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RESPONSE OF TWO PEA CULTIVARS TO PHOSPHORINE INOCULATION AND ORGANIC FERTILIZER (COMPOST)UNDER THE NEWLY RECLAIMED SOIL CONDITION

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ABSTRACT

Two filed experiments were conducted in the two successive winter seasons of 2003/2004 and 2004/2005 in a sandy loam soil of a private farm of newely reclaimed soil at west of El-fashn, Beni Sweif Governorate to investigate the effect of seeds inoculation with phosphorine and application of compost fertilizer on the growth, yield and yield quality of the two pea cultivars "Lincoln" and "Victory Freezer".

The obtained results indicated that number and weight of nodules /pant were not significantly different in the two studied cultivars. On the other hand, the two cultivars were significantly different from each other in most studied characters, where cv. Victory Freezer was superior in almost all characters including total yield / fed.

Phosphorine inoculation significantly increased number and weight of nodules/ plant, enhanced plant growth, total yield / fed. and seed's chemical composition, i.e. protein and phosphorus percentage.

Compost applications significantly affected most of the studied characters. The best application in this regards was when plants fertilized with half rate of recommended NPK in addition to 15 tons of compost / fed.

Based on the obtained results, it may be recommended to grow cv. "Victory Freezer" after inoculation the seeds with phosphorine and fertilizing plants with half rate of the recommended NPK in addition to 15 tons of compost / fed. to increase the productivity and quality. Furthermore, minimizing the environmental pollution and the risk on human health as a result of reducing the chemical NPK fertilizers require for pea production.

INTRODUCTION

PEA is one of the most popular and important legume vegetable crops grown in Egypt and many countries all over the world. It has high nutrition values specially protein which was reported to be 24.1 % (Hassan, 1997). Increasing pea production with good quality are important goal. Moreover, reducing environmental pollution through decreasing amount of chemical fertilizers is of great demand nowadays for human and animal safety and reducing air and water pollution. These goals could be achieved through using the organic fertilizer, i.e. compost and biofertilizer such as the desolving phosphorus bacteria so called phosphorine.

Biofertilizers have been reported to be an important factor in reducing the application of chemical fertilizers and hence reducing the environmental pollution (El- Kholi, 1998). Biofertilization maxmize the number and activity of micro-organisms for the decay of the organic matter and mineralization to create good medium for plant growth, specially in the new reclaimed soils (El-Sersawy *et al.*, 1997). Phosphorine has been reported to increase growth, yield and N, P and K uptake by pea plants (Saber *et al.*, 1981; Gebraiel,

1995; El- Gamal, 1996 and El- Sayed, 1999). Application of phosphorine could safe about fifty percent of the recommended rate of mineral phosphorus fertilizer (Sarhan *et al.*, 2002). Chaudhari and Gavhane (2005) inoculated pea plants with five phosphate – solubilizing isolated where they recorded significant increases in plant dry matter, N and P uptake and grain yield of pigeon pea.

Organic fertilizer (compost) has been reported to have a great effect on the growth and productivity of pea plants as well as reducing the recommended rate of chemical fertilizers, which in turns reduce the environmental pollution and reduces the production cost. El- Kina and konstantinova (1998) reported that the application of 200 or 500 ton compost / ha increased humus content, soil porosity, activity of cellulolytic microorganisms, base saturation and yield of pea as well as affecting the contents of N,P,K, Ca and Mg in plants. Sawan *et al.* (2001) declared that increasing compost levels from zero up to 16 t / feddan resulted in a significant increase in growth characters of sugar pea cv. "Sugar pearl" i.e., plant height, number of leaves and branches as well as dry weight of plant parts, yield and chemical contents of N,P and K in vegetative plant parts. Organic fertilizers were reported to increase yield of cowpea with increasing rate of farmyard manure (FYM) to 15 t / ha as reported by Vikrant *et al* (2005).Pandey *et al* (2006) reported that the highest pod yield of garden pea was obtained with the application of FYM at the rate of 20 t / ha. Moreover, organic fertilizer recorded significant improvement in physicochemical properties of soil.

