physical and chemical properties of the experimental soil for upper foot layer (0 – 30 cm) in the two growing seasons

Seasons	Sites	Physical properties				Texture	Chemical properties												N%	P%	K%
		Sand		Silt	Clay		pH 1:2.5	E.C mmhos/ cm 20°C	$CaCO_3$ %	Cations (ml/100g)				Anions (ml g/100g)						
		Coarse	Fine							Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$			
2007 / 2008	1	1.8	52.2	26	20	Sandy clay	7.58	0.39	2.5	1.2	1.00	1.11	0.46	-	1.1	1.5	1.11	0.15	0.09	0.01
2008 / 2009	2	2.0	52.0	27	21	Sandy clay	8.30	0.40	2.7	1.5	1.20	1.50	0.56	0.9	1.5	1.7	1.33	0.20	0.12	0.03

sprayed twice at i.e., after 35 and 75 days of planting respectively. Phosphorus fertilizer rates (0, 100 and 200 kg/fa) in the splite-split plots. For each experiment, a split-split plot design with three replicates was followed. The plot size was 6m^2 consisting of three rows, each row 3 meter long spaced at 60cm. In case of Lupine, two seeds were drilled in one side of rows, and the spacing between hills was 20 cm. In case of Chickpea, two seeds were dilled in the two sides of rows, the spacing between hills was 10 cm, hen then thinning took place of janumery leaving one plant / hill in a chickpea. In case of lentil: the seeds were drilled in the two sides of each row.

The rates of phosphors fertilization (0, 100 and 200 kg/fa) were applied as super phosphate (15.5% P_2O_5) before planting. The nitrogenous fertilizer at the rate of 15 kg per feddan was applied before the first irrigation as a starter dose. The first foliar application of phosphorus fertilizer was applied after 35 days from planting and the second application was applied at the first flowering in after 35 and 75 days from sowing. At maturity, plants were harvested and the following yield characters, *i.e.* plant height, number of branch, number of pods / plant, seeds weight / plant, 100-seeds / weight as well as seeds, straw and total yields / fad were recorded,

Seed samples of each crop were taken and dried, then ground to powder for chemical analysis. Nitrogen content was determined using improving macro-kjeldahl method **(A.O.A.C., 1975)**. The percentage of seed protein content was calculated by multiplying the percentage of nitrogen content by the factor of 6.25 according to **Tripathi *et al* (1971)**. Phosphorus content was determined calorimetrically using spectro-photomater was determined using flame photometer according to **Chapman and Pratt (1961)**

Statistical Analysis

All collected data were subjected to statistical analysis for each season and to combined analysis over years according to **Gomez and Gomez (1984)**.

RESULTS

Effect of Phosphorus Fertilizers in Greenhouse

Data in **Table (2)** illustrate the effect of super phosphate (0, 100, 200 kg /fed) on the percentage of pre- and post-emergence damping-off, wilt disease severity caused by the fungal pathogens, *Fusairum oxysporum* f.sp. All tested phosphorus fertilizers significantly reduced the development of root-rot disease, under greenhouse conditions compared with control. The highest percentage of survival plant in all legume crops was resulted in soil fertilized with super phosphate at 200 kg/fed).

Effect of Phosphorus Fertilizers in the field

Effects on disease incidence

Data in **Table (3)** clearly show the influence of super phosphate (0, 100 and 200 kg/fed) on pre- and post-emergence damping-off of lupine, chickpea and lentil under field conditions during two successive seasons. The results revealed that application of both fertilizer rates (100 and 200 kg/fed) significantly reduced pre- and post-emergence damping-off compared to un-treated plants (control). In general, the protection degree offered by super phosphate fertilizer applied at rate of 200 kg/fed was much higher than untreated control.

Effects on plant growth characters

The obtained data in **Table (4)** revealed a significant effect of fertilization with super phosphate over the control where these effects were shown in case of plant height, fresh weight and dry weight. The obtained results were confirmed from the two experiments conducted in 2007/2008 and 2008/2009 seasons, respectively. However, the great effect on plant growth was given by fertilization with super phosphate (200 kg/fed) application compared with non-fertilized control.

Effect of foliar spraying of lupine, chickpea and lentil plants with super phosphate

Effects on severity of root-rot/wilt

Data in **Table (5)** show the efficacy of spraying super phosphate on root-rot/wilt disease severity under field conditions in two seasons, 2007/2008 and 2008/2009. The obtained results revealed that the super phosphate spray reduced significantly disease severity of *F. oxysporum* compared to untreated one (control). The protection effect was increased by increasing of spraying number. The plants received 3 sprays showed the lowest disease severity.

