4. RESULTES AND DISCUSSION

4.1. First experiment:

"Effect of different sources of organic manure and bio-fertilizers as well as their interaction on pea growth and productivity under saline conditions."

4.1.1. Vegetative growth:

Data presented in Tables (1&2) show the effect of different sources of organic manures, recommended dose of NPK and bio fertilizers as well as their interaction on different vegetative growth parameters, *i.e.* plant length, number of branches and leaves/ plant and leaf area as well as fresh and dry weight per plant.

a. Effect of organic manures:

Data in Table (1) show that there were significant differences among the tested organic manures in all measured growth parameters expressed as plant length, number of leaves and branches per plant, average leaf area as well as fresh and dry weights of plant foliage. Obtained results are true during both seasons of study. In this respect, such data revealed that using farm yard manure at a rate of 30 m^3 / fed. significantly increased plant length, number of leaves and branches per plant as well as dry weight of plant foliage during both seasons of growth compared with using both chicken manure at a rate of 10 m^3 / fed. and sheep dung at a rate of 20 m^3 / fed. On the other hand, using chicken manure at a rate of 10 m^3 / fed.

reflected the highest values for average leaf area during both seasons and weight of plant foliage during the first season only.

On the contrary, the lowest values in all measured growth traits were recorded in case of using sheep dung at a rate of 20 m^3 / fed. during both seasons of growth. The enhancing effect of using farm yard and chicken manures on plant growth may be due to that such organic manures play a role as soil amendment which improves water holding capacity of sandy soils and increase macro and micro elements availability in the rhizosphere around root system which in turn increased plant growth. However, application of sheep dung increased the osmotic pressure of soil solution due to higher salinity and higher sodium ion content as shown from Table (D) which adversely affects plant growth.

Also, growth parameters may be enhanced due to increase in humic and fluvic acids in soil solution and its effect on soil pH and the availability of nutrient elements. This suggestion agrees with the results obtained by **Innocent *et al.* (1995)** who indicated that composts of Bark and Tenporon improved shoot growth under Japan saline conditions. In addition, **Farrag (1996)** mentioned that farm yard manure at rate of 30 m^3 /fed. or canal sediments at rate of 40 m^3 / fed. significantly increased growth parameters of pea plants.

b. Effect of NPK and bio- fertilizers:

Data illustrated in Table (1) showed that plant length, number of leaves and branches, average leaf area as well as

fresh and dry weight per plant were significantly affected due to application of mineral fertilizer (NPK) at the recommended dose and treating the seeds as pre-planting with different agents of bio-fertilizer either in a single form or in combination during both seasons of study compared with the control treatment. In this respect, except plant length and fresh weight of plant foliage during first season and number of leaves and fresh weight of plant foliage during the second one which recorded the highest values due to application of mineral fertilizers at the recommended dose, the highest values in the other studied growth parameters were recorded in case of using bio-fertilizers in a mixed form compared with the other studied treatments. These results were true during both seasons of growth.

These results are in agreement with those obtained by **Abo-Bakr, *et al.* 1993 a, Bakry, *et al.* 1995 and El-Beheidi, *et al.* 1996** on pea, they found that the application of NPK fertilizer increased morphological characteristics of plant foliage. Furthermore, the results show excellent work to microorganisms which have the capability to fixing nitrogen and bring insoluble phosphate in soil into soluble forms, also reduce pH level through producing organic acids in turn realize macro and micro-nutrients which plants need (**El-Borollosy, 1999**). These results agree also with those of **El-Oksh *et al.* (1991)** on common bean and **Abo-Sedera et al. (2005)** on bean who found that pre-sowing seed treatment with bio-fertilizer

Table (1): Effect of organic manures, mineral and bio fertilizers on some foliage parameters of pea plants.

Characters / Treatments	1999 - 2000						2000 – 2001					
	Plant high (cm)	No. of branches/ plant	No. of leaves	Average leaf area (cm^2)	Weight of plant foliage (g.)		Plant high (cm)	No. of branches	No. of leaves	Average leaf area (cm^2)	Weight of plant foliage (g.)	
					Fresh	Dry					Fresh	Dry
F.Y.M	54.9	4.0	35.3	107.1	66.0	12.0	51.2	3.9	34.1	96.2	61.7	12.1
Ch.M	54.4	3.3	26.9	112.7	70.2	12.3	51.1	3.2	26.6	105.4	61.5	11.1
Sh. D.	52.9	3.7	32.9	109.4	62.0	11.1	48.6	3.6	28.8	99.2	57.4	10.1
L.S.D. at 0.05	**0.6**	**0.4**	**0.5**	**2.5**	**2.5**	**0.7**	**1.1**	**0.2**	**0.9**	**2.5**	**2.9**	**0.3**
Control	48.4	3.4	30.4	96.2	55.5	9.0	45.8	3.4	27.0	90.2	48.7	8.0
NPK	59.3	3.3	32.2	114.7	75.3	13.6	53.8	3.2	31.0	106.2	68.7	13.1
A	54.6	3.8	33.3	109.6	66.1	12.1	51.4	3.3	30.4	96.6	63.8	11.2
Az	51.9	3.9	31.0	111.4	63.2	11.0	47.7	3.4	28.6	96.9	57.8	10.6
B	51.3	3.5	30.0	106.8	61.9	10.5	48.4	3.5	28.9	97.9	54.3	10.1
A + Az + B	58.8	4.2	33.4	119.8	74.5	14.6	54.8	4.6	28.9	113.8	67.9	13.6
L.S.D. at 0.05	**0.9**	**0.3**	**1.4**	**2.7**	**3.4**	**0.7**	**1.6**	**0.2**	**0.8**	**2.0**	**2.2**	**0.6**

F.Y.M. = Farm yard manure Ch. M. = Chicken manure Sh. D. = Sheep Dung
A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

increased plant growth parameters.

c. Effect of the interaction:

It is obvious from the data presented in Table (2) that the highest values in all the studied growth parameters expressed as plant length, number of leaves and branches per plant, average leaf area as well as fresh and dry weight per plant were, in general, recorded as a result of the combination of pre-sowing inoculation of the seeds with mixture of bio-fertilizers agents and the application of farm yard manure at the rate of 30 m^3 / fed. during the two seasons of the experiment.

Obtained results may be due to the main role of organic manure (F.Y.M.) as a source for macro- and micro-nutrients (Table D) which released as a result of bio-fertilizers agents to be available for plant absorption which in turn increased plant growth rate (**Bear, 1955**). In addition, application of bio-fertilizers play major role in atmospheric nitrogen fixation which increased the fertility of the soil and consequently affected plant growth. Moreover, such bio-fertilizers may change the unavailable form of macro-elements to soluble form which become available to plant absorption which consequently affects plant growth.

In this respect, several investigators reported that supplementing soil with an organic matter having a wide C:N ratio (29.83 for farm yard manure used in the present study) resulted in densities of microorganisms especially those having the capability to fix atmospheric nitrogen **(Eweda,**

Table (2): Effect of the interaction between some organic manures, mineral and bio fertilizers on some foliage parameters of pea plants.

Characters / Treatments		1999 – 2000						2000 – 2001					
		Plant high (cm)	No. of Branches / plant	No. of Leaves / plant	Average leaf area (cm^2)	Weight of plant foliage (g.)		Plant high (cm)	No. of Branches / plant	No. of Leaves / plant	Average leaf area (cm^2)	Weight of plant foliage (g.)	
						Fresh	Dry					Fresh	Dry
Farm Yard Manure	control	47.2	3.7	33.7	92.9	53.2	8.55	46.9	3.7	31.45	85.1	50.0	8.38
	NPK	60.5	3.2	35.7	114.4	75.3	13.96	54.0	3.4	35.7	103.3	69.4	13.87
	A	59.0	4.3	40.0	103.9	74.8	13.36	55.5	3.8	34.4	90.0	68.6	13.08
	Az	50.6	4.2	32.6	111.3	59.6	10.38	47.8	3.8	32.7	95.2	52.8	11.66
	B	51.5	3.7	38.7	102.6	58.9	10.01	47.6	3.7	32.5	93.7	53.8	10.78
	A +Az +B	60.7	5.1	37.4	117.6	80.9	15.40	55.9	5.2	37.7	110.1	75.7	14.69
Chicken Manure	control	51.2	3.3	27.9	106.5	54.5	10.36	49.8	3.1	24.7	96.9	50.4	8.28
	NPK	60.2	3.1	26.6	114.5	78.8	13.74	54.0	3.0	26.6	108.5	72.8	13.80
	A	52.5	3.1	26.4	112.3	67.2	11.91	50.5	3.0	28.1	105.3	61.3	10.44
	Az	53.1	3.3	27.3	112.7	66.9	11.70	49.6	3.2	26.1	100.7	61.0	10.17
	B	52.0	3.4	26.1	107.2	68.8	11.91	50.2	3.1	25.4	103.4	56.9	9.86
	A+ Az+ B	57.6	3.7	29.2	123.3	74.2	13.02	53.2	3.8	29.1	119.2	67.2	13.95
Sheep Dung	control	46.8	3.3	31.3	89.2	49.0	8.14	41.2	3.4	24.8	88.4	45.77	7.45
	NPK	57.5	3.7	34.4	115.3	70.7	13.07	53.4	3.2	30.7	106.9	63.9	11.51
	A	52.2	4.0	33.3	112.5	62.8	10.90	48.2	3.2	28.7	96.3	61.9	10.12
	Az	52.0	4.1	33.5	110.1	63.2	10.77	46.2	3.3	27.0	94.8	59.6	9.90
	B	50.5	3.3	31.2	110.6	57.8	9.50	47.5	3.6	28.8	96.5	52.4	9.60
	A +Az +B	58.2	3.9	33.7	118.4	68.4	14.40	55.5	4.7	32.8	112.0	60.7	12.17
L.S.D. at 0.05		**1.5**	**0.5**	**2.5**	**4.7**	**2.6**	**1.3**	**2.3**	**0.3**	**1.4**	**3.4**	**3.7**	**1.0**

A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

1983; Mostafa, 1983; Faid, 1994; El-Sayed, 2000 and Desouky, 2000).