The objective of the present study was to investigate the effect of inoculating seeds with phosphorine and organic fertilizer (Compost) on the growth, yield and chemical composition of seeds of two pea cultivars and the possibility of reducing the application rate of the NPK chemical fertilizers.

MATERIALS AND METHODS

Two field experiments were carried out during the two successive winter of 2003/2004 and 2004/2005 in a private farm located at west El-Fashn, Beni Sweif Governorate to investigate the effect of phosphate solubilizing bacteria (PMB) so called phosphorine and compost fertilizer rate on the growth, yield and its components, seeds chemical composition of two pea cultivars, i.e. Lincoln and victory freezer and the possibility of reducing NPK chemical fertilizer in order to minimize production cost and environmental pollution. Soil chemical and physical analysis were carried out according to Black *et al* (1965) and presented in Table (1). The analysis of the used compost in the present study showed the following : 0.03% Carbon, 35.03 organic matter, C/N ratio 10.66, 1.91% N, 0.54% P, 1.40% K, 0.20% Ca, 0.18% Mg, 2456 ppm Fe and 2356 ppm Mn.

Treatments were arranged in a split- split plots design in complete randomized blocks system. Each experimental plot consisted of 5 ridges each 3m long and 70 cm wide and seeds were planted in hills and 3-4 seeds were sown / hill at 15 cm apart at one side of ridges. Agricultural practices

known for pea commercial production prevailing in the studied area were followed.

Cultivars were arranged randomly in the main plots. Two phosphorine treatments (inoculated and uninoculated seeds) were arranged randomly in the sub-plots and the compost treatments were randomly distributed in the sub-sub plots (0.0, 5.0, 10.0 and 15 tons/fed.), where the control (0.0 compost) was fertilized with NPK at the recommended dose for pea commercial production, while other compost treatments received NPK at half the recommended rate. The recommended rate of NPK was 100 kg N/ fed as ammonium sulphate,75kg P_2O_5/ fed. as superphosphate and 100 kg K_2O / fed. as potassium sulphate. The NPK fertilizers were applied at 3 equal doses after 15,30 and 45 days of planting time. Phosphorine was obtained from the Organization of the Agriculture Equalization fund (G.O.A.E.F.), Ministry of Agriculture, Egypt. The seed inoculation was carried out just before planting. Compost applications were incorported to the soil in the appropriate experimental plots before planting.

Table 1 : chemical and physical characters of the experimental soil in the two seasons of 2003/2004 and 2004/2005.

Characteristics	2003/2004	2004/2005
EC mmhos cm^{-1}	0.71	0.78
PH 1: 25 soil : water susp.	7.79	7.81
Ca CO3 %	8.40	8.12
Organic matter %	0.32	0.43
NaHCO3 – ext.P ppm	4.85	5.10
NH4 OAC- ext. K ppm	85.14	88.17
Total N %	0.033	0.029
Coarse sand %	28.41	32.55
Fine sand %	42.53	37.76
Silt %	24.26	26.13
Clay %	4.80	3.56
Soil texture	Sandy loam	Sandy loam

Seed of pea cultivars were sown on the 10th and 12th of October in 2004 and 2005, respectively. After 15 days from planting time, seedlings were thinned to two plants per hill. After 50 days form planting time, ten plants from each experimental plot were taken randomly to record bacterial nodules number and weight. At the end of the growing season, ten plants, chosen at random from each plot to determine plant height and number of branches per plant. Fresh pod yield was started to be harvested on 25 of January in two studied seasons. Pea pods were harvested at 10 days intervals for three times in both seasons.

Twenty pods were taken randomly from each plot at the second picking time to determine pod length, pod width and average weight and number of seeds per pod. Pod fresh weight per plot was determined and then converted to total fresh pod yield (tons/fed). Samples of fresh seeds from each plot were taken randomly from the second picking and dried at 70C till constant weight, ground and then digested wet. Nitrogen was determined

using the micro- kjeldahl method and then converted to protein percentage according to Chapman and pratt (1961). Phosphorus was determined colorimetrically and potassium was determined using by the flame photometry method as mentioned by Murphy and Riely (1962) and Page *et al* (1982), respectively.