Table 2. Effect of super phosphate, on incidence and severity of root-rot/wilt disease complex of lupine, chickpea and lentil plants, grown in soil infested with specific forma species of *Fusarium oxysporum*, under greenhouse conditions.*

Crop	Treatment kg/fed	Fungus	Pre-emergence damping-off %	Post-emergence damping-off %	Survived plant %**	Disease severity %***
Lupine	0	*F. oxysporum* f.sp. *lupini*	23.33	20.0	56.67	61.67
	100		13.33	13.33	73.34	45.00
	200		10.00	6.66	83.34	41.67
	Mean		15.55	13.33	71.12	49.45
Chickpea	0	*F. oxysporum* f.sp. *ciceri*	13.33	23.33	63.34	68.33
	100		6.66	20.00	73.34	51.67
	200		0.00	10.00	90.00	36.67
	Mean		6.66	17.78	75.56	52.22
Lentil	0	*F. oxysporum* f.sp. *lentis*	23.33	26.66	50.00	65.00
	100		16.66	13.33	70.00	46.67
	200		13.33	3.33	83.33	30.00
	Mean		17.77	14.44	67.78	47.22
L.S.D. at 0.5			8.51	8.43	12.58	6.97

* The pathogens used were: *Fusairum oxysporum* f.sp. *lentis* on lentil, *F. oxysporum* f.sp. *ciceri* on chickpea and *F. oxysporum* f.sp. *lupine* on lupine.

** After 30 days from sowing.

*** Determined after 60 days from sowing.

Table 3. Effect of different rates (0, 100 and 200 kg/fed) of super phosphate soil fertilizer on incidence of root-rot/wilt disease of lupine, chickpea and lentil during two seasons under field conditions

Crop	Treatment kg/fed	Disease incidence					
		Season 2007-2008			Season 2008-2009		
		Pre-%	Post-%	Survival %	Pre-%	Post-%	Survival %
Lupine	0	20.0	16.67	63.33	23.33	20.00	56.67
	100	16.67	10.00	73.33	13.33	3.33	83.33
	200	6.67	3.33	90.00	3.33	0.00	56.67
Mean	-	14.45	10.00	75.55	13.33	7.78	65.55
Chickpea	0	20.0	10.00	70.00	20.00	23.33	56.67
	100	13.3	3.33	83.33	16.67	10.00	73.33
	200	3.33	0.00	96.66	3.33	3.33	93.33
Mean	-	12.22	4.44	83.33	13.33	12.22	74.44
Lentil	0	20.0	13.33	66.67	26.67	26.67	46.67
	100	13.33	10.00	76.67	20.00	13.33	66.67
	200	3.33	6.67	900.0	6.67	6.67	86.67
Mean	-	12.22	10.0	77.78	17.78	15.55	66.67
L.S.D. at 0.05:							
Crops A		5.41	3.95	6.55	5.23	5.41	9.47
Treatment B		7.34	7.96	9.75	7.96	5.03	12.34
Interaction AB		9.90	7.38	11.43	8.73	8.08	15.12

Table 4. Effect of different rates (0, 100 and 200 kg/fed) of super phosphate on some growth characters of lupine, chickpea and lentil, grown during two seasons under field conditions

Crop	Treatment kg / fed	Crop parameters of (lupine, chickpea and lentil) plant during					
		Season 2007-2008			Season 2008-2009		
		Plant height (cm)	Fresh weight/plant (g)	Dry weight/plant (g)	Plant height (cm)	Fresh weight/plant (g)	Dry weight/plant (g)
	0	32.67	10.33	0.97	28.67	9.83	1.13
Lupine	100	34.33	10.73	1.17	31.00	10.10	1.50
	200	34.33	11.43	1.43	32.33	11.53	1.83
Mean	-	33.77	10.83	1.19	30.67	10.48	1.49
	0	22.67	7.30	0.68	20.33	7.07	0.77
Chickpea	100	25.00	7.50	0.77	23.33	7.77	0.70
	200	36.00	8.47	0.82	25.00	8.60	0.93
Mean	-	27.89	7.75	0.75	22.89	7.81	0.80
	0	17.67	4.33	0.56	14.33	4.33	0.62
Lentil	100	20.67	4.83	0.62	16.00	5.23	0.67
	200	22.00	5.57	0.63	17.67	6.00	0.77
Mean	-	20.11	4.91	0.60	8.54	5.18	0.68
L.S.D. at 0.05:							
Crops A		0.76	0.26	0.090	0.86	0.45	0.15
Treatment B		1.02	0.19	0.14	1.18	0.39	0.12
Interaction AB		1.55	0.46	0.18	1.40	0.75	0.22