4.1.2. Chemical constituents of plant foliage

4.1.2.1. Photosynthetic pigments:-

a. Effect of organic manure:-

Significant superiority in chlorophyll a, b and total chlorophyll values actualized from chicken manure treatment compared with other organic manure treatments in the two seasons are shown in Table (3). In addition, using chicken manure at a rate of 10 m^3 / fed. reflected the lowest values in carotenoides content during the two seasons of study. This result may be due to the different specifity of nitrogen and magnesium content (as shown in Table D) in chicken manure more than other organic manure treatments. This result agree with that of **El-Sheikh and El-Zidany (1997)**. **Ahmed *et al.* (2003)** who reported also that increasing sewage sludge up to 15 m^3 / fed. to pea plants led to a significant increase in chlorophyll a, chlorophyll b, total chlorophyll and carotenoids in whole plant. Moreover, no significant differences are noticed among the tested rates of farm yard manure and sheep dung in all assayed photosynthetic pigments content in both seasons of the experiment.

b. Effect of NPK and bio-fertilizers:

The same data in Table (3) showed clearly that chlorophyll a, b and total chlorophyll were significantly increased by seeds soaking and soil inoculation treatment with all the tested bio-

fertilizer microorganisms either in a single form or in combination as well as fertilization the plants during the growth with N,P and K mineral fertilizers during both seasons of growth compared to the control. In this regard, the highest concentration of chlorophyll a, b and total chlorophyll was obtained due to treating the seeds and soil inoculation with the mixture of tested bio-fertilizers agents (*Azospirillum* + *Azotobacter* + *Bacillus megatherium*) followed by NPK treatment compared with the other tested treatments. On the other hand, caroteneoids content was decreased with either using bio or mineral fertilizer treatments compared with the check one. In this respect, the highest values were recorded in case of the control treatment during the two seasons of growth. The promoting effect of using bio and mineral fertilizer treatments on chlorophyll pigments content may be related to the role of the same symbiotic, non-symbiotic N_2-fixing and phosphate dissolving bacteria in producing of phytohormones or improving the availability and acquisition of nutrients or both which promoted the vegetative growth.

Many investigators indicated that total chlorophyll in legumes and other vegetable crops increased according to inoculation with bio-fertilizers. **Barakart and Gabr (1998)** reported that the inoculation with *Azotobacter* sp., *Azospirillum* sp. and *Klebsiella* sp. alone or together on tomato plants significantly increased total chlorophyll and decreased carotene content. In the same line, **Ismail (2002)** found that the

Table (3): Effect of organic manures, mineral and bio fertilizers on photosynthetic pigments concentration (mg / 100 g fresh weight) of plant foliage.

Characters / Treatments	1999 / 2000				2000 / 2001			
	Chlorophyll			Total Caroteno-ides	Chlorophyll			Total Caroteno-ides
	a	b	Total		a	b	Total	
F.Y.M	102	60	162	79	100	55	155	81
Ch.M.	105	62	167	77	103	58	161	78
Sh. D.	103	60	163	78	100	55	155	80
L.S.D. at 0.05	**1**	**1**	**2**	**1**	**2**	**1**	**3**	**1**
control	98	55	153	82	93	52	145	84
NPK	107	64	171	75	105	59	164	77
A	103	61	164	77	101	56	157	79
Az	102	60	162	78	100	55	155	80
B	101	59	160	80	100	54	154	82
A + Az + B	109	66	175	74	108	61	169	76
L.S.D. at 0.05	**1**	**1**	**2**	**1**	**2**	**1**	**3**	**1**

F.Y.M. = Farm yard manure Ch. M. = Chicken manure
Sh. D. = Sheep Dung A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

inoculation with *Rhizobium leguminosarum* + *Bacillus megatherium* var. phosphaticum significantly increased chlorophyll content in pea leaves. In addition, **Abed *et al.*(1987 b)** and **Fedina and Tsonev (1997)** indicated that salinity produced pea plants with low content of chlorophyll and high carotene such photosynthetic pigments were enhanced by spraying with micro-nutrients. Also, **Shokr (2000)** reported that pea plants fertilized with NPK at rate of 60-30-30 or 48-48-24 kg/ fed. have more chlorophyll in their leaves compared with low rate treatments of NPK.

c. Effect of the interaction:

Obtained results recorded in Table (4) reveal that chlorophyll a, b and total chlorophyll were increased when soil was supplied with organic fertilizers combined with mixture of studied microorganisms as compared with soil supplied with only soil amendments, mineral fertilizers or individual bio-fertilization treatments. The highest values of a, b and total chlorophyll were accomplished from 10 m^3/fed. chicken manure plus mixed bio-fertilizers followed with 30 m^3/fed. farm yard manure plus mixed bio-fertilizers then 20 m^3/fed. sheep dung inoculated with mixed of bio-fertilizers. However, data on chlorophyll a, b, and carotenoids were not significant in both seasons.

Table (4): Effect of interaction between some organic manures, mineral and bio fertilizers on foliage pigments (mg. / 100 g.) of pea plants.

Characters / Treatments		1999 / 2000				2000 / 2001			
		Clorophyll			Total Carotenoides	Clorophyll (mg. / 100 g.)			Total Carotenoides
		a	b	Total		A	b	Total	
FarmYard Manure	control	94	54	148	84	92	51	143	85
	NPK	105	63	168	76	103	58	161	78
	A	101	60	161	78	100	55	155	80
	Az	101	60	161	80	99	54	153	82
	B	100	59	159	81	99	52	151	83
	A +Az+ B	109	65	174	75	107	60	167	77
Chicken manure	control	101	57	158	81	95	54	149	82
	NPK	109	66	175	75	107	62	169	78
	A	105	62	167	76	103	57	160	77
	Az	103	61	164	77	102	56	158	79
	B	103	61	164	79	101	55	156	81
	A +Az +B	111	68	179	74	110	63	173	74
Sheep Dung	control	99	55	154	82	93	51	144	84
	NPK	107	64	171	75	104	58	162	77
	A	102	60	162	77	100	55	155	79
	Az	102	59	161	78	99	54	153	80
	B	101	59	160	81	98	53	151	82
	A +Az +B	108	65	173	74	106	61	167	76
L.S.D. at 0.05		N.S.	N.S.	4	N.S.	N.S.	N.S.	5	N.S.

A=*Azospirillum* Az=*Azotobacter* B=*Bacillus*

4.1.2.2. Endogenues hormones:

Data recorded in Table (5) show that the effect of organic manures, bio and mineral fertilizers as well as their combination on endogenues hormone contents in plant foliage during both seasons of study.

a. Effect of organic manures:-

Such data in Table (5) reveal that there were significant differences in assayed endogenues hormones, *i.e.*, gibberellins (GA), indole acetic acid (IAA) and cytokinins (CK) content among the tested sources of organic manures (farm yard manure, chicken manure and sheep dung) during both seasons of study. In this regard, the highest values of gibberellins, indole acetic acid and cytokinins were recorded in plants treated with 30 m^3/fed. farm yard manure in the two growing successive seasons. Moreover, the lowest values were attained from sheep dung treatment. On the other hand, no significant dissimilarity in substance values between farm yard manure and chicken manure treatment can be noticed in this respect.

These results coincided with those of **El-Ghadban *et al.* (2003)** who found that the content of IAA, GA_3 and CK in marjoram plants treated with compost at rate of 7.5 ton / fed. significantly increased compared with the control (with out compost) and were nearly of equal quantity to the plants treated with recommended dose of NPK fertilizers.

b. Effect of NPK and bio-fertilizers:

Data in Table (5) show also that pre-sowing treatment the seeds with different bio-fertilizers either in a single form or in a

mixture and / or fertilizing the plants with NPK fertilizers at the recommended dose during the growing seasons significantly increased all the measured endogenues hormones (GA, IAA and CK) compared with the control treatment. In this connection, seed inoculation with mixed *Azospirillum*, *Azotobacter* and *Bacillus* significantly increased GA, IAA and CK compared with the control or individual microbial inoculation or NPK treatments. In addition, NPK treatment came in the second rank in this concern. The results were in the same trend in the two cultivation seasons.