All data were statistically analyzed and treatments means were compared using the L.S.D method described by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

1-Number and weight of nodulation:

Data of these characters are presented in Table (2). The two cultivars were not significantly different from each other in these two characters, in both seasons. Data show that plants inoculated with phosphorine significantly had higher number and weight of nodules per plant in both seasons. This could be resulted from the role of phosphorine in some enzymatic reaction in plant which depend on phosphorylation and its essentiality for cell division and for the development of meristem tissues (Russell, 1973). El-Neklawy *et al.* (1985) and Singh *et al.* (1992) declared the importance of P in encouraging of root growth and nodulation fromation.

Compost treatments significantly affected both nodulation characters in both seasons, where the highest values were obtained from the application of 10 ton compost + ½ NPK recommended rate, while the lowest values were obtained from the application of 5 ton compost + ½ NPK recommended rate. All interactions among the studied factors had insignificant effect on nodulation characters (Table 2) in both seasons.

2-Vegetative growth characters:

Data of these characters in Table (3) show that the two grown cultivars where significantly different from each other in plant height and number of branches / plant where cv. "Victory Freezer" had higher values, in both seasons. Plant growth characters have been reported to be cultivar dependent (El- Asdoudi and Ouf, 1994).

With respect to phosphorine inoculation the same data at Table (3) show that significantly affected plant height in both seasons and number of branches/ plant in the second season. Inoculated plants had higher values than those of the uninoculated plants. The stimulated effect of phosphorine on pea growth may be resulted from releasing originally bound phosphorus compounds in soil (Osman *et al.*, 1974).Phosphorus has agreat effect on enhancing the activity of vegetative growth in the process of photosynthesis as a result of increasing P in different plant parts which in turns assist in increasing cell devision in the meristemic areas which results in increasing plant height and number of branches/ plant which considered to be the final sinks of plant nutrition in the early growth stage of plants (Simon and Skradeta, 1983).

The obtained data also show that the compost treatments significantly affected both growth characters in both seasons.

Table (2): Effect of phosphorine inoculation and compost applications on number and weight of nodules/ plant of the two studied pea cultivars in 2003/2004 and 2004/2005 seasons.

Cultivars	Inoculation with phosphorine (P)	Number of nodules/ plant										Weight of nodules/ plant (gm)									
		2003/2004 Compost "C"* "C"					2004/2005 Compost "C"* "C"					2003/2004 Compost "C"* "C"					2004/2005 Compost "C"* "C"				
"A"	"B"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"
Lincoln	P0	30.68	22.81	31.05	30.61	29.49	25.81	23.64	31.76	28.42	29.01	1.62	1.52	1.73	1.52	1.65	1.79	1.60	2.02	1.75	1.86
	P1	32.21	24.16	32.64	31.76		32.93	24.70	34.51	30.35		1.76	1.61	1.86	1.59		1.98	1.71	2.13	1.92	
Victory	P0	28.45	23.61	35.78	29.52	30.31	27.22	24.17	33.98	28.50	29.83	1.45	1.43	1.97	1.52	1.71	1.93	1.50	2.69	1.95	1.99
Freezer	P1	31.72	24.80	37.38	31.21		31.64	25.56	36.76	30.81		1.82	1.56	2.11	1.83		1.82	1.49	2.61	1.91	
Mean"C"		30.76	23.84	34.21	30.77		29.40	24.52	34.25	29.52		1.66	1.53	1.92	1.61		1.88	1.57	2.36	1.88	
Mean of (B) for		P0 = 29.06 P1 = 30.73					P0 = 27.94 P1 = 30.91					P0 = 1.59 P1 =1.77					P0 = 1.97 P1 = 1.91				
L.S.D. 0.05:																					
A=		NS					NS					NS					NS				
B=		0.06					1.00					0.11					0.05				
C=		1.23					2.35					0.21					0.09				
A× B =		NS					NS					NS					NS				
A × C =		NS					NS					NS					NS				
B× C =		NS					NS					NS					NS				
A× B× C =		NS					NS					NS					NS				

* CO = NPK recommended rate
C1 = ½ NPK+5 ton/fed. compost
C2= ½ NPK+10 ton/fed. compost
C3= ½ NPK+15 ton/fed. compost

Table (3): Effect of phosphorine inoculation and compost applications on plant height and number of branches per /plant of the two studied pea cultivars in 2003/2004 and 2004/2005 seasons.