Table 5. Effect of interaction between fertilization and spraying super phosphate on severity of wilt disease on lupine, chickpea and lentil foliages, under field conditions.*

Crop	Spray	Treatment	2007/2008			2008/2009		
			1**	2***	Mean	1	2	mean
Lupine	No spray	kg/fed	18.68	19.77	19.22	22.96	25.18	24.07
		100	17.00	18.20	17.60	20.00	22.88	21.41
		200	15.55	17.00	10.85	18.88	22.22	20.55
	Spray	0	13.15	13.70	13.42	15.18	15.52	15.35
		100	12.00	12.87	12.43	12.59	13.33	12.96
		200	10.37	11.93	11.15	11.11	11.70	11.40
Chickpea	No spray	0	20.74	22.22	21.48	25.45	27.58	26.51
		100	18.34	19.83	19.08	23.70	26.66	25.18
		200	16.40	16.93	33.33	20.74	23.48	22.11
	Spray	0	17.33	18.66	17.99	21.48	22.48	21.98
		100	15.33	16.17	15.75	20.00	20.33	20.16
		200	14.27	15.33	14.80	18.00	18.59	18.29
Lentil	No spray	0	21.11	22.15	21.63	33.33	35.00	34.16
		100	17.00	18.10	17.55	30.00	32.22	31.11
		200	16.00	16.87	16.43	28.88	30.00	29.44
	Spray	0	16.40	17.17	16.78	20.37	20.74	20.55
		100	13.76	15.17	14.46	20.00	20.00	20.00
		200	12.33	13.48	12.90	17.77	18.88	18.32
L.S.D. at 0.05:								
Crops			0.27	0.21		0.38	0.42	
Spray			0.41	0.10		0.46	0.40	
Treatment			0.36	0.18		0.56	0.61	
Interaction			0.74	0.46		1.00	1.03	

* Foliar spray applied at rate.

** The first spray was applied after 35 from sowing.

*** Further additional spray applied after 75 from sowing.

Effects on growth characters and yield components

Data presented in **Table (6)** showed that all treatments gave high values of plant height and number of branches. Super phosphate spray treatment was more effective on these parameters. Marked differences were detected among all treatments on yield components of lupine, chickpea and lentil plants. Lupine recorded the highest values of number of pods/plant and weight of 100-seed, the application of super phosphate spray increased significantly number of pods/plant and weight of 100-seed in all crops. On the other hand, no spray had any significant effect in number of pods/plant but increased weight of 100-seed.

Effect of super phosphate fertilizers on chemical composition of lupin, chickpea and lentil plants

The present results indicated that the different rates of super phosphates applied to soils or with additional foliar spray caused significant increase in soluble and total nitrogen contents in lupine, chickpea and lentil plants.

The present results in **Table (7)** are agreed with those obtained by **Mengle and Krikby (1987)**. They found that in seeds and grains, P contents in the range of 0.4 to 0.5% in the dry matter. However, data indicated that the root-rot diseases of (lupine, chickpea and lentil) plants were decreased with P fertilization **Tables (7)**.

Table 6. Effect of super phosphate spray on some yield component of lupin, chickpea and lentil under field conditions