These results are in agreement with those observed by **Jain and Patriquin (1985)**, where they found that bacteria of the genera, *Azotobacter* and *Azospirillum*, could produce more than 30 µg of indole acetic acid. **Jagnow *et al.* (1991)** indicated also that *Azotobacter* and *Azospirillum* strains produced adequate amounts of indole acetic acid and cytokinins, which increased the surface area per unit root length and were responsible for root hair branching with an eventual increase in acquisition of nutrients from the soil. Moreover, **Datta and Basu, 1997** found that a large amount of IAA was released from root nodule isolated from legume plants.

c. Effect of the interaction:

With regard to the effect of NPK and bio-fertilizers within organic manures, the results reported in Table (5), generally showed that the gibberellins, Indole acetic acid and cytokinins concentrations were significantly increased by application of mixed bio-fertilizers with farm yard manure compared with

Table (5): Effect of some organic manure, mineral and bio fertilizers and its interaction on some foliage indogenues hormones (μ g/100 g. fresh weight) of pea plants.

Seasons / Charcters / Treatments		1999 - 2000			2000 - 2001		
		GA	IAA	CK	GA	IAA	CK
F.Y.M		2.41	43.8	98	2.37	42.7	95
Ch.M.		2.40	43.4	97	2.34	42.4	95
Sh. D.		2.23	40.8	89	2.12	40.3	86
L.S.D. at 0.05		**0.02**	**0.2**	**2**	**0.04**	**0.6**	**1**
control		1.65	38.6	84	1.59	37.0	81
NPK		2.80	45.3	104	2.69	44.3	101
A		2.26	42.2	93	2.19	41.6	91
Az		2.34	42.2	88	2.30	41.7	87
B		2.22	42.0	92	2.15	41.6	99
A + Az + B		2.81	45.8	107	2.74	44.6	104
L.S.D. at 0.05		**0.03**	**0.3**	**2**	**0.03**	**0.5**	**2**
Farm Yard Manure	control	1.66	39.5	84	1.67	37.6	80
	NPK	2.80	45.5	106	2.74	44.4	102
	A	2.45	43.8	104	2.49	42.8	102
	Az	2.31	43.5	90	2.25	42.7	89
	B	2.08	41.2	92	2.11	40.8	90
	A Az B	3.12	49.2	113	2.99	48.0	108
Chicken manure	control	1.76	39.8	92	1.69	38.3	90
	NPK	2.93	46.6	105	2.87	45.4	103
	A	2.18	42.4	94	2.09	42.2	92
	Az	2.33	42.7	92	2.25	41.8	91
	B	2.47	43.8	92	2.35	43.2	90
	A Az B	2.77	45.2	107	2.78	43.5	105
Sheep Dung	control	1.54	36.4	75	1.42	35.2	72
	NPK	2.68	43.7	101	2.47	43.1	98
	A	2.15	40.2	81	2.00	39.8	79
	Az	2.34	40.4	83	2.40	40.5	80
	B	2.09	41.0	91	2.01	40.9	90
	A Az B	2.55	42.8	101	2.44	42.4	98
L.S.D. at 0.05		**0.06**	**0.5**	**4**	**0.06**	**0.9**	**3**

F.Y.M. = Farm yard manure Ch.M. = Chicken manure
Sh. D. = Sheep Dung
A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

other treatments followed by mineral fertilizer with chicken manure. The increments of growth hormones in plants can increase some plant parameters, which might be reflected on whole plant fresh and dry weight (Table 2).

These results are in agreement with those obtained by **Frankenberger and Arshad (1995)** who reported that soil microorganisms release growth hormones as IAA, CK and GA which stimulate plant growth, dry matter and absorption of nutrients. **Ismail (2002)** pointed out also that the concentration of gibberellins, indole acetic acid and cytokinins in pea plants were significantly increased with increasing N rates. Moreover, GA, IAA and Ck were significantly increased by seed inoculated with *Rhizobium leguminosarum* + *Bacillus megaterium* var. phosphaticum. In the same line, **El-Ghadban *et al.* (2003)** found that the increases in compost rates up to 7.5 ton / fed. combined with bio-fertilizers significantly increased IAA, GA3 and CK compared with recommended dose of NPK fertilizers.

4.1.2.3. Mineral constituents of plant foliage:

a. Effect of organic manures:

Data in Table (6) clearly indicate that the application of organic manure significantly affected foliage mineral content. In this regard, application of farm yard manure increased phosphorus, potassium and calcium concentrations of plant foliage, while nitrogen content was increased with the application of chicken manure treatment. Moreover, the plants

treated with sheep dung reflected the highest concentration of Na. The lowest quantity of N, P, K and Ca concentration in case of sheep dung might be due to the excess of sodium chloride in sheep dung as well as in soil and irrigation water (Tables B and D) which inhibited the availability of macro and micro-nutrients needed by plants. These results are in agreement with those observed by **Abed *et al.* (1987 b)** who reported that increasing salinity up to 9000 ppm in irrigation water decreased N, P and K and increased Na and Ca concentrations of pea plants. In the same line, **Sawires *et al.* (1997)** reported that the concentration of sodium, carbohydrate and free proline increased with increasing salinity up to 1.2% NaCl in growth medium for callus formed from explant of peas *cv.* Little Marvel, whereas K concentration of callus decreased with sodium chloride levels. According to nutrients uptake enhancement under saline conditions, **Abo-Elela (2002)** found that the farm yard manure up to 30 m^3 / fed. and chicken manure up to 15 m^3 / fed. significantly increased N, P and K as well as Mn, Fe, Zn and Cu in pea plants.

b. NPK and bio-fertilizers:

Concerning the data of N, P, K, Ca and Na concentration in pea plants treated with recommended dose of NPK (NPK), *Azospirillum*, *Azotobacter*, *Bacillus* and the mixture of *Azospirillum* + *Azotobacter* + *Bacillus*, data are tabulated in Table (6).

Generally, using mixed bio-fertilizers increased only N concentration in pea foliage while fertilizing the plants during

the growing seasons with the recommended dose of mineral fertilizers led to an increase in P, K and Ca concentrations. However, such treatments significantly decreased Na concentration during both seasons of study. Moreover, **Hervas *et al.* (1991)** found that N supply and nodulation affected nitrate reduction activity and growth of pea. In this respect, **Abo-Bakr *et al.* (1993 b)** and **Srivastava and Ahlawat (1995)** pointed out that N and P uptake by pea plants increased with increasing P rates up to 25.8 kg P / ha. **Ismail (2002)** pointed out also that the high rate of nitrogen fertilization, 90 kg N / fed. significantly affected the chemical composition of peas. Although, N, K and Mg increased with increasing N levels up to 90 kg / fed., in the same time, P, Ca and Na accumulation decreased in dry leaves. Moreover, **Srivastava and Ahlawat (1995)** indicated that pea seed inoculated with *Rhizobium* and/or phosphate solublizing was more pronounced with the combined inoculation than with the single ones. In this regard, **Barakart and Gabr (1998)** reported also that the inoculation with *Azotobacter* sp., *Azospirillum* sp. and *Klebsiella* sp. single or mixed as bio-fertilizers significantly increased leaf nitrogen content and leaf P content in either of seedling or mature tomato plants.

c. Effect of the interaction:

Data illustrated in Table (7) clearly show the effect of interaction between used organic manures, recommended dose of NPK (NPK) and inoculation with *Azospirillum*, *Azotobacter*, *Bacillus* or mixed *Azospirillum* + *Azotobacter* +

Table (6): Effect of organic manures, mineral and bio fertilizers on foliage mineral content (mg. / 100g.) of pea plants.

Characters / Treatments	1999 – 2000					2000 – 2001				
	N	P	K	Ca	Na	N	P	K	Ca	Na
F.Y.M	4000	301	3076	1311	204	3868	317	2965	1299	227
Ch.M.	4052	293	2634	1297	216	3981	290	2586	1290	236
Sh. D.	3717	285	2847	1286	226	3643	285	2845	1277	245
L.S.D. at 0.05	**19**	**3**	**78**	**3**	**2**	**37**	**2**	**32**	**3**	**2**
control	3712	272	2442	1243	281	3626	305	2467	1224	301
NPK	4067	322	3299	1350	160	3988	320	3125	1336	180
A	3969	280	2933	1281	229	3862	285	2755	1272	251
Az	3854	281	2915	1283	204	3741	282	2845	1276	225
B	3806	296	2895	1300	218	3694	292	2944	1294	242
A + Az + B	4129	307	2630	1331	200	4072	301	2654	1328	215
L.S.D. at 0.05	**11**	**3**	**77**	**4**	**4**	**42**	**3**	**43**	**4**	**3**

F.Y.M. = Farm yard manure Ch.M.. = Chicken manure
Sh. D. = Sheep Dung
A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

Bacillus on pea foliage mineral content.

Such data clearly indicate that nitrogen concentration in pea plants was significantly increased with application of chicken manure combined with inculation mixed bio-fertilizers followed with mixed bio-fertilizers within farm yard manure. On other hand, the lowest nitrogen value was achieved from sheep dung plus separate *Rhizobium* treatment (control). The phosphorus, potassium and calcium same constant increases took other tend, whereas the highest values were actualized from NPK application with farm yard manure compared with control and all other treatments. Furthermore, the content of sodium in pea plant foliage was significantly increased with control treatment and sheep dung manure but the lowest value of sodium concentration in pea plant foliage resulted from NPK plus farm yard manure treatment. These results are in agreement with those found by **Abed *et al.* (1987 b)** who reported that salinity decreased N, P and K and increased Na and Ca concentrations of pea foliage.

Concerning the effect of interaction between organic manure, NPK fertilizers and bio-fertilizer under saline conditions or without salinity, **Dravid (1991)** found that P uptake increased in both peas and lentil irrigated without saline water and inoculated with Rhizobium and supplemented 30 kg P_2O_5 /ha. In addition, **Mohamed (2000)** reported that application of *Azotobacter*, *Azospirillum* and *Rhizobium* for broad bean significantly increased N, P and K in whole plant. **Shokr (2000)** illustrated also that the levels of NPK

Table (7): Effect of interaction between organic manures, mineral and bio fertilizers on foliage mineral content (mg. / 100 g.) of pea plants.

Characters / Treatments		1999 – 2000					2000 – 2001				
		N	P	K	Ca	Na	N	P	K	Ca	Na
Farm Yard Manure	Control	3745	285	2659	1255	269	3632	284	2627	1229	294
	NPK	4173	330	3367	1368	142	4055	325	3105	1350	162
	A	4062	286	3107	1296	225	3893	289	2908	1283	253
	Az	3934	287	3295	1295	190	3769	291	3243	1288	214
	B	3896	300	3146	1307	207	3681	301	3171	1297	233
	A+ Az +B	4191	316	3216	1344	190	4176	312	2737	1346	204
Chicken manure	Control	3879	274	2138	1244	282	3801	265	2022	1227	298
	NPK	4183	322	3240	1343	161	4124	319	3093	1338	183
	A	4118	281	2835	1282	228	4022	285	2712	1275	248
	Az	3988	280	2477	1286	208	3962	279	2387	1277	227
	B	3924	295	2721	1297	218	3885	292	2684	1292	241
	A +Az +B	4222	309	2391	1328	197	4194	301	2616	1327	216
Sheep Dung	Control	3513	258	2529	1230	291	3445	265	2753	1217	311
	NPK	3845	313	3290	1338	178	3787	315	3177	1319	196
	A	3727	274	2856	1264	235	3670	281	2646	1259	253
	Az	3642	276	2973	1268	215	3592	275	2905	1262	234
	B	3600	294	2818	1296	227	3517	285	2976	1295	252
	A +Az +B	3974	297	2618	1318	211	3845	289	2610	1312	225
L.S.D. at 0.05		**19**	**5**	**133**	**7**	**6**	**73**	**6**	**75**	**7**	**5**

A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

fertilization had significant effect on mineral contents of dry leaves.

4.1.3. Green pod yield and its components:-

Data in Table (8) reflect the single effect of soil amendments, *i.e.*, farm yard manure, chicken manure and sheep dung, all at recommended rates as well as the recommended dose of NPK and microbial inoculation, *i.e.*, *Azospirillum*, *Azotobacter*, *Bacillus* in single form or as a mixed (*Azospirillum* + *Azotobacter* + *Bacillus)* on green pod yield and its components expressed as number of pods per plant, pod weight, plant yield and total yield per fed. Meanwhile, data in Table (9) indicate the effect of the interaction of NPK and bio-fertilizers within organic manures on the same parameters.

a. Effect of organic manures:

The results illustrated in Table (8) clearly indicate that green pod yield and its components were significantly affected when plants were fertilized with the different studied organic manures where the number of pods per plant was significantly increased with application of chicken manure compared with either farm yard manure or sheep dung. Meanwhile, weight of pod significantly increased with the application of farm yard manure compared with either chicken manure and sheep dung. Concerning the effect of organic manures on green pod yield / plant and total yield per fed., using 30 m^3 / fed farm yard manure followed by 10 m^3 / fed chicken manure show significant increases compared with sheep dung manure. In this

respect, no significant differences can be noticed between FYM and ChM. These results are in the same trend in the first and second seasons. Such increasing effect of FYM and ChM on yield and its components was due to the enhancing effect of them on vegetative growth (Table 1) and increasing the macro-nutrients (N, P, K and Ca) content in plant foliage (Table 6) which judging the productivity of plants. Concerning the improving effect of organic manure on green pod yield and its components, similar results were reported by **Farrag (1996)** and **Ahmed *et al.* (2003)** on peas, **Guu *et al.* (1995), Tamayo and Munoz (1996), Guu *et al.* (1997)** as well as **Gaber (2000), Shafeek and El-Habbasha (2000)** and **Santos *et al.* (2001)** all working on snap bean.

Moreover, Atia and Bardisi (2005) indicated that the application of FYM at the rate of 30 m^3 /fed. gave the highest values of pods / plant, yield / plant and yield / fed. Furthermore, increasing FYM to 45 m^3 / fed. did not show any significant differences with 30 m^3 / fed.

b. Effect of NPK and bio-fertilizers:

Regarding the effect of NPK and single or mixed microbial inoculation on total green pod yield and its components, the data illustrated in Table (8) show that the application of mixed bio-fertilizers, *i.e., Azospirillum lipoferum, Azotobacter chroococcum* and *Bacillus megatherium* var. phosphaticum followed by single inoculation with *Azotobacter* and *Azospirillum* during the first season and inoculation with

Azotobacter and Bacillus in the second one significantly increased total green pod yield and its components expressed as number of pods per plant, pod weight, plant yield and total yield per fed. compared with the control or recommended dose of NPK application. The most effective treatment in increasing the green pod yield and its components was the application of the mixed bio-fertilizer. These results are in the same trend in the first and second seasons. The increased total green pod yield with the application of separated or mixed bio-fertilizers as increasing the number and weight of pods per plant which increased due to the increased branch number and the weight of foliage dry matter (Table 1) which contain abundance of mineral nutrients that plants need to increasing the yield. (Table 6). These results agree with those obtained by **Mor and Manchanda (1992), Kanaujia *et al.* (1998)** and **Patel *et al.* (1998)** on peas, **Mohamed (2000)** on broad bean and **Zayed (2003)** on soybean and **Gupta and Namdeo (1999)** on pigeon pea.

c. Effect of the interaction:

According to the effect of the interaction between organic manure treatments (FYM, Ch.M. and Sh.D) and recommended dose of NPK fertilizer or the inoculation with bio-fertilizers (*Azospirillum*, *Azotobacter*, *Bacillus* and mixed *Azospirillum* + *Azotobacter* + *Bacillus*) on green pod yield and its components expressed as number of pods per plant, average of pod weight, plant yield and total yield per fed.

Table (8): Effect of organic manures, mineral and bio fertilizers on yield and its components of pea plants.

Characters / Treatments	1999 - 2000				2000 - 2001			
	Number of pods / plant	Pod weight (g.)	Plant yield (g.)	Yield (kg. / Fed.)	Number of pods / plant	Pod weight (g.)	Plant yield (g.)	Yield (kg. / Fed.)
F.Y.M	6.0	5.9	34.8	4950	5.3	5.6	30.0	3827
Ch.M.	6.4	5.5	35.1	4935	5.7	5.2	29.7	3818
Sh. D.	6.0	5.7	34.1	4755	4.7	5.3	25.3	3188
L.S.D. at 0.05	**0.1**	**0.2**	**0.9**	**122**	**0.3**	**0.2**	**0.6**	**47**
Control	5.7	5.1	29.3	4140	4.7	4.6	22.0	2626
NPK	5.8	5.3	31.0	4433	4.8	5.2	25.2	3124
A	6.0	5.6	32.8	4619	5.2	5.3	27.7	3474
Az	6.2	6.2	38.1	5384	5.4	5.7	30.7	4000
B	5.7	5.6	31.4	4446	5.1	5.4	27.8	3680
A + Az + B	7.2	6.3	45.3	6260	6.2	5.9	36.6	4764
L.S.D. at 0.05	**0.2**	**0.3**	**2.0**	**266**	**0.2**	**0.2**	**2.0**	**203**

F.Y.M. = Farm yard manure Ch. M. = Chicken manure
Sh. D. = Sheep Dung
A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

The recorded data in Table (9) indicated that the highest significant increases in green pod yield and its components were obtained due to the application of mixed bio-fertilizers within all organic manure treatments compared with control treatment, mineral NPK fertilization or single inoculation with bio-fertilizers. The must highest significant values of pod number per plant, plant yield and total green pod yield were achieved from the mixed bio-fertilizers combined with farm yard manure treatment. Moreover, the highest value of pod weight were achieved from the inoculation with *Bacillus megatherium* var. phosphaticum within farm yard manure treatment. These results are obtained in the first season, but, in the second one the highest value of pod weight was obtained as a result of using chicken manure and mixed bio-fertilizers treatment. Moreover, the highest total green pods yield was obtained due to the application of bio-fertilizer in a mixed form combined with using 30 m^3 / fed. farm yard manure or with 20 m^3 / fed sheep dung during both seasons of study. In this respect, no significant differences can be noticed among such treatments (FYM & Sh.D.). Similar results were reported by **Patel *et al.* (1998)** and **Srivastava *et al.* (1998)** on pea and **El-shimi (2004) and Abo Sedera *et al.* (2005)** on *Phaseolus vulgaris*.

Table (9): Effect of interaction between some organic manure, mineral and bio fertilizers on yield and its component of pea plants.

Characters / Treatments		1999 - 2000				2000 - 2001			
		Number of pods / plant	Pod weight (g.)	Plant yield (g.)	Yield (kg. / Fed.)	Number of pods / plant	Pod weight (g.)	Plant yield (g.)	Yield (kg. / Fed.)
Farmyard Manure	Control	5.9	5.1	30.0	4145	4.9	4.9	24.3	2783
	NPK	5.6	5.4	30.0	4410	4.8	5.1	24.4	3095
	A	5.8	5.6	32.7	4785	5.0	5.5	27.9	3598
	Az	6.0	5.3	37.8	5286	5.4	6.1	32.9	4284
	B	4.8	6.6	31.6	4461	5.0	5.8	29.0	3756
	A+Az +B	7.3	6.3	46.5	6616	6.6	6.2	41.2	5445
Chicken Manure	Control	6.3	4.9	31.1	4547	4.9	4.5	22.0	2851
	NPK	6.6	5.2	34.0	4683	5.1	5.0	25.5	3083
	A	6.9	5.0	34.5	4704	6.0	5.2	30.9	3826
	Az	5.7	6.1	34.7	5090	6.1	5.4	33.0	4389
	B	5.9	5.6	32.6	4649	5.9	5.3	31.5	4364
	A+ Az +B	7.2	6.1	44.1	5940	6.3	6.3	35.5	4397
Sheep Dung	Control	4.9	5.4	26.8	3729	4.3	4.5	19.6	2243
	NPK	5.4	5.4	28.9	4206	4.6	5.6	25.7	3191
	A	5.1	6.1	31.3	4368	4.5	5.3	24.2	3004
	Az	6.9	6.1	41.9	5775	4.7	5.5	26.1	3327
	B	6.3	4.8	30.2	4228	4.5	5.2	23.1	2919
	A+ Az +B	7.1	6.4	45.3	6225	5.7	5.9	33.2	4449
L.S.D. at 0.05		**0.3**	**0.5**	**3.5**	**461**	**0.4**	**0.4**	**3.4**	**351**

A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

4.1.4. Pea physical characteristics:

a. Effect of organic manures:

Data present in Table (10) show the effect of the application of farm yard manure, chicken manure and sheep dung on pea pod characters, *i.e.*, average of pod length, pod diameter, number of seeds per pod and 100-seed weight as well as netting percentage, during both seasons of the study.

Such data refer that except average of pod diameter, which was not affected, there were significant differences among the used organic manures in average pod length, number of seeds per pod, weight of 100-seeds and the netting percentage, In this regard, application of sheep dung at 20 m^3 / fed. gave the highest values for average pod length, number of seeds per pod and net weight percentage during the two seasons of the experiment while, using chicken manure at a rate of 10 m^3 / fed. reflected the highest values for 100-seeds weight. Similar results were obtained by **El-Shimi (2004)** on common bean.

b. Effect of NPK and bio-fertilizer:

According to the results of the effect of recommended dose of NPK, *Azospirillum*, *Azotobacter*, *Bacillus* and mixed *Azospirillum* + *Azotobacter* + *Bacillus* data scheduled in Table (10) clearly show that inoculation with mixed bio-fertilizer realized significant increases for physical pea parameters expressed as average of pod length and diameter, number of seeds per pod, 100-seed weight as well as netting percentage

compared with all other treatments. In addition, inoculation with *Azotobacter* alone ranked the second place and increased all the studied pod parameters except number of seeds per pod and netting percentage which exhibited the highest values by using recommended dose of NPK compared with control or other separate inoculation treatments in the first and second seasons.

These results are in agreement with those obtained by **Ismail (2002)** on peas and **Mohamed (2000)** on broad bean, who indicated that the application of bio-fertilization with *Azotobacter*, *Azospirillum* and *Rhizobium* were resulted in significant increase number of pods / plant, weight of seeds / pod, weight of 100 seeds. Similar results were obtained by, **Neweigy *et al.* (2000)** on broad bean, and **Zayed (2003)** on soybean.

c. Effect of the interaction:

Regarding the effect of the interaction between organic manures *i.e.* farm yard manure, chicken manure and sheep dung as well as recommended dose of NPK, *Azospirillum*, *Azotobacter*, *Bacillus* and mixed *Azospirillum* + *Azotobacter* + *Bacillus* on some physical characteristic of pea pods, data scheduled in Table (11) indicate that significant increases in pod length, pod diameter and net weight percentage parameters in the first and second seasons were detected but no significant effects were achieved on number of seeds per pod and pod diameter due to the application of such treatments. In this

Table (10): Effect of organic manures, mineral and bio fertilizers on some physical characteristics of pea pods.

Characters / Treatments	1999 - 2000					2000 – 2001				
	Average of pod length (cm)	Pod diameter (mm)	Number of seeds / pod	100 seeds weight (g)	Netting (%)	Average of pod length (cm)	Pod diameter (mm)	Number of seeds / pod	100 seeds weight (g)	Netting (%)
F.Y.M	7.5	11.2	6.5	45.4	57.5	7.2	11.5	6.1	39.1	48.9
Ch.M	7.2	11.2	6.6	47.5	58.8	7.1	11.5	6.4	46.5	55.3
Sh. D.	7.6	11.0	6.9	44.7	59.7	7.5	11.4	6.7	41.9	53.3
L.S.D. at 0.05	**0.2**	**NS**	**0.1**	**2.1**	**1.7**	**0.1**	**NS**	**0.1**	**1.2**	**0.9**
Control	7.1	10.7	6.1	42.7	55.7	6.9	11.0	5.8	39.3	49.9
NPK	7.4	11.1	6.9	44.8	59.5	7.2	11.3	6.8	41.7	51.8
A	7.4	11.0	6.7	44.1	57.3	7.2	11.3	6.3	41.7	50.9
Az	7.4	11.3	6.8	48.6	59.1	7.2	11.7	6.5	42.6	53.1
B	7.4	11.3	6.5	45.5	58.4	7.4	11.4	6.1	40.7	52.5
A + Az + B	8.0	11.3	7.1	49.4	61.9	7.7	11.9	7.0	42.9	55.9
L.S.D. at 0.05	**0.2**	**0.4**	**0.2**	**2.5**	**2.3**	**0.3**	**0.4**	**0.1**	**1.5**	**1.2**

F.Y.M. = Farm yard manure Ch.M. = Chicken manure
Sh. D. = Sheep Dung A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

respect, the inoculation with mixed bio-fertilizers combined with sheep dung achieved the highest values of pod length, number of seeds per pod and net weight percentage in the first season, while the positive effect from this treatment was only on pod length and number of seeds per pod in the second season.

The interaction between farm yard manure and the inoculation with *Bacillus megatherium* var. phosphaticum produced the highest value of pod diameter in the first season. The increase in 100-seed weight affirmed due to the application of chicken manure included the inoculation with *Azotobacter* (Az) in the first season, while in the second one, it was achieved from chicken manure and mixed bio-fertilizers. The mixed bio-fertilizers treatment produced the highest values of pod diameter and net weight percentage in the second season.

These results agree with those obtained by **Ismail (2002)** who found that the pod length, number of seeds per pod and net weight percentage significantly increased when pea plants were treated with sheep manure at a rate of 20 m^3 / fed. as a recommended dose and inoculation with *Rhizobium* and phosphate dissolving bacteria. Going in the same trend, **Ahmed *et al.* (2003)** reported also that the pod length and weight were significantly affected by increasing sludge up to 10 m^3 / fed. and the inoculation with *Rhizobium* and phosphorine while number of seeds / pod was not significantly affected. Furthermore, the results obtained by

Table (11): Effect of interaction between organic manures, mineral and bio fertilizers on some physical characteristics of pea pods.

Characters / Treatments		1999 – 2000					2000 – 2001				
		Average of pod length (cm)	Pod diameter (mm)	Number of seeds / pod	100-seeds weight (g)	Netting (%)	Average of pod length (cm)	Pod diameter (mm)	Number of seeds / pod	100-seeds weight (g)	Netting (%)
Farm Yard Manure	Control	7.0	10.8	5.9	42.6	55.4	6.8	11.1	5.5	38.9	47.6
	NPK	7.5	11.2	6.7	41.2	56.7	7.2	11.3	6.4	35.6	48.1
	A	7.5	10.9	6.5	44.4	57.9	7.1	11.2	6.0	37.6	47.3
	Az	7.5	11.5	6.6	47.7	57.8	7.3	11.5	6.2	40.8	49.0
	B	7.6	11.9	6.3	48.5	56.8	7.4	11.7	5.8	40.2	48.4
	A+Az+B	7.9	10.8	6.9	47.7	59.2	7.5	11.7	6.7	41.8	52.7
Chicken Manure	Control	7.0	10.8	6.0	44.3	55.6	6.7	11.1	5.7	39.5	51.1
	NPK	7.2	10.8	6.9	45.4	59.7	6.9	11.2	6.7	43.3	54.3
	A	6.9	10.9	6.5	43.2	58.7	6.6	11.2	6.2	48.3	53.8
	Az	7.5	11.4	6.6	53.8	60.3	7.3	12.1	6.4	44.3	56.1
	B	7.2	11.3	6.3	47.1	58.1	7.2	11.2	6.1	51.1	56.1
	A+Az+B	7.7	11.8	7.1	51.1	60.4	7.5	12.2	7.0	54.2	59.0
Sheep Dung	Control	7.2	10.5	6.5	41.2	54.5	7.0	10.8	6.0	39.6	51.1
	NPK	7.6	11.2	7.1	44.7	62.5	7.5	11.3	7.1	45.9	52.6
	A	7.9	11.1	6.9	44.9	55.6	7.7	11.4	6.5	39.0	51.6
	Az	7.1	10.6	7.0	43.9	62.9	6.9	11.6	6.8	42.0	54.0
	B	7.5	10.7	6.6	41.1	59.1	7.4	11.3	6.3	39.2	53.0
	A+Az+B	8.5	11.1	7.3	49.4	64.3	8.1	11.9	7.3	43.0	56.7
L.S.D. at 0.05		0.3	NS	NS	4.4	4.4	0.5	NS	NS	2.6	2.6

A = Azospirillum Az = Azotobacter B = Bacillus

Zayed (2003) indicated that 100-seed weight was significantly higher by both single and combined inoculation with *Rhizobium* and / or phosphate-solubilizing bacteria.

4.1.5. Nutritional value of seeds:

4.1.5.1. Organic chemical composition of pea seeds:

a. Effect of organic manure:

The results reported in Table (12) clarify indicated that there were significant differences between the used organic manures, *i.e.*, farm yard manure, chicken manure and sheep dung, on organic chemical constituents in pea seeds expressed as crude protein, total carbohydrates and fiber percentage during both seasons of the experiment. The highest protein seed content and the lowest fiber content were attributed to the application of chicken manure whereas adding sheep dung significantly increased carbohydrates percentage in dried green seeds of peas. These results are true in the two growing experimental seasons. The results regarding the effect of organic manure on organic chemical constituents in green pea seeds are in agreement with those of **El-Sheikh and El-Zidany (1997)** on faba bean who found that application of chicken manure (3 – 15 t/ha) resulted in significant increase in seed protein content. In this respect, **Khalil (1990)** and **Singer *et al.* (1998)** reported that higher contents of protein and carbohydrates as well as lower fiber percentage in snap bean pods were achieved from the application of 20 m^3 / fed. of sheep dung organic manure.

b. NPK and bio-fertilizers:

With respect to the effect of recommended dose of mineral NPK fertilizer, *Azospirillum lipoferum*, *Azotobacter chroococcum*, *Bacillus megatherium* var. phosphaticum and mixed bio-fertilizers on organic chemical constituents in green pea seeds, the same data in Table (12) show that crude protein, total carbohydrates and fiber percentage were positively affected due to the application of all fertilization treatments compared with the control one. In this regard, the application of NPK and mixed bio-fertilizers increased crude protein in both seasons. Whereas, the increases in total carbohydrates was associated with the control treatment in two successive growing seasons. Also, the fiber percentage increased with adding mineral fertilizers in the first and second seasons. These results are in confirmity with those obtained by **Wojcieska *et al.* (1998), Amer (1998), Mansour (2000), Shokr (2000), Ismail (2002) and El-Shimi (2004)** who pointed out that the application of NPK fertilizers significantly increased protein content in green pea seeds. **Mohamed (2000)** found also that the application of *Azotobacter*, *Azospirillum* and *Rhizobium* on broad bean significantly increased crude protein in seeds.

c. Effect of the interaction:

Data illustrated in Table (12) clearly show the effect of interaction between organic manures, *i.e.*, farm yard manure, chicken manure and sheep dung at used rates for each as well

Table (12): Effect of some organic manures, mineral and bio fertilizers and their interactions on protein, carbohydrates and fibers percentage in green seeds of pea plants.

Seasons / Charcters / Treatments		1999 – 2000			2000 - 2001		
		Protein	Carbo-hydrates	Fibers	Protein	Carbo-hydrates	Fibers
F.Y.M		20.7	61.2	5.9	19.6	60.6	5.8
Ch.M.		22.8	58.3	5.7	21.2	56.8	5.2
Sh. D.		19.8	62.1	4.9	19.0	61.4	6.1
L.S.D. at 0.05		0.3	0.4	0.3	0.4	0.6	0.4
Control		19.4	62.7	5.2	18.0	61.8	5.5
NPK		22.6	58.9	6.2	21.4	58.0	6.5
A		21.4	59.6	5.0	20.1	59.0	5.4
Az		20.3	60.3	5.3	19.2	59.5	5.6
B		20.3	61.0	5.9	19.1	59.8	6.0
A + Az + B		22.4	60.6	5.1	21.7	59.5	5.4
L.S.D. at 0.05		0.5	1.8	0.3	0.4	1.3	0.5
Farm Yard Manure	Control	18.8	63.6	5.0	18.1	63.0	5.1
	NPK	22.6	58.9	6.8	21.1	58.5	6.5
	A	21.6	60.3	5.4	19.8	60.4	5.5
	Az	19.7	61.7	5.9	18.8	60.9	5.6
	B	19.1	61.9	6.3	18.5	60.9	5.9
	A+Az +B	22.6	60.8	5.7	21.4	60.1	6.2
Chicken Manure	Control	21.5	59.7	4.8	19.2	58.8	5.0
	NPK	24.3	56.3	5.2	22.7	54.7	5.7
	A	22.7	57.8	4.5	21.1	56.4	4.9
	Az	22.0	58.2	4.7	20.6	57.0	5.2
	B	22.5	59.3	5.4	20.7	57.4	5.5
	A+Az +B	23.6	58.3	4.8	22.8	56.6	4.9
Sheep Dung	Control	17.9	64.9	5.8	16.6	63.8	6.3
	NPK	20.9	61.5	6.7	20.5	60.9	7.2
	A	19.9	60.6	5.2	19.3	60.1	5.8
	Az	19.3	60.9	5.5	18.3	60.7	6.1
	B	19.5	61.7	6.0	18.2	61.0	6.4
	A+ Az+B	21.1	62.7	4.8	21.0	61.8	5.0
L.S.D. at 0.05		0.8	NS	0.6	1.2	NS	0.8

F.Y.M. = Farm yard manure Ch.M.. = Chicken manure Sh. D. = Sheep Dung
A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

as recommended dose of NPK and *Azospirillum*, *Azotobacter*, *Bacillus* as single inoculation or mixed *Azospirillum* + *Azotobacter* + *Bacillus* on organic chemical constituents in green pea seeds. Such results pointed out that the studied treatments significantly affected crude protein and fiber percentage while they have no significant effect on total carbohydrate. The highest crude protein content was achieved from adding chicken manure combined with either NPK or mixed bio-fertilizers. These results are in agreement with those reported by **El-Bassiony (2003)** and **El-Shimi (2004)** on *Phaseolus vulgaris*, where they found that the crude protein increased with the application of organic manure and NPK fertilization.

4.1.5.2. Mineral constituents of green pea seeds:

a. Effect of organic manure:

The results reported in Table (13) show the effect of organic manures on mineral constituents of pea seeds *cv.* Little Marvel expressed as nitrogen, phosphorus, potassium, calcium and sodium. Such results clearly indicate that organic manure application significantly affected pea mineral contents during both seasons of this experiment. Data indicated that the seeds of plants grown in soil provided with chicken manure at rate of 10 m^3 / fed contained the highest amount of nitrogen while the highest amounts of phosphorus, potassium and calcium were established in seeds of plants received farm yard manure at rate of 30 m^3 / fed. On the other hand, sodium content was

decreased with application of farm yard manure. These results were true in both seasons of this trial.

Concerning the effect of organic manures on mineral constituents of pea seeds, such data are in accordance with those obtained by **El-Bassiony (2003)** on *Phaseolus vulgaris* who found that total nitrogen and potassium increased when he used 43 kg organic-N as cattle manure + 43 kg mineral nitrogen or as poultry manure. **El-Shimi (2004)** pointed out also that the significantly higher values of nitrogen, phosphorus and potassium in snap bean pods were achieved from 40 kg N/fed. as biogas manure compared with control treatment.

b. Effect of NPK and bio-fertilizers:

The results reported in Table (13) show the effect of recommended dose of NPK, *Azospirillum lipoferum*, *Azotobacter chroococcum*, *Bacillus megatherium* var. phosphaticum and mixed bio-fertilizers inoculation on mineral constituents of pea seeds *cv.* Little Marvel expressed as nitrogen, phosphorus, potassium, calcium and sodium. Such data indicated that high significant differences attained according to the application of NPK or single and mixed bio-fertilizers compared with control treatment. The highest amounts of nitrogen, phosphorus, potassium and calcium as well as the lowest content of sodium were fulfilled without significant differences from application of NPK or mixed bio-fertilizers. These results are true in both growing seasons of this experiment. The increases of nitrogen, phosphorus, potassium and calcium associated with the application of NPK

Table (13): Effect of organic manures, mineral and bio fertilizers on some mineral content as mg. /100 g. in dried green seeds of pea plants.

Characters / Treatments	1999 - 2000					2000 – 2001				
	N	P	K	Ca	Na	N	P	K	Ca	Na
F.Y.M	3602	274	1817	721	97	3410	270	1775	712	101
Ch.M.	3961	269	1659	685	102	3735	263	1614	664	106
Sh. D.	3426	263	1770	706	105	3300	259	1685	687	109
L.S.D. at 0.05	**59**	**2**	**63**	**11**	**1**	**28**	**1**	**60**	**5**	**1**
Control	3372	255	1595	613	113	3130	249	1547	593	116
NPK	3929	280	1989	739	93	3825	275	1851	717	97
A	3725	262	1670	691	100	3488	260	1631	679	103
Az	3531	261	1638	670	103	3342	258	1655	673	106
B	3537	275	1660	669	105	3326	270	1651	661	110
A + Az + B	3902	279	1989	844	95	3777	273	1813	803	99
L.S.D. at 0.05	**79**	**2**	**68**	**10**	**2**	**32**	**2**	**82**	**8**	**2**

F.Y.M. = Farm yard manure Ch. M. = Chicken manure
Sh. D. = Sheep Dung A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

or mixed bio-fertilizers may be due to the increase of those nutrients in plant tissues, which translocated and stored, in mature seeds. On the other hand, the decreased sodium concentration in pea seeds may be due to the increasing of potassium concentration in plant tissues which minimized the saline harmful effect in turn decreases sodium absorption from soil solution. With respect to the effect of mineral NPK and bio-fertilizers on mineral contents in pea seeds, these results agree with those obtained by **Midan and Malash (1982), El-Neklawy *et al.* (1985), Arisha (1993), Hanafy *et al.* (1999), Mohamed and El-Kabbany (1999) and Ismail (2002)** on peas as well as **Mohamed (2000), Neweigy et al. (2000)** and **Shokr (2000).**

c. Effect of interaction:

According to the effect of the interaction between organic manure treatments (FYM, Ch.M. and Sh.D. at recommended rates), recommended dose of NPK fertilizer and the inoculation with bio-fertilizers (*Azospirillum*, *Azotobacter*, *Bacillus* and mixed *Azospirillum* + *Azotobacter* + *Bacillus*) on mineral constituents of pea seeds expressed as total nitrogen, phosphorus, potassium, calcium and sodium, it is obvious from such data in Table (14) that total N, P, K and Na concentrations in pea seeds were significantly affected with different treatments during both growing seasons of this experiment. On other hand, Ca content was significantly affected in the first season only. The highest values of nitrogen content were

associated with mineral NPK fertilization combined with chicken manure at rate of 10 m^3 per feddan followed with mixed bio-fertilizers in case of chicken manure in both seasons. Concerning the phosphorus and sodium contents in pea seeds, data showed that the application of NPK or bio-fertilizers combined with farm yard manure accomplished the highest values of phosphorus and the lowest sodium content in both growing seasons.

In this concern, the highest amounts of both potassium and calcium concentration in pea seeds were obtained from the application of mineral NPK fertilization within farm yard manure. These results may be due to that the supplying with mineral NPK or bio-fertilizers may cause supply more amount of nitrogen, phosphorus and potassium in soil solution directly with NPK fertilization or indirectly by bio-fertilizers with fixing atmospheric nitrogen and mineralizing soil phosphorus as well as producing high amounts of organic acids which decrease soil pH and available potassium, calcium and micro-nutrients in soil solution.

These results are in agreement with those reported by **Hassan *et al.* (1993), El-Sheikh and El-Zidany (1997), El-Sayed (2000), Ismail (2002), Ahmed *et al.* (2003)** and **El-Shimi (2004).**

Table (14): Effect of interaction between some organic manures, mineral and bio fertilizers on some mineral content as mg. /100 g. in dried green seeds of pea plants.

Characters / Treatments		1999 – 2000					2000 – 2001				
		N	P	K	Ca	Na	N	P	K	Ca	Na
Farm Yard Manure	Control	3264	263	1661	621	108	3138	258	1525	613	111
	NPK	3943	285	2048	753	87	3665	280	1930	736	91
	A	3758	268	1780	713	97	3445	265	1756	700	100
	Az	3406	266	1734	690	98	3266	260	1780	697	102
	B	3318	278	1743	680	100	3222	275	1696	687	106
	A+ Az +B	3930	283	1937	870	89	3720	279	1964	837	97
Chicken Manure	Control	3742	256	1534	607	114	3342	251	1486	571	116
	NPK	4225	279	1924	721	94	4244	273	1811	690	98
	A	3947	264	1567	666	100	3671	259	1531	657	104
	Az	3837	264	1550	644	103	3586	257	1517	651	106
	B	3906	276	1571	648	106	3597	268	1624	650	111
	A +Az +B	4107	278	1810	821	97	3968	272	1716	763	101
Sheep Dung	Control	3111	247	1590	611	116	2576	237	1629	594	119
	NPK	3626	276	1996	742	96	3566	270	1813	723	101
	A	3470	256	1664	693	102	3348	256	1607	680	106
	Az	3351	255	1630	674	106	7172	255	1667	673	110
	B	3387	271	1667	677	108	3157	267	1637	645	113
	A +Az +B	3669	276	1894	840	100	3644	269	1760	808	104
L.S.D. at 0.05		**136**	**2**	**106**	**13**	**2**	**143**	**3**	**112**	**NS**	**3**

A = *Azospirillum* Az = *Azotobacter* B = *Bacillus*

4.2. Second experiment:

Effect of different sources of organic manures and their combinations on growth and yield of pea plants under saline conditions.

4.2.1. Vegetative growth characteristics:

Data presented in Table (15) show the effect of 40 m^3 farm yard manure (FYM), 30 m^3 sheep dung (Sh.D), 10 m^3 chicken manure (Ch.M), 20 m^3 FYM plus 5 m^3 Ch.M, 20 m^3 FYM plus 15 m^3 Sh.D,, 5 m^3 Ch.M plus 15 m^3 Sh.D and 20 m^3 FYM plus 5 m^3 Ch.M plus 15 m^3 Sh.D / fed. in comparison with recommended dose of NPK (control) on the morphological characteristics, *i.e.*, plant length, number of branches and leaves per plant and average of leaf area, as well as fresh and dry weight of per pea plant foliage.

Such results showed that the highest significant increases of the studied parameters were achieved from using 20 m^3 FYM plus 5 m^3 Ch.M plus 15 m^3 Sh.D / fed. treatment except, leaf area character which increased according to using Ch.M at rate of 10 m^3 / fed. treatment in the first and second seasons. These results may be due to the abundance of organic matter which decrease the saline harmful effect and its content of the soil microorganisms which help to slow release of mineral nutrition plants need especially microelements which play important role in plant metabolism.

These results are in agreement with those obtained by **Waksman (1952)** and **El-Hadidy, Tomader *et al.* (1976)** on

Table (15): Effect of NPK and different organic manures on some morphological characters of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000						2000 – 2001					
	Plant high (cm)	Branch number	Leaf number	fourth leaf area (cm^2)	Foliage weight (g.)		Plant high (cm)	Branchnu mber	Leaf number	fourth leaf area (cm^2)	Foliage weight (g.)	
					Fresh	Dry					Fresh	Dry
NPK	24.2	2.1	11.9	47.9	26.2	4.6	22.7	2.0	11.0	40.4	22.8	4.2
Farm yard manure (FYM)	49.9	3.7	35.9	93.3	51.4	8.8	47.3	3.7	32.3	86.5	49.9	8.7
Sheep dung (Sh.D.)	48.4	3.3	33.0	79.1	45.3	7.9	44.4	3.4	28.8	76.7	44.4	6.7
Chicken manure (Ch.M.)	52.5	3.3	27.8	105.3	52.3	8.3	51.8	3.1	24.1	99.4	50.9	8.3
½ FYM + ½ Ch. M.	51.7	3.3	31.7	94.0	54.8	9.3	49.7	3.1	28.5	88.9	52.6	9.4
½ FYM + ½ Sh.D.	49.0	3.2	33.7	88.7	49.4	8.5	45.2	2.9	31.3	80.1	46.9	8.4
½ Ch. M. + ½ Sh. D.	50.4	3.0	28.8	90.7	49.5	8.3	48.6	2.7	26.5	84.5	47.8	8.4
½ FYM + ½ Sh.D. + ½ Ch. M.	56.0	3.8	37.0	101.9	63.7	11.4	54.6	3.7	34.2	96.2	58.8	11.2
LSD at 0.05	**2.4**	**0.5**	**3.4**	**3.9**	**3.7**	**1.1**	**2.7**	**0.6**	**2.5**	**2.9**	**2.9**	**1.4**

cowpea as well as **Abed *et al.* (1987 a), Farrag (1996)** and **Arisha and Abd El-Bary (2000)** on peas, they found that the application of organic manure was significantly increased the morphological characteristics of plant foliage.

4.2.2. Chemical constituents of plant foliage

4.2.2.1. Photosynthetic pigments:-

Data showing chlorophyll a, chlorophyll b, total chlorophyll and carotenoides pigments of pea foliage plants as affected with FYM, Sh.D and Ch.M either single or in combination forms as well as recommended dose of NPK fertilizers are schedule in Table (16).

Such data indicated that the combination of the three used different sources of organic manure significantly increased a, b and total chlorophyll pigments followed with the application of farm yard manure at half rate plus chicken manure at half rate too or plus sheep dung at half rate. However, the lowest significant values of carotenoides achieved with the same treatments compared with the other treatments. The results were true in both growing experimental seasons. These results may be due to the organic manure role in mineral amelioration status especially magnesium, sulfur and micro-nutrients which are not found in mineral fertilizers and plants need to constructing the organic composition. The obtained results are in agreement with those indicated by **El-Mansi *et al.* (1999), Ali (2000) and El-Shimi (2004)** where they found that

Table (16): Effect of NPK and different organic manures on foliage pigments (mg./100 g.) of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000				2000 – 2001			
	Chlorophyll			Total Caroten-oides	Chlorophyll			Total Caroten-oides
	a	b	Total		a	b	Total	
NPK	101	61	162	79	97	58	155	80
Farm yard manure (FYM)	98	56	154	83	94	53	147	84
Sheep dung (Sh.D.)	100	57	157	77	97	55	152	79
Chicken manure (Ch.M.)	101	59	160	78	96	56	152	78
½ FYM + ½ Ch. M.	105	62	167	74	105	58	163	75
½ FYM + ½ Sh.D.	105	63	168	74	105	61	166	76
½ Ch. M. + ½ Sh. D.	103	62	165	76	101	60	161	78
½ FYM + ½ Sh.D. + ½ Ch. M.	108	64	172	72	107	62	169	74
LSD at 0.05	2	1	2	2	1	2	3	3

chlorophyll a, b and total (a+b) in leaf tissues were significantly increased with the addition of organic manure at different rates.

4.2.2.2. Endogenous hormones:

Data of gibberellins, indole acetic acid and cytokinins as affected by organic manures as well as recommended dose of NPK (control) were scheduled in Table (17).

Such data indicated that there were significant differences affirmed among treatments. The highest values for gibberellins, indole acetic acid and cytokinins were found in plants treated with the mixture of the three tested different sources of organic manure as farm yard manure at rate of 20 m^3 / fed + sheep dung at rate of 15 m^3 / fed and 5 m^3 / fed of chicken manure, followed with FYM at rate of 20 m^3 / fed plus 15m^3 / fed of Sh.D for gibberellins and indole acetic acid or FYM at rate of 20 m^3 / fed plus 5m^3 / fed of Ch.M for cytokinins.

Obtained results are the same during the two seasons of study. Such increase in IAA may be due to the organic manure which may be have some organic constituents such as tryptophan which synthesize by the pyruvate decarboxylase pathway in some soil micro-organisms to auxin in agricultural medium (**Hegazi *et al.*, 1993**). In addition, obtained results are in agreement with those reported by **El-Ghadban *et al.* (2003).**

Table (17): Effect of NPK and different organic manures on some foliage indogenues hormones (μ g/100 g fresh weight) of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000			2000 - 2001		
	GA	IAA	CK	GA	IAA	CK
NPK	1.44	31.7	71	1.40	30.5	69
Farm yard manure (FYM)	1.89	44.0	94	1.88	43.0	91
Sheep dung (Sh.D.)	1.72	38.3	82	1.69	36.7	80
Chicken manure (Ch.M.)	1.81	39.6	93	1.77	38.8	89
½ FYM + ½ Ch. M.	1.86	44.3	98	1.83	44.0	96
½ FYM + ½ Sh.D.	1.93	45.3	95	1.89	44.4	94
½ Ch. M. + ½ Sh. D.	1.89	43.7	94	1.83	42.6	93
½ FYM + ½ Sh.D. + ½ Ch. M.	2.29	48.5	110	2.21	48.1	111
LSD at 0.05	**0.04**	**1.6**	**2**	**0.05**	**1.1**	**2**

4.2.2.3. Foliage mineral content:

Data presented in Table (18) show the effect of recommended dose of NPK fertilizer, farm yard manure, sheep dung and chicken manure as well as organic manures as mixture at half of the tested rates for each on mineral contents of pea plant foliage expressed as nitrogen, phosphorus, potassium, calcium and sodium.

Statistical analysis indicated that such treatments significantly affected all assayed macro-element contents. The highest values of nitrogen, phosphorus and calcium and the lowest values of sodium content were attributed to the application of the combination of the three used organic manure sources followed with the treatment of half farm yard manure plus half chicken manure for nitrogen, half farm yard manure plus half sheep dung for phosphorus and calcium contents and individual farm yard manure for sodium. On the other hand, the highest potassium concentration in pea foliage was achieved from using mineral fertilization followed with application of the combination of the three used different sources of organic manure. These results are true in both growing seasons of the experiment. Such increments in N, P and Ca due to the application of organic manures compared to the recommended dose of NPK may be attributed to the organic manure contents of total nitrogen and phosphorus, in all cases, more than those applied through mineral fertilization (Tables D and E) especially in combined treatments which may

Table (18): Effect of NPK and different organic manures on foliage mineral content (mg. / 100g.) of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000					2000 - 2001				
	N	P	K	Ca	Na	N	P	K	Ca	Na
NPK	3159	174	2468	964	232	3078	167	2439	934	246
Farm yard manure (FYM)	3845	238	2365	1357	157	3809	226	2346	1358	164
Sheep dung (Sh.D.)	3761	212	2086	1345	208	3738	208	2049	1322	216
Chicken manure (Ch.M.)	3925	205	2022	1306	194	3916	193	2113	1284	203
½ FYM + ½ Ch. M.	4036	229	2287	1414	148	3985	217	2294	1396	159
½ FYM + ½ Sh.D.	3816	253	2341	1430	166	3784	239	2315	1418	171
½ Ch. M. + ½ Sh. D.	3782	217	2154	1322	181	3767	205	2152	1306	194
½ FYM + ½ Sh.D. + ½ Ch. M.	4158	269	2417	1477	123	4126	254	2405	1444	126
LSD at 0.05	**31**	**19**	**43**	**41**	**19**	**25**	**20**	**28**	**42**	**12**

justify increasing nitrogen and phosphorus concentration in plant tissue. Furthermore, during the decomposition of organic manures, more amounts of organic acids are produced in turn decreasing soil solution pH **(Waksman, 1952 ; Bear, 1955)** and some nutrients affected with salinity become more available like calcium which increased according to application of mixed organic manure. The decreasing sodium concentration may be warrant to same cause.

The obtained results are in agreement with those reported by **Araujo *et al.* (1982), Arisha and Abd El-Bary (2000), El-Bassiony (2003) and El-Shimi (2004).**

4.2.3. Yield and its component of peas:-

Data in Table (19) reflect the effect of soil amendments, *i.e.*, farm yard manure, sheep dung and chicken manure, as well as their combinations at half amount of used rates in addition to the recommended dose of NPK fertilization on green pod yield and its components expressed as number and weight of pods per plant, average of pod weight and total green pod yield per fed. Obtained results indicate that all individual and combinations of organic manure treatments significantly increased total green pod yield and its components compared with the recommended dose of NPK fertilizers. Such increasing in total green pod yield and its components are connected with the increasing in plant growth and its content of organic components and macro-nutrients as shown in Tables (15 and 18 respectively), may increase the productivity of the same plant under the same treatments.

Table (19): Effect of NPK and different organic manures on yield and its component of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000				2000 - 2001			
	Number of pods / plant	Average of pod weight (g.)	Average of plant yield (g.)	Yield kg. / Fedd.	Number of pods / plant	Average of pod weight (g