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EFFECT OF SOME BIOSTIMULANTS AND NPK FERTILIZERS LEVELS ON GROWTH, GREEN POD YIELD AND ITS QUALITY OF PEAS (*Pisum sativum L*)

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ABSTRACT

Two field experiments were carried out in 2002-2003 and 2003-2004 winter seasons to study the effect of some biostimulants (Rhizobacterein and Phosphorein) and NPK fertilizer levels (0-0-0, 5-5-5 and 10-10-10 kg/fad.) on plant growth, chemical composition and green pod yield and its components as well as quality (physical pod characters and nutritive value of seeds) of pea cv Master B.

The results showed that inoculation of pea seeds with rhizobacterein increased plant growth (plant height, number of both leaves and branches, fresh and dry weight of leaves and branches as well as total dry weight, minerals content of leaves (N, P and K as a concentration), yield and its components (average of pod weight, weight of pods/plant and total green pod yield/fad.), as well as physical pod characters (dry weight of seeds/pod, pod length, pod thickness, number of seeds/pod and 100-seeds weight) and nutritive value of seeds (N, P and K content, protein and total carbohydrates).

Increasing level of NPK fertilizer from 5-5-5 to 10-10-10 kg NPK/fad. produced the highest values of different studied characteristics of vegetative growth, chemical composition, yield and its components as well as their quality. Rhizobacterein within the lowest used level of NPK fertilizer (5-5-5 kg/fad.) followed by phosphorein within the highest used level of NPK fertilizer (10-10-10 kg/fad.) resulted the highest values of most studied characters.

Keywords: Peas, biostimulants, NPK fertilizers, growth, yield.

INTRODUCTION

Pea (*Pisum sativum* L.) is considered one of the important vegetable crops in Egypt for local consumption and also for exportation. Large quantities of peas are exported annually to Europe markets. Such importance comes from the fact that legumes are very rich in protein content which is very important for human nutrition (Kerlous, 1997). As might be expected with vegetable crops of such promising potentialities efforts to improve its production should be carried out. Among the improvement possibilities, the biostimulants, such as rhizobacterein and phosphorein play a major role as well as low quantities of N, P and K fertilizers are major essential elements required for physiological mechanisms of plant growth.

Many investigators reported that rhizobacterein and /or phosphorein increased plant growth, chemical composition and yield and its components

of legumes plants (Tartoura, 2002 and Abou El-Salehein *et al.*, 2004 on peas, Sobh *et al.*, 2000 on faba bean and Hassan *et al.*, 2002 on snap bean).
Moreover, many investigators demonstrated that N, P and K as a mixture fertilizer increased plant growth, chemical composition and yield and its components of legumes crops (Gewailly *et al.*, 1996 and Abdalla *et al.*, 2000 on peas, Abou El-Salehein and Ahmed, 1998 and Ahmed *et al.*, 2003 on beans; Sobh *et al.*, 2000 on faba bean; and Abou El-Salehein and Wahdan, 2002 on cowpea).

The aim of this work is to study the effect of some biostimulants; i.e., rhizobacterein and phosphorein and the effect of different levels of NPK as a mixture as well as interaction effect between them on the growth, chemical composition and yield and its quality of peas.

MATERIALS AND METHODS

Two field experiments were carried out during two successive winter growing seasons of 2002/2003 and 2003/2004 at Shebein El-Kanater, Kalubia Governorate, to study the effect of some biostimulants and NPK fertilizer levels on growth, chemical composition and green pod yield and quality of pea (*Pisum sativum* L.) cv Master- B.

Pea seeds were sown on November 15th and 13th in 2002 and 2003 winter seasons,respectively . The soil of the experimental field was clay loam in texture. The physical and chemical properties of the soil are shown in Table 1.

Table 1: The physical properties and chemical analysis of the soil of experiment

Characters	Soil content
Mechanical properties:	
Coarse sand %	3.40
Fine sand %	15.87
Silt %	33.75
Clay %	40.67
Chemical analysis:	
Organic matter %	1.37
Available N ppm	81.69
Available P ppm	19.79
Exchangeable K ppm	290.60
E. C. Mmhos/cm at 25^{o}C	4.13
pH	7.4

This experiment was investigated to study the effect of three biostimulants which were:
1- Control (without any biostimulant).
2- Rhizobacterein.
3- Phosphorein.

Seeds were inoculated at sowing with rhizobacterein and phosphorein

Rhizobacterein: is a bio-stimulant that contains symbiotic and non- symbiotic microorganisms.
Phosphorein : is a bio-stimulant that contains free living bacteria which transforms the unavailable form of $Ca_3 (PO_4)_2$ to the available form of $Ca(HPO_4)_2$.
Plus three NPK fertilizer levels which were:

N	P_2O_5	K_2O (kg/fad.)
0	0	0
5	5	5
10	10	10

and their combination resulting in 9 treatments.