Crop	Spray	Treatment kg/fed	Season									
			2007/2008					2008/2009				
			Plant height (cm)	Branches plant	No. seeds pods	100-seed weight (g)	Seed weight ardab/ fed.	Plant height	Branches/ plant	No. seeds pods	100-seed weight (g)	Seed weight ardab/ fed.
Lupine	No spray	0	108.00	2.00	23.33	28.00	3.44	99.00	2.00	18.00	28.67	3.70
		100	113.33	2.66	24.33	29.00	5.25	103.33	2.66	19.00	31.67	4.87
		200	115.00	3.00	25.33	31.67	5.66	105.00	3.00	21.00	32.67	5.51
	Spray	0	127.66	3.00	24.33	31.67	4.23	121.67	3.00	22.00	29.00	5.89
		100	129.66	3.66	25.00	34.33	6.27	123.33	3.66	23.00	34.00	6.59
		200	135.00	4.00	30.67	36.33	7.07	128.33	4.00	25.00	36.33	7.71
Chickpea	No spray	0	79.67	1.66	39.33	21.33	3.07	73.33	2.33	43.67	23.67	3.31
		100	81.33	1.66	41.67	23.00	4.42	76.66	3.33	45.00	25.33	3.75
		200	88.00	2.00	44.33	24.33	5.04	83.33	3.66	48.67	27.00	4.50
	Spray	0	88.33	3.33	48.00	25.67	4.09	83.33	4.00	50.00	28.67	3.60
		100	91.62	3.33	49.33	26.67	5.69	88.00	4.00	54.00	30.00	5.42
		200	95.00	3.66	53.67	28.67	6.14	90.00	4.33	55.00	31.00	5.88
Lentil	No spray	0	60.67	3.00	18.67	4.33	2.30	51.67	5.33	24.00	5.33	2.64
		100	61.67	3.00	21.33	5.33	3.06	55.00	5.33	27.00	6.00	3.01
		200	65.00	3.66	23.67	5.66	3.93	58.00	6.33	29.33	7.00	3.60
	Spray	0	63.00	3.66	26.00	5.00	3.53	63.67	6.66	32.00	8.33	3.47
		100	69.33	4.66	30.67	6.67	4.39	61.67	7.00	36.00	8.67	4.89
		200	77.67	5.33	33.33	7.33	5.13	65.00	7.00	39.33	9.00	5.94
L.S.D. at 0.05:												
Crops			1.41	0.22	0.56	0.41	0.72	1.65	0.21	0.68	0.44	0.16
Spray			1.34	0.47	0.43	0.42	0.45	1.40	0.47	0.56	0.52	0.27
Treatment			3.25	0.36	1.71	1.09	1.09	2.19	0.43	1.19	1.47	0.33
Interaction			3.82	0.75	1.64	1.49	1.64	3.95	0.71	1.75	1.47	0.50

* Foliar spray applied at rate of 100 liter / 5 kg super phosphate.

** The first spray was applied after 75 from sowing.

*** Further additional spray applied after 95 from sowing.

Table 7. Effect of super phosphate treatments on chemical composition of lupin, chickpea and lentil plants

Crop	Spray*	Concentration	2007/2008			2008/2009		
			P%	N%	Protein %	P%	N%	Protein %
Lupin	no. spray	0	0.30	3.69	23.07	0.33	3.79	23.66
		100	0.36	3.94	24.76	0.37	4.05	25.31
		200	0.46	4.20	26.26	0.45	4.18	26.14
	Spray	0	0.38	3.77	23.55	0.39	3.91	24.43
		100	0.56	4.15	25.89	0.57	4.22	26.40
		200	0.59	4.49	28.04	0.62	4.49	28.09
Chickpea	no spray	0	0.47	3.57	22.35	0.46	3.72	23.23
		100	0.53	3.95	24.71	0.55	4.01	25.08
		200	0.55	4.09	25.55	0.61	4.16	26.01
	Spray	0	0.56	3.83	23.93	0.58	3.88	24.29
		100	0.60	4.09	25.58	0.65	4.15	25.9
		200	0.63	4.24	26.53	0.67	4.28	26.77
Lentil	no spray	0	0.37	3.47	21.72	0.39	3.56	22.29
		100	0.44	3.74	23.42	0.44	3.79	23.71
		200	0.58	4.02	25.16	0.55	4.07	25.44
	Spray	0	0.42	3.75	23.45	0.42	3.78	23.66
		100	0.55	3.95	24.70	0.61	4.03	25.23
		200	0.61	4.12	25.95	0.64	4.25	26.54

* Plants were sprayed twice.

DISCUSSION

The results of this study indicated that resistance of (lupine, chickpea and lentil) against root-rot and wilt could be induced by super phosphate. In greenhouse and field condition, super phosphate treatments significantly reduced pre-and post-emergence damping-off as well as root-rot disease, consequently increased germination percentage and healthy plants. In addition, super phosphate treatment increased significantly vegetative growth parameters and yield component. Fungal infection is considered as one of the most important stress conditions. Such enhancement effect of super phosphate on the vegetative growth parameters might be attributed to its effect on nodulation and yield parameters (**Jain *et al* 1999; Khurana and Sharma, 2000 and Rudresh *et al* 2005**). They added that super phosphate is required for the synthesis of tryptophane which, consider the precursor of IAA. The formation of such growth substances is also due to indirect effect of by super phosphate treatment.