Cultivars	Inoculation with phosphorine (p)	Plant height (cm.)										Number of branches/ plant									
		2003/2004 Compost "C"* "C"					2004/2005 Compost "C"* "C"					2003/2004 Compost "C"* "C"					2004/2005 Compost "C"* "C"				
"A"	"B"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"
Lincoln	P0	84.45	75.66	82.96	83.52	83.81	87.33	76.21	84.11	92.38	86.08	4.22	3.86	4.16	4.32	4.19	4.34	3.87	4.23	4.41	4.26
	P1	88.34	75.66	88.15	91.71		88.69	79.35	86.37	94.20		4.26	3.93	4.24	4.53		4.46	3.88	4.34	4.56	
Victory Freezer	P0	86.73	80.13	83.69	87.07	86.35	87.55	82.13	85.46	92.56	88.08	4.45	3.84	4.34	4.46	4.37	4.47	3.86	4.36	4.50	4.35
	P1	88.37	83.39	87.28	94.11		89.78	84.52	86.52	96.11		4.66	3.97	4.53	4.73		4.59	3.98	4.44	4.62	
Mean"C"		86.97	78.71	85.52	87.10		88.43	80.55	85.61	93.81		4.39	3.90	4.32	4.50		4.46	3.89	4.34	4.52	
Mean of (B) for		P0 = 83.03 P1 = 87.13					P0 = 85.97 P1 = 88.19					P0= 4.20 P1 =4.36					P0= 4.25 P1 = 4.36				
L.S.D. 0.05:																					
A=		1.26					1.45					0.12					0.08				
B=		1.30					1.09					NS					0.11				
C=		2.08					1.72					0.13					0.14				
A× B=		2.15					2.00					NS					NS				
A× C=		2.41					2.15					0.21					0.18				
B× C=		2.32					2.17					NS					NS				
A× B × C=		NS					NS					NS					NS				

* C0= NPK recommended rate
C1= ½ NPK+5 ton/fed. compost
C2= ½ NPK+10 ton/fed. compost
C3= ½ NPK+15 ton/fed. compost

The least values were obtained from plants fertilized with half amount of recommended rate of NPK and5 tons of compost / fed. However, values of plant height and number of branches/ plant were increased when compost application rate were 10 ton/ fed. or above in addition to half of NPK recommended rate, where values were equal or surpassed those of plants fertilized with the recommended rate of chemical NPK fertilizers as shown in Table (3). Similar results on the effect of increasing plant height and number of branches / plant as affected by increasing compost rate was reported by Sawan et al (2001).

Data in Table (3) show that all the interactions among the three studied factors had significant effect on plant height with the exception of the three way interaction in both seasons. The only significant interaction on number of branches / plant was that between the grown cultivar "Victory Freezer" and compost at the rate of 15 tons/fed.

3-Pod characteristics:

Data of these parameters are presented in Table (4 and 5). The two grown cultivars were significantly different from each other where cv. "Victory Freezer" was superior over cv. "Lincoln" in the values of pod length, pod width, average pod weight and number of seeds/ pod with the exception of pod width in the second season where no significant difference was detected.

Phosphorine inoculation significantly affected pod length where the inoculated plants had higher values of pod length in both seasons. On the other hand, phosphorine inoculation had insignificant effects on pod width, number of seeds/ pod and average pod weight in both seasons.

With regard to the effect of compost treatments, data show that pod width and number of seeds/ pod were not affected in both seasons. Number of seeds / pod is an important character where it is affected by seed set and fertility percentage. Availability of nutrition such as N and P in good balance during flowering is an important physiological factor for fertilization, seed set and seed formation (Tawaha and Turk, 2004). In the present study, it seems that all treatment provided good nutritional balance for seed set and hence there no differences in means of different treatments. However, pod length and average pod weight were significantly increased, where the least values were obtained when plants fertilized with half rate of recommended NPk plus 5 tons of compost per feddan. Furthermore, plants fertilized with half rate of recommended NPK in addition to 10 or 15 tons of compost / fed. had equal or higher values of pod length and average pod weight than those obtained from plants fertilized with the recommended rate of chemical NPK fertilizer (control).

With regard to the interactions among the three studied factors, data in Tables (4 and 5) show that all interactions had insignificant effects on all for mentioned studied pod characters with the exception of those between the grown cultivar"Victory Freezer" and phosphorine inoculation on pod length in the first season and that between the grown cultivar "Victory Freezer" and compost treatments at the rate of 10 or 15 tons/ fed. on pod length and average pod weight, in both seasons.

Table (4): Effect of phosphorine inoculation and compost applications on pod length and pod width of the two studied pea cultivars in 2003/2004 and 2004/2005 seasons.

Cultivars	Inoculation with phosphorine (p)	Pod length (cm.)										Pod width (cm.)									
		2003/2004 Compost "C"*					2004/2005 Compost "C"					2003/2004 Compost "C"*					2004/2005 Compost "C"				
"A"	"B"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"
Lincoln	P0	7.69	7.45	8.12	8.23	8.01	8.20	7.75	8.22	8.40	8.20	1.20	1.19	1.21	1.21	1.21	1.25	1.21	1.24	1.26	1.24
	P1	8.25	7.64	8.23	8.46		8.34	7.81	8.35	8.55		1.22	1.20	1.23	1.24		1.25	1.22	1.25	1.26	
Victory	P0	8.70	8.61	9.26	9.36	9.07	9.18	8.75	9.71	9.38	9.28	1.22	1.20	1.23	1.23	1.23	1.27	1.15	1.25	1.30	1.25
Freezer	P1	8.79	8.93	9.43	9.52		9.51	9.06	9.51	9.72		1.24	1.22	1.24	1.2		1.30	1.16	1.25	1.33	
Mean "C"		8.36	8.16	8.76	8.89		8.80	8.34	8.81	9.01		1.22	1.20	1.23	1.23		1.27	1.18	1.25	1.29	
Mean of (B) for		P0= 8.43 P1= 8.66					P0= 8.63 P1= 8.86					P0= 1.21 P1= 1.23					P0= 1.24 P1= 1.25				
L.S.D.0.05:																					
A=		0.11					0.32					0.01					NS				
B=		0.13					0.14					NS					NS				
C=		0.12					0.16					NS					NS				
A× B =		0.34					NS					NS					NS				
A × C =		0.17					0.20					NS					NS				
A × C =		NS					NS					NS					NS				
A × B × C =		NS					NS														

*C0= NPK recommended rate
C1 = ½ NPK + 5 ton / fed. compost
C2 = ½ NPK + 10 ton / fed. compost
C3 = ½ NPK + 15 ton / fed. compost

Table (5): Effect of phosphorine inoculation and compost applications on average pod weight (gm.) and number of seeds per pod of the two studied pea cultivars in 2003/2004 and 2004/2005 seasons.

Cultivars	Inoculation with phosphorine (p)	Average pod weight (gm.)										Number of seeds / pod									
		2003/2004 Compost "C"* "C"					2004/2005 Compost "C"* "C"					2003/2004 Compost "C"* "C"					2004/2005 Compost "C"* "C"				
"A"	"B"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"
Lincoln	P0	4.18	3.72	4.26	4.32	4.16	4.30	3.98	4.27	4.35	4.19	5.60	5.37	5.57	5.69	5.61	5.62	5.26	5.58	5.69	5.57
	P1	4.23	3.87	4.29	4.38		4.25	3.88	4.23	4.28		5.72	5.47	5.68	5.75		5.69	5.33	5.67	5.71	
Victory	P0	4.30	4.20	4.36	4.39	4.36	4.20	4.34	4.37	4.31	4.36	7.52	7.13	7.46	7.64	7.52	7.82	6.59	7.81	7.83	7.59
Freezer	P1	4.41	4.22	4.57	4.47		4.26	4.46	4.50	4.42		7.78	7.25	7.66	7.75		7.97	6.79	7.97	7.98	
Mean "C"		4.28	4.00	4.37	4.39		4.25	4.16	4.34	4.34		6.65	6.30	6.59	6.71		6.77	5.99	6.76	6.80	
Mean of (B) for		P0= 4.22 P1= 4.30					P0= 4.26 P1= 4.28					P0= 6.50 P1=6.63					P0= 6.52 P1= 6.64				
L.S.D.0.05:																					
A =		0.06					0.05					0.02					0.02				
B =		NS					NS					NS					NS				
C =		0.02					0.03					NS					NS				
A× B=		NS					NS					NS					NS				
A× C =		0.12					0.11					NS					NS				
B× C=		NS					NS					NS					NS				
A× B× C=		NS					NS					NS					NS				

*C_0 = NPK recommended rate
C_1 = ½ NPK + 5 ton / fed. compost
C_2= ½ NPK + 10 ton / fed. compost
C_3 = ½ NPK + 15 ton / fed. compost

4-Total pod yield (ton/fed):

The obtained data of this character are presented in Table (6) declare that the two grown cultivars were significantly different from each other in both seasons where cv. "Victory Freezer" was superior over cv. "Lincoln" in this character. Yields of cv. "Victory Freezer" exceeded those of cv. "Lincoln" by 17.61 and 17.95% in the first and second seasons, respectively. Singh (1995) and Abdel – Ati *et al.* (2000) declared that yields of pea are a cultivar dependent.

Phosphorine inoculation significantly increased the total yield of pea per feddan, where the inoculation treatment increased production values in both seasons. This increment may be due to the effect of phosphorine on increasing number and weight of nodules / plant which in turn enhance plant growth and increasing photosynthetic process. Also, the beneficial effect of phosphorine in increasing total yield may be attributed to its effect on making P available to the plant (Gaur *et al.*, 1979) and producing some growth promoting substances (Brown, 1974) and improving plant growth and stimulate the microbial activity (Lue *et al.*, 1958). Similar results were reported by Saber *et al.*, (1981).

Compost treatments significantly increased total yield / fed., in both seasons. The lowest yield was obtained from plants fertilized with half rate of NPK fertilizer plus 5 tons of compost per feddan which was significantly lower than all other treatments. However, treatments of fertilizing with 10 or 15 tons of compost in addition to half rate of the recommended NPK fertilizers produced equal or higher yields than those received the recommended rate of NPK. Furthermore, the highest yields were obtained from plants fertilized with half rate of NPK plus 15 tons of compost (3.534 and 3.265 tons / fed., in the first and second seasons, respectively). The effect of compost on increasing pea yield was reported by Vikrant *et al* (2005) and Pandey *et al* (2006).

All interactions among the three studied factors had insignificant effect on total yield / fed., with the exception of that between the grown cultivars and phosphorine inoculation in the first season and that of the grown cultivars and compost treatments in both seasons. In this regards, the highest yield was obtained from cultivar "Victory Freezer" fertilized with half rate of the recommended NPK fertilizers and supplied with 15 tons compost / fed. (Table 6).

5-Chemical composition of seeds:

Data of protein, phosphorus and potassium percentage in pea seeds as affected by the studied factors are presented in Tables (6 and 7). Potassium percentage was not affected by all studied factors as well as their interactions in both seasons. The obtained results declared that protein % and phosphorus % in seeds were significantly increased when the plants inoculated with phosphorine, in both seasons.

Furthermore, compost applications significantly increased protein % and phosphorus % of pea seeds, where the highest values were obtained from plants fertilized with 15 tons of compost/ fed. in addition to half rate of the recommended NPK chemical fertilizer rate.

Table (6): Effect of phosphorine inoculation and compost applications on total pod yield (tons / fed.) and protein percentage of the two studied pea cultivars in 2003/2004 and 2004/2005 seasons.

Cultivars	Inoculation with phosphorine (p)	Total pod yield (tons / fed.)										Protein %									
		2003/2004 Compost "C"*					2004/2005 Compost "C"*					2003/2004 Compost "C"*					2004/2005 Compost "C"*				
"A"	"B"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"
Lincoln	P0	2.589	2.576	2.888	3.122	2.859	2.670	1.760	2.730	2.950	2.581	20.69	19.56	20.31	20.62	20.44	20.56	20.00	20.25	20.50	20.43
	P1	2.675	2.631	2.907	3.488		2.750	1.952	2.839	2.998		20.75	20.12	20.69	20.75		20.69	20.19	20.37	20.87	
Victory	P0	3.451	2.789	3.521	3.636	3.442	3.000	2.416	2.895	3.226	3.108	19.37	20.75	20.81	21.31	20.80	20.69	20.87	20.94	20.94	20.88
Freezer	P1	3.572	2.979	3.694	3.892		3.430	2.787	3.226	3.887		18.75	21.25	21.69	22.50		20.81	20.87	21.00	20.94	
Mean "C"		3.072	2.744	3.252	3.534		2.962	2.229	2.922	3.265		19.89	20.42	20.87	21.29		20.69	20.48	20.64	20.81	
Mean of (B) for		P0= 3.071 P1= 3.230					P0= 2.706 P1= 2.984					P0= 20.43 P1=20.81					P0= 20.59 P1= 20.72				
L.S.D.0.05:																					
A =		0.172					0.143					N.S					N.S				
B =		0.069					0.054					0.04					0.01				
C =		0.167					0.078					0.05					0.02				
A× B=		0.213					NS					N.S					NS				
A× C =		0.202					0.189					N.S					NS				
B× C=		NS					NS					N.S					NS				
A× B× C =		NS					NS					N.S					NS				

*C_0= NPK recommended rate
C_1 = ½ NPK + 5 ton / fed. compost
C_2 = ½ NPK + 10 ton / fed compost
C_3= ½ NPK + 15 ton / fed. compost

Table (7): Effect of phosphorine inoculation and compost applications on phosphorus percentage and potassium percentage of the two studied pea cultivars in 2003/2004 and 2004/2005 seasons.

Cultivars	Inoculation with phosphorine (p)	Phosphorus %										Potassium %									
		2003/2004 compost "C"*					2004/2005 compost "C"*					2003/2004 compost "C"*					2004/2005 compost "C"*				
"A"	"B"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"	0.0	5	10	15	Mean "A"
Lincoln	P0	0.26	0.24	0.27	0.29	0.28	0.26	0.22	0.25	0.27	0.26	2.48	2.50	2.55	2.60	2.55	2.60	2.43	2.60	2.71	2.62
	P1	0.29	0.28	0.30	0.32		0.28	0.23	0.26	0.28		2.57	2.51	2.58	2.62		2.75	2.51	2.60	2.75	
Victory	P0	0.29	0.22	0.28	0.30	0.29	0.27	0.23	0.26	0.29	0.26	2.48	2.47	2.56	2.56	2.53	2.53	2.50	2.57	2.60	2.59
Freezer	P1	0.32	0.26	0.32	0.33		0.28	0.24	0.27	0.28		2.50	2.51	2.58	2.60		2.63	2.54	2.62	2.70	
Mean "C"		0.29	0.25	0.29	0.31		0.27	0.23	0.26	0.28		2.51	2.50	2.57	2.59		2.63	2.49	2.60	2.69	
Mean of (B) for P0= 0.27 P1= 0.30							P0= 0.25 P1= 0.26					P0= 2.52 P1=2.53					P0= 2.57 P1= 2.64				
L.S.D.0.05:																					
A =		NS					NS					NS					NS				
B =		0.02					0.01					NS					NS				
C =		0.01					0.01					NS					NS				
A× B=		NS					NS					NS					NS				
A× C =		NS					NS					NS					NS				
B× C=		0.03					0.02					NS					NS				
A× B× C=		NS					NS					NS					NS				

*C_0 = NPK recommended rate
C_1 = ½ NPK + 5ton / fed. compost
C_2 = ½ NPK + 10 ton / fed. compost
C_3 = ½ NPK + 15 ton / fed. compost

All interactions among the three studied factors had insignificant effects on seed contents of protein and phosphorus (Tables 6 and 7), with the exception of that between phosphorine inoculation and the compost treatments, in both seasons. Chaudhari and Gavhane (2005) reported that phosphate solubilizing bacteria increases N, P and K uptake by pigeon pea plants. On the other hand, El – Kina and konstantinova (1998) and Sawan *et al* (2001) declared that compost application significantly increased the contents of N,P and K in pea plants.

In conclusion, the obtained results suggested that it may be recommended to grow pea cv "Victory Freezer" after inoculating the seeds with phosphorine and fertilizing plants with half rate of chemical NPK fertilizer in addition to 15 tons of compost /fed. to increase pea productivity, improve quality and minimizing the environmental pollution through reducing the NPK chemical fertilizers required for pea production in similar conditions to that of the present study.

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إستجابة صنفين من البسلة للتلقيح البكتيرى بالفوسفورين والتسميد العضوى بالكمبوست تحت ظروف الأراضى حديثة الإستصلاح.

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أجريت تجربتان حقليتان خلال موسمى الزراعة الشتوى لعامى ٢٠٠٣/٢٠٠٤م، ٢٠٠٤/٢٠٠٥م فى إحدى المزارع الخاصة بالأراضى حديثة الإستصلاح غرب مدينة الفشن بمحافظة بنى سويف حيث تمت دراسة إستجابة صنفين من البسلة (لنكولن، فيكتورى فريزر) للتلقيح بالبكتريا المذيبة للفسفور (فوسفورين) والتسميد العضوى بالكمبوست (١٥،١٠،٥ طن/ فدان بالإضافة إلى نصف الكمية الموصى بها من السماد الكيماوى NPK) واستخدمت معاملة المقارنة التى لم يضاف فيها الكمبوست ولكن سمدت بالمعدل الموصى به من السماد الكيماوى NPK. وكان الهدف من هذه الدراسة معرفة تأثير المعاملات السابقة على النمو والمحصول وصفات القرون والتركيب الكيماوى للبذور وإمكانية خفض كمية التسميد الكيماوى بالـ NPK لخفض تكاليف الإنتاج والحفاظ على بيئة نظيفة وتقليل الأخطار التى يتعرض لها المستهلكين والناجمة عن إستخدام الأسمدة الكيماوية.

يمكن تلخيص النتائج التى تم التوصل إليها فيما يلى:

لم يكن هناك أى فرق معنوى فى عدد ووزن العقد البكتيرية على جذور صنفى البسلة تحت هذه الدراسة الحالية فى حين كان هناك إختلاف معنوى بين الصنفين فى معظم الصفات التى تمت دراستها حيث تفوق الصنف فيكتورى فريزر على الصنف لنكولن فى المحصول الكلى وباقى الصفات الأخرى.

أدى التلقيح بالفوسفورين إلى زيادة أعداد ووزن بكتيريا العقد الجذرية وزيادة النمو الخضرى والمحصول الكلى والمكونات الكيماوية للبذور (النسبة المئوية للبروتين والفوسفور) فى موسمى الدراسة.

أثرت المعاملة بالكمبوست على معظم الصفات التى تمت دراستها حيث كانت أفضل معاملة لتحسين النمو الخضرى والمحصول والمكونات الكيماوية للبذور هى تلك التى سمدت فيها النباتات بنصف كمية السمادى الموصى به من النيتروجين والفوسفور والبوتاسيوم (NPK) بالإضافة إلى ١٥ طن من الكمبوست للفدان.

بناء على النتائج التى تم التوصل إليها فى هذه الدراسة يمكن التوصية بزراعة صنف البسلة فيكتورى فريزر مع التلقيح للبذور قبل الزراعة بالبكتيريا المذيبة للفسفور (الفوسفورين) مع إضافة ١٥ طن من الكمبوست للفدان والتسميد الكيماوى بنصف الكمية الموصى بها من الـ NPK للحصول على أفضل إنتاجية للفدان من البسلة وتقليل تلوث البيئة وتقليل المخاطر على صحة الإنسان نتيجة خفض كمية السماد الكيماوى المستخدم واللازم للنباتات وذلك فى الظروف المشابهة لتلك التى تمت فيها هذه الدراسة.