The sources of fertilizers were ammonium sulphate (20.5 % N), calcium superphosphate (15.5 % P_2O_5) and potassium sulphate (48% K_2O).

Seeds were sown at15 cm apart in hills on both sides of ridges.

The different amounts of fertilizers were added at three doses from the same level, the first dose was added during preparing the soil for planting, the second one was added at three weeks after sowing and the third one was added at the fifth week after sowing.

These treatments were arranged in a split-plot design with four replicates. The biostimulants were assigned in the main plots and the levels of NPK fertilizers were arranged in sub-plots. The area of sub-plots was 8.4 m^2 with four ridges (3.5 m in length and 0.6 m in width). One guard row was left without planting between each two plots.
The normal agricultural practices took place whenever they were necessary according to the recommendations of the Egyptian Ministry of Agriculture.
At the seventh week from planting, 10 plants from every treatment in all replicates were randomly taken and the following data were recorded:

1.a- Plant growth measurements:
Plant height (cm),
Number of both leaves and branches.and
Fresh and dry weight of branches and leaves as well as whole plant.

1.b- Chemical composition of leaves:

The concentration of N, P and K were determined in a random sample of dry matter of leaves after wet digestion according to Kock and Mc Meekin (1924), Troug and Meyers (1939) and Jackson (1967), respectively.

II. Green pod yield and its components:

Green pod was calculated from weight and number of all harvested pods through whole harvesting season and number of plants per plot,
Average number and weight of pods/plant (g),
Means of pod weight (g),
Total green pod yield/plant (g).
Total green pod yield (ton/fad.), it was calculated from the yield/plot.

Physical pod characters:

At the second (mid. season) harvesting, a representative sample of 20 pods from every treatment in all replicates were randomly taken and the following data were recorded:

1- Mean pod length, width and diameter (cm),
2- Number of seeds/pod.
3- Mean fresh and dry weight of seeds/pod, and
4- 100-seeds weight(g) (seed index).

Seed chemical contents (the nutritive value):

1- Total nitrogen, phosphorus and potassium; were determined according to Kock and McMeekin (1924), Troug and Mayers (1939) and Jackson (1967), respectively.
2- Total carbohydrates, according to Michel *et al.* (1956).
3- Total protein percentage, by multiplying N-value by 6.25.

Statistical analysis:

The obtained data were statistically analyzed according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Vegetative Growth Characters:

Effect of biostimulants:

Data presented in Tables 2 and 4 show clearly that inoculation of pea seeds by rhizobacterein resulted in greater vegetative growth expressed as plant height, number of both leaves and branches, fresh and dry weight of leaves and branches as well as total dry weight.

As for the role of rhizobacterein as an inoculation to seeds, Subba Rao (1984) concluded that rhizobacterein is a biostimulant contains symbiotic and non-symbiotic microorganisms which fixed nitrogen , and it can be easily assimilated by plants and then increasing plant growth.

Such results coincided with those obtained by Tartoura, (2002) and Abou El-Salehein *et al.*, (2004) on peas, Sobh *et al.*,(2000) on faba bean and Hassan *et al.*, (2002) on snap bean.

Table 2: Effect of some biostimulants and NPK fertilizers on vegetative growth of peas plant

Treatments	Plant height (cm)		Number of branches		Number of leaves		Fresh weight of branches (g)		Fresh weight of leaves (g)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Control	37.43	37.77	2 09	2.14	15.00	15.66	8.337	8.078	40 306	40.492
Rhizobacterein	45.44	46.94	2.98	3.06	18 73	19.50	11.157	10.929	45.581	45.622
Phosphorein	42.07	43.36	2.59	2.72	17 84	18.18	10.529	10.078	44.226	44.124
L. S. D. (0.05)	1.04	2.05	0.25	0.25	0.80	0.60	0.318	0.269	0.266	0.865
N P K (kg /fad.)										
0 0 0	34.72	35.44	1.79	1.84	13 97	14.54	7.192	7.311	38.002	38.118
5 5 5	45.03	45.08	2.99	3.09	18 71	19.12	11.277	10.812	45 669	45.877
10 10 10	45.19	47.54	2.89	2.99	18.90	19.67	11.553	10.961	46.441	46.244
L. S. D. (0.05)	1.79	1.01	0 20	0.13	1 08	0.44	0.557	0.402	1.074	0.496

Effect of NPK fertilizer level:

It is clearly evident from such data in Tables 2 and 4 that increasing of NPK from 5-5-5 up to 10-10-10 kg/fad.. resulted in the highest values in this respect in the two growing seasons , in most cases of studied vegetative growth characters .

As for the role of NPK elements in plant, Edmond *et al.*, (1981) concluded that nitrogen is an indispensable elementary constituent of numerous organic compounds of general importance (amino acids, protein, nucleic acids and it is needed in the formation of protoplasm and new cells, as well as encouragement for cell elongation. Moreover, Bidwell (1979) illustrated that nitrogen deficiency is characterized by a poor growth rate, the leaves remain small and stem have a spindly appearance. Furthermore, Bidwell (1979) added that, phosphorus is a part of molecular structure of several vitally important compounds notably nucleic acids (DNA, the two forms of RNA). In addition, Edmond *et al.*, (1981) concluded that phosphorus plays indispensable role in the enzyme system necessary for the energy transform in photosynthesis and respiration. It is also a constituent of cell nucleus and essential for cell division and for the development of meristem tissues (Bidwell, 1979 and Edmond et al., 1981). Concerning the role of potassium, Bidwell (1979) ; Edmond *et al.* (1981) stated that potassium is the prevalent cation in plant and may be involved in maintenance of ionic balance in cells and it bounds ionically to the enzyme pyruvate kinase, which is essential in respiration and carbohydrate metabolism. Thus, potassium element is very important in the overall metabolism of plant. Moreover, it has a beneficial effect of water consumption.

Obtained results are confirmed with the results obtained by Gewailly *et al.*, (1996)and Abdalla *et al.*, 2000 on peas. Abou El-Salehein and Ahmed (1998) and Ahmed *et al.*,(2003)on bean, Sobh et al.(2000) on faba bean, and Abou El-Salehein and Wahdan(2002)on cowpea.

Effect of biostimulant and NPK fertilizer Interaction:

Data in Tables 3 and 5 show that the interaction between biostimulants and NPK fertilizer were significant with regard to plant growth.

The illustrated data demonstrated that rhizobacterein combined with application of NPK fertilizer at the level of 5-5-5 kg/fad. followed by phosphorein with 10-10-10 kg/fad., resulted in the highest values of most studied parameters of plant growth.

Table 3: Effect of interaction between some biostimulants and N P K fertilizers on vegetative growth of peas plant

Treatments				Plant height (cm)		Number of branches		Number of leaves		Fresh weight of branches (g)		Fresh weight of leaves (g)	
				2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
	N	P	K										
	0	0	0	32.53	32.80	1 53	1.50	12.10	13.00	6.996	7.163	37 796	37.706
Control	5	5	5	39 17	39.80	2.23	2.40	16.00	16.37	9.053	8.456	40.373	40.476
	10	10	10	40.60	40.70	2.50	2.53	16.90	17.60	8.960	8.613	42.746	43.290
	0	0	0	37.13	37.80	2 00	2.13	15.37	16.23	7.330	7.466	38.206	38.363
Rhizo.[1]	5	5	5	53.03	53.03	4.13	4.03	21.83	22.40	14.716	14.273	50.813	51.666
	10	10	10	46.17	50.00	2.80	3.00	19.00	19.87	11.420	11.046	47.723	46.836
	0	0	0	34.50	35.73	1.83	1.90	14.43	14.40	7.246	7.303	38.003	38.283
Phosph.[2]	5	5	5	42.90	42.40	2.60	2.83	18.30	18.60	10.060	9.706	45.820	45.486
	10	10	10	48.80	51.93	3.33	3.43	20.80	21.53	14.280	13.223	48.850	48.603
L.S. D. (0.05)				3.10	1.74	0.34	0.22	1.86	0.76	0.964	0.697	1.859	0.860

1= Rhizobacterein 2 = PhosphoreinChemical composition in

Obtained results are in harmony with those reported by Sobh *et al.*, (2000) on faba bean.

leaves:

Effect of biostimulants:

Data in Table 4 indicate clearly that the highest values of N, P and K contents were obtained by inoculation with rhizobacterein. Similar trend was observed in both growing seasons in this respect.

Rhizobacterein which contained nitrogen fixation bacteria plays an active part in atmospheric nitrogen fixation and absorption of nutrients; i. e., N, P and K and its active translocation (Pacovsky *et al.*, 1991).

Similar findings were also obtained by Abou El-Salehein *et al.* (2004)on peas and Sobh *et al.*(2000) on faba bean.

Table 4: Effect of some biostimulants and NPK fertilizers on dry weight of peas plant and chemical composition of leaves

Treatments			Dry weight of branches (g)		Dry weight of leaves (g)		Total dry weight (g)		Chemical composition in leaves (%)					
									N		P		K	
			2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Control			0.351	0.350	1.025	0.991	1.375	1 347	3.80	3.70	0.274	0.267	1.54	1.51
Rhizobacterein			0.564	0.546	1.940	1.798	2.504	2.344	4.11	4.00	0.310	0.302	1.96	1.85
Phosphorein			0.499	0.483	1.627	1.508	2.126	1.991	4.04	3.91	0.304	0.293	1.82	1.74
L. S. D. (0.05)			0.026	0.140	0.079	0 055	0.087	0 065	0.09	0.03	0 002	0.003	0.03	0.04
N	P	K												
(kg /fad.)														
0	0	0	0.309	0.308	0.780	0.733	1.089	1 048	3.61	3.54	0.266	0.259	1.49	1.46
5	5	5	0.558	0.537	1.867	1 789	2.424	2 326	4.15	4.01	0.309	0.298	1.87	1.79
10	10	10	0.547	0.534	1 944	1 774	2.491	2.308	4.19	4.07	0.312	0 304	1.97	1.85
L. S. D. (0.05)			0.018	0 190	0.095	0 036	0 082	0 035	0.03	0.04	0.003	0.002	0.03	0.05

Effect of NPK fertilizers level:

Results shown in Table 4 illustrate that the highest increments regarding leaves content of N, P and K as concentration were observed by increasing NPK fertilizer level up to 10-10-10 kg/fad. at both growing seasons of the experiment. The treatment of NPK fertilizer level, i.e. 10-10-10 kg/fad., being the most effective on NPK content of leaves.

The enhancing effect of nitrogen, phosphorus and potassium fertilizers in this concern may be due to the available N, P and K in soil and /or the high absorbing efficiency of roots (Mengel and Kirkby. 1982 ; El-Basyouny, 1995).

These results are going in agreement with those obtained by Abdalla *et al.*(2000) on peas, Abou El-Salehein and Ahmed *et al.*(1998) and Ahmed *et al.*(2003) on beans and Abou El-Salehein and Wahdan(2002) on cowpea.

Effect of biostimulant and NPK fertilizer interaction:

It is evident from data presented in Table 5 that the interaction between rhizobacterein and NPK fertilizer at 5-5-5 kg/fad. followed by

phosphorein and NPK fertilizer at 10-10-10 kg/fad. Were the most effective interaction treatments and had significant effect on N,P and K content of leaves as a concentration.

Such results may be attributed to the rhizobacterein that have the chance for absorbing more quantities of minerals when it needed low level of NPK fertilizer; i.e., 5-5-5 kg/fad., as well as phosphorein needed high level of NPK fertilizer; i.e., 10-10-10 kg/fad.

These results are in agreement with those reported by Sobh et al., 2000 on faba bean.

Table 5: Effect of some biostimulants and NPK fertilizers on dry weight of peas plant and chemical composition of leaves

Treatments				Dry weight of branches (g)		Dry weight of leaves (g)		Total dry weight (g)		Chemical composition in leaves (%) N		P		K	
				2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
	N	P	K												
Control	0	0	0	0.288	0.231	0.480	0.512	0.708	0 764	3.55	3.48	0.257	0.254	1.43	1.42
	5	5	5	0.400	0 394	1.215	1.175	1.611	1.569	3.90	3.77	0.277	0 271	1 57	1.53
	10	10	10	0.424	0.425	1.380	1284	1.804	1.708	3.95	3.86	0.287	0.277	1.63	1.57
Rhizo.[1]	0	0	0	0.372	0.371	1.082	0.992	1 455	1.294	3.66	3.58	0.274	0.265	1.54	1.49
	5	5	5	0.729	0.693	2.654	2.553	3.384	3.246	4.37	4.29	0.337	0.331	2.27	2.16
	10	10	10	0.590	0.572	2.082	1.919	2 672	2.491	4.30	4.14	0.318	0.309	2.08	1.90
Phosph.[2]	0	0	0	0.325	0.319	0.778	0.765	1.104	1.085	3.62	3.57	0.268	0.259	1.50	1.46
	5	5	5	0.544	0.525	1.732	1.638	2.276	2.163	4.18	3.96	0.313	0.293	1.76	1.67
	10	10	10	0.626	0.606	2.371	2.119	2.997	2.725	4.33	4.21	0.331	0.328	2.20	2.09
L.S. D. (0.05)				0.032	0.031	0.164	0.062	0.142	0.061	0.05	0.07	0.004	0.004	0.05	0.08

1= Rhizobacterein 2 = Phosphorein

Yield and its Components:

Effect of biostimulants:

Data tabulated in Table 6 show that average pod weight, weight of pods/plant and total green pod yield/fad. were significantly affected by rhizobacterein treatment. Such effect was clear and going in the same trend, in all cases in both seasons of this work, except with phosphorein on number of pods /plant in the second season only. The excess of green pod yield with rhizobacterein and phosphorein was 19.58 and 10.54% over the control,respectively. The increase in green pod yield and its components as a result of inoculation with rhizobacterein to pea seeds might be attributed to the increase in its vegetative growth and dry matter accumulation (Tables 2 and 4) as well as chemical composition of leaves (Table 4).

In addition, the increase in total green pods yield could be due directly, to the increase in both number of pods ahd mean pod weight which in turn reflected on total yield per plant and per feddan.

Regarding the effect of rhizobacterein on green pod yield and its components, the results in this respect are in agreement with those reported by Tartoura(2002) on peas and Sobh *et al* (2000) on faba bean and Hassan *et al.*, 2002 on snap bean.

Table 6: Effect of some biostimulants and NPK fertilizers on yield and its components of peas

Treatments	Number of pods/plant		Average pod weight (g)		Weight of pods/plant (g)		Total green pod yield/feddan(ton)			
	2002	2003	2002	2003	2002	2003	2002	2003	Mean treat.	Excess %
Control	5.47	5.38	4.810	4.764	26.569	25.883	2.488	2.598	2.543	-
Rhizobacterein	5.56	6.57	5.674	5.684	37.740	37.812	3.064	3.017	3.041	19.58
Phosphorein	6.19	6.23	5.410	5.419	34.051	34.342	2.789	2.833	2.811	10.54
L. S. D. (0.05)	0.29	0.17	0.140	0.114	1.741	1.463	0.105	0.125	-	-
N P K (kg /fad.)										
0 0 0	4.83	4.89	4.622	4.610	22.426	22.638	2.392	2.433	2.413	-
5 5 5	6.57	6.47	5.621	5.596	37.347	36.618	2.967	2.959	2.963	22.79
10 10 10	6.81	6.82	5.651	5.662	38.588	38.781	2.982	3.056	3.019	25.11
L. S. D. (0.05)	0.23	0.18	0.150	0.087	1.296	0.853	0.080	0.083	-	-

Effect of NPK fertilizers level:

Data presented in Table 6 indicated that number of pods /plant, average pod weight, weight of pods /plant and total green pods/fad. significantly increased with increasing NPK fertilizer level from 0-0-0 to 10-10-10 kg/fed. The treatment of NPK fertilizer level, i.e., 10-10-10 kg/fed., being the most effective level on green pod yield and its components in the two growing seasons of experiment.

The excess of green pod yield of peas was 25.11 and 22.79% with 10-10-10 and 5-5-5 NPK kg/fad ,respectively over the control (without any fertilizer).

The highest values of different studied characters of plant green pod yield and its components may be explained on the base that plants growing under such conditions are supplied with adequate N, P and K fertilizers level for plant growth (Tables 2 and 4), which resulted in the highest plants minerals content (Table 4). Hence, such vigrous growth and good nutritional plant status resulted in turn in increasing the amount of metabolites synthesized and dry matter accumulation by the plant. The increase in total green pod yield owe directly to the increase in average pod weight and pods number per plant.

Obtained results are in agreement with those reported by Gewailly *et al.*, (1996)and Abdalla *et al.*(2000) on peas, Abou El-Salehein and Ahmed (1998) and Ahmed *et al.*(2003)on beans. Sobh *et al.*(2000)on faba bean and Abou El-Salehein and Wahdan(2002) on cowpea.

Effect of Biostimulant and NPK fertilizer interaction:

Data presented in Table 7 show that green pod yield and its components significantly increased by the interaction of rhizobacterein and NPK fertilizer level at 5-5-5 kg/fad., followed by phosphorein and 10-10-10 kg/fad. NPK fertilizer level. In addition, the excess in green pod yield of peas was 51.63 and 39.91 % by rhizobacterein x 5-5-5 kg NPK/fad. and

phosphorein x 10-10-10 kg NPK/fad. compared with the other treatments and control.

Obtained results are in harmony with those reported by Sobh *et al.* (2000) on faba bean.

Table 7:Effect of interaction between some biostimulants and N P K fertilizers on yield and its components of peas.

Treatments				Number of pods/plant		Average of pod weight (g)		Weight of pods/plant (g)		Total green pod yield/feddan (ton)			
				2002	2003	2002	2003	2002	2003	2002	2003	Mean treat.	Excess (%)
	N	P	K										
	0	0	0	4.33	4.27	4.383	4.336	19.016	18.502	2.270	2.340	2.305	-
Control	5	5	5	5.63	5.53	4.913	4.890	27.678	27.075	2.550	2.660	2.605	13.02
	10	10	10	6.43	6.33	5.133	5.063	33.013	32.073	2.640	2.793	2.717	17.87
	0	0	0	5.33	5.40	4.867	4.886	25.945	26.376	2.496	2.530	2.513	9.02
Rhizo.[1]	5	5	5	7.36	7 27	6.487	6.433	47.780	46.739	3.586	3.403	3 495	51.63
	10	10	10	6.97	7.03	5.670	5.733	39.496	40.321	3.110	3.116	3.113	35.05
	0	0	0	4.83	5.00	4.616	4.606	22.316	23.037	2.410	2.430	2 430	5.42
Phosph.[2]	5	5	5	6.70	6.60	5.463	5.460	36 583	36.040	2.763	2.810	2 787	20.91
	10	10	10	6.70	7.10	6 150	6.190	43.254	43.949	3.193	3.256	3.225	39.91
L.S. D. (0.05)				0.40	0.32	0.253	0.150	2.245	1 477	0.139	0.143	-	-

1= Rhizobacterein 2 = Phosphorein

Pod and Seed Quality:

a- Physical pod characters:

Effect of biostimulants:

Data given in Tables 8 and 10 revealed that, physical pod characters; i.e., dry weight of seeds/pod. pod length, pod width, number of seeds/pod and 100-seeds weight (seed index) responded significantly to rhizobacterein inoculation. It is worthy to notice that similar trend was observed during both growing seasons of the experiment.

These results were agreed with those obtained by Tartoura(2002) and Abou El-Salehein *et al.*(2004) on peas and Hassan *et al.*(2002) on snap bean.

Table 8: Effect of some biostimulants and N P K fertilizers on physical pod characters of peas

Treatments	Fresh weight of seeds/pod (g)		Dry weight of seeds/pod (g)		Pod length (cm)		Pod width (cm)		Pod diameter (cm)		Number of seeds/pod	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Control	8.548	8.568	0.881	0.839	8.48	8 51	1.28	1.36	0.70	0.73	6.89	6.66
Rhizobacterein	9.409	9.427	1.239	1.124	9.47	9 39	1 50	1.61	0.83	0.87	8.27	8.23
Phosphorein	9.278	9.152	1.022	1.020	9.08	9.01	1.37	1.50	0.78	0.81	7.74	7.60
L. S. D. (0.05)	0.144	0.238	0.103	0.064	0.31	0 13	0.06	0.10	0.04	0.10	0.39	0.19
N P K (kg /fad.)												
0 0 0	8.393	8 353	0.746	0 738	8.00	8 09	1.12	1 20	0.62	0 67	6.13	6.10
5 5 5	9.418	9 443	1.219	1.091	9.43	9 43	1 52	1.64	0 84	0 88	8.33	8.17
10 10 10	9.423	9.350	1.178	1.154	9.59	9 39	1 50	1.62	0.84	0 87	8.43	8.22
L. S. D. (0.05)	0.107	0 129	0.084	0.085	0.17	0 29	0 13	0.12	0.06	0.05	1.82	0.26

Effect of NPK fertilizers level:

Data tabulated in Tables 8 and 10 show clearly that NPK fertilizer levels; i.e., 5-5-5 or 10-10-10 kg/fad. caused an increases in physical pod characters, but these increases were not significant .

Obtained results are in confirmity with those reported by Abdalla et al., 2000 on peas and Abou El-Salehein and Ahmed(1998) and Ahmed *et al.* (2003)on beans.

Effect of biostimulant and NPK fertilizer interaction:

Data presented in Tables 9 and 11 show that rhizobacterein and 5-5-5 NPK kg/fad. followed by phosphorein and 10-10-10 NPK kg/fad. were the most effective interaction treatments which resulted in the highest values of fresh weight of seeds/pod and dry weight of seeds/pod in both growing seasons, as well as pod length in the first season and number of seeds/pod in the second season only.

Rhizobacterein or phosphorein with NPK levels caused an increase in physical pod characters, obtained results are in agreement with those shown by Sobh et al.(2000)on faba bean.

Table 9: Effect of interaction between some biostimulants and N P K fertilizers on physical pod characters of peas

Treatments				Fresh weight of seeds/pod (g)		Dry weight of seeds/pod (g)		Pod length (cm)		Pod width(cm)		Pod diameter (cm)		Number of seeds/pod	
				2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
	N	P	K												
Control	0	0	0	7.920	7.953	0.666	0.657	7.67	7.73	1.06	1.13	0.53	0.57	5.53	5.60
	5	5	5	8.770	8.850	0.927	0.823	8.57	8.77	1.04	1.47	0.77	0.80	7.47	6.90
	10	10	10	8.953	8.900	1.050	1.037	9.20	9.03	1.37	1.47	0.80	0.83	7.67	7.47
Rhizo.[1]	0	0	0	8.697	8.657	0.853	0.850	8.33	8.40	1.20	1.30	0.70	0.77	6.63	6.60
	5	5	5	10.367	10.423	1.673	1.363	10.50	10.20	1.67	1.83	0.93	0.97	9.77	9.87
	10	10	10	9.160	9.200	1.190	1.160	9.57	9.57	1.63	1.70	0.87	0.87	8.40	8.23
Phosph.[2]	0	0	0	8.563	8.450	0.717	0.707	8.00	8.13	1.10	1.17	0.63	0.67	6.23	6.10
	5	5	5	9.117	9.057	1.057	1.087	9.23	9.33	1.50	1.63	0.83	0.87	7.77	7.73
	10	10	10	10.153	9.950	1.290	1.267	10.00	9.57	1.50	1.70	0.87	0.90	9.23	8.97
L.S. D. (0.05)				0.185	0.223	0.145	0.148	0.30	N.S.	N.S.	N.S	N.S.	N.S	N.S.	0.45

1= Rhizobacterein 2 = Phosphorein

b- Seed chemical constituents (the nutritive value):

Effect of biostimulants:

Data shown in Table 10 reveal that nutritive value of pea seeds; i.e., N, P, K, protein and total carbohydrates percentages were significantly affected by rhizobacterein compared with phosphorein or control treatments.

Such results are due to the favourable effect of rhizobacterein on plant vegetative growth (Tables 2 and 4), higher NPK contents of leaves (Table 4) and resulted in highest green pod yield and its components (Table 6) as well as highest pod characters.

Obtained results are in harmony with those reported by Tartoura (2002)and Abou El-Salehein *et al.*(2004) on peas and Hassan *et al.*(2002) on snap bean.

Table 10: Effect of some biostimulants and N P K fertilizers on seed index and seed quality (nutritive value) of peas

Treatments	100-seeds weight (g)		N%		P%		K %		Protein %		Total carbohydrates %	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Control	18.862	18 813	3.19	3.23	0.315	0.313	2.24	2.23	19.959	20.181	45 119	45.186
Rhizobacterein	21.211	21 522	3.40	3.42	0 359	0 365	2 53	2.44	21 278	21.389	47 809	47 444
Phosphorein	20.946	20 456	3.35	3.36	0 347	0 348	2 44	2.37	20 924	20.987	47 091	46 709
L. S. D. (0.05)	0.499	0.820	0 08	0 10	0 009	0 005	0.04	0.03	0.504	0.629	0.347	0.205
N P K (kg / fad.)												
0 0 0	18 257	18 098	3.04	3.03	0 302	0 306	2.21	2.18	19 000	18 917	45 024	45.068
5 5 5	21.834	21.226	3.44	3.48	0 356	0 355	2 48	2.42	21 493	21.722	47 430	47 146
10 10 10	21.928	21 468	3.47	3 51	0 364	0 367	2.51	2.43	21.867	21.917	47 564	47.126
L. S. D. (0.05)	0.275	0.502	0.09	0.04	0 008	0 004	0.03	0.03	0.529	0.266	0.181	0.147

Effect of NPK fertilizers level:

Data tabulated in Table 10 show that the highest values of nutritive value of pea seeds were observed by increasing NPK fertilizer level up to 10-10-10 kg/fad. at both growing seasons of the study. This level of NPK, being the most effective treatment on nutritive value of pea seeds. In spite of that, there were insignificantly of differences between the two levels of NPK (5-5-5 kg/fad.) and 10-10-10 kg/fad.

Obtained results are going in agreement with those reported by Abdalla *et al.*(2000) on peas and Abou El-Salehein and Ahmed(1998)and Ahmed *et al.*(2003) on beans.

Effect of biostimulant and NPK fertilizer interaction:

Data in Table 11 show that most studied characteristics of nutritive value of pea seeds were significantly affected by the interaction of biostimulants and NPK fertilizers levels in both growing seasons.

Table 11: Effect of interaction between some biostimulants and N P K fertilizers on seed index and seed quality (nutritive value) of peas

Treatments				100-seeds weight (g)		N %		P %		K%		Protein %		Total carbohydrates %	
				2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
	N	P	K												
	0	0	0	17 003	17 057	2 90	2 90	0 290	0 292	2 14	2 14	18 125	18 104	44.726	44 830
Control	5	5	5	19 666	19 590	3 30	3 34	0 322	0 318	2.28	2 26	20 605	20 896	45.263	45 323
	10	10	10	19 917	19 793	3 38	3 45	0 334	0 328	2 28	2 29	21.146	21 542	45 366	45 403
	0	0	0	19 420	19 140	3 14	3 15	0 307	0 314	2 26	2 25	19 604	19 667	45 173	45 253
Rhizo.[1]	5	5	5	24 737	24.017	3 57	3 60	0 400	0 402	2 75	2 67	22.334	22 500	50 347	49 866
	10	10	10	22 476	21 410	3 50	3 52	0 370	0 378	2.56	2 39	21 896	22 000	47 907	47.213
	0	0	0	18 347	18.097	3 08	3.04	0 308	0 305	2 22	2 15	19 271	18.980	45 173	45 120
Phosph.[2]	5	5	5	21 100	20 070	3 45	3 48	0 345	0 345	2.41	2 32	21 542	21 771	46.680	46.246
	10	10	10	23 390	23 200	3 51	3 55	0.386	0 394	2 68	2.63	21 959	22.209	49.420	48.760
L.S. D. (0.05)				0.476	0.869	N S		0.07	0.014	0 007	0 04	0 05	N S	0.460	0 314	0 254

1= Rhizobacterein 2 = Phosphorein

It is evident from such data that rhizobacterein x 5-5-5 NPK kg/fad. followed by phosphorein x 10-10-10 NPK kg/fad. were of significant increasing effect in this respect. Obtained results are in agreement with those reported by Sobh *et al.*(2000)on faba bean.

Generally, it can be concluded that rhizobacterein, NPK fertilizer level at 10-10-10 kg/fad. and rhizobacterein x 5-5-5 NPK kg/fad. gave a promotion effect for most of studied characters of peas.

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تأثير بعض المنشطات الحيوية ومعدلات الأسمدة النيتروجينية الفوسفاتية البوتاسية علي نمو ومحصول القرون وجودتها للبسلة.

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أجريت تجربتان حقليتان في شتاء موسمي ٢٠٠٢/٢٠٠٣ ، ٢٠٠٣/٢٠٠٤ لدراسة تأثير بعض المنشطات الحيوية (الريزوباكترين والفوسفورين) ومعدلات السماد النيتروجيني الفوسفاتي البوتاسي (صفر- صفر- صفر ، ٥- ٥- ٥ ، ١٠-١٠-١٠ كجم /فدان) علي نمو النبات ، والمحتوي الكيماوي ومحصول القرون الخضراء ومكوناته وكذلك الصفات الطبيعية للقرن والقيمة الغذائية للبذور للبسلة صنف ماستر- ب.

أوضحت النتائج أن تلقيح بذور البسلة بالريزوباكترين عمل علي زيادة نمو النبات (ارتفاع النبات ، كلا من عدد الأوراق والفروع ، الوزن الطازج والجاف للاوراق والفروع وكذلك الوزن الجاف الكلي) ، المحتوي العنصري للأوراق (تركيز كلا من ن ، فو ، بو) ، المحصول ومكوناته (متوسط وزن القرن ، وزن القرون/نبات ومحصول القرون الخضراء الكلي/فدان)، وكذلك صفات القرن الطبيعية (وزن البذور الجافة/قرن ، طول القرن ، سمك القرن، عدد البذور /قرن ووزن ١٠٠ بذرة)، والقيمة الغذائية للبذور (محتوي كل من ن ، فو ، بو ، والبروتين والكربوهيدرات).

بزيادة معدل التسميد النيتروجيني الفوسفاتي البوتاسي من ٥ - ٥ - ٥ إلي ١٠ -١٠ -١٠ كجم ن فو بو /فدان أعطى أعلى القيم من الصفات المدروسة المختلفة للنمو الخضري ، والمحتوي الكيماوي ، والمحصول ومكوناته وكذلك جودته.

الريزوباكترين مع المعدل المنخفض للتسميد النيتروجيني الفوسفاتي البوتاسي (٥ –٥ –٥ كجم /فدان) متبوعة بالفوسفورين مع المعدل المرتفع للتسميد النيتروجيني الفوسفاتي البوتاسي (١٠- ١٠- ١٠ كجم/فدان) أعطي أعلي القيم لمعظم الصفات المدروسة.