Data presented in **Table (5)** showed that the soil application of phosphorus fertilizer increased plant height, number of branches / plant, number of pods / plant, 100-seed weight / g) and seed weight ardab / fed in both seasons of the three legume varieties. It is clear from the same table that foliar spraying of phosphorus solution significantly increased all these parameters. These results are in agreement with (**Ahmed *et al* 1992**), they found that the application P increased significantly protein content and carbohydrate content in seed and different plant parts.

The interaction effect of foliar spraying of phosphorus solution and the soil application as a rate 200 kg / fed calcium superphosphate 15.5 P_2O_5 gave the highest values in the all legume varieties. These results are agreed with those obtained by **Singh *et al* (1981)**. They found that, P applied at 60 and 90 kg / ha significantly increased yields in comparison with 30 kg / ha P, when 4 levels of P (0, 30, 60 and 90 kg / ha) were applied. **El-Gharably and Abd El-Razek (1982)** studied the effect of various levels of P being added to a sandy calcareous soil on snap been grown in greenhouse for 35 days. They found that the maximum growth was obtained by 150 ppm P application. **Negm *et al* (1992)** observed that, phosphorus application increased the number of branches and flowers per plant

It is obvious from these data that all intensive systems of arable cropping have a relatively high demand for phosphate. Phosphorus is particularly important for leguminous plants possibly by its influence on the activity of the rhizobioum bacteria. For mixed swords it is therefore important that soil P levels should be kept high in order to maintain the leguminous species. **(Mengle and Krikby, 1987)**. Also, phosphorus exerts many and varied functions in plants metabolism and hence inadequate phosphate supply to the plant seriously affects numerous metabolic processes. It is well shown that, the most important function of P formation of pyrophosphate bonds allow energy transfer **(Mengle and Krikby, 1987)**.

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تأثير التسميد الفوسفاتى على شدة وحدوث أمراض عفن الجذور والذبول ، وبعض الصفات المحصولية لنباتات الحمص والعدس والترمس

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الموجـــــــز

أجريت هذه الدراسة تحت ظروف الصوبة والحقل فى محطة البحوث الزراعية بسرس الليان – محافظة المنوفية عام ٢٠٠٧/٢٠٠٨ – ٢٠٠٨/٢٠٠٩ لدراسة تأثير السوبر فوسفات على أمراض عفــن الجــذور والذبول والذى يُسببه فطــر *Fusarium oxysporum* بتركيزات مختلفة ٠ ، ١٠٠ ، ٢٠٠ كجم للفدان على ثلاث محاصيل هم (الترمس – الحمص – العــدس) وأدى التسميد الفوسفاتى إلى انخفاض نــسبة الــذبول مقارنةً بالكنترول وذلك تحت ظروف الصوبة وفــى وجود الفطر *Fusarium oxysporum* . تحت ظروف الحقل أدى التسميد الفوسفاتى إلــى انخفــاض نــسبة الأمراض كما أدى التسميد لزيادة الصفات المحصولية المختلفة للمحاصيل الثلاثة ، حيث أدى إلــى زيــادة التفريع وعدد القرون ووزن القرون ووزن الــ ١٠٠ بذرة وكذلك زيادة فى محصول الفدان وعنــد عمــل تحليل البذور الجافة وجدت زيادة فى نسبة البــروتين والنيتروجين والفوسفور .

وقد أثبتت التجارب الحقلية أن استخدام التــسميد الفوسفاتى سواء كان مخلوطاً فى التربة أو رشاً على الأوراق كان لها تأثير ملحوظ على الإصابة بمــرض الذبول وعفن الجذور حيث أدت المعاملات إلى زيادة عدد النباتات السليمة وكذلك زيادة فى وزن الــ ١٠٠ بذرة وعدد البذور والقرون ووزن القطعة التجريبية .

لذلك نُوصى باستخدام التــسميد الفوســفاتى قبــل الزراعة مُباشرةً وأيضاً رشاً على النباتات لأنه يُعطى قوة للمحاصيل وبالتالى تكون لديه قدرة على مقاومـــة الأمراض المختلفة وتُعطى زيـــادة للمحــصول عنــد مقارنتها بالكنترول .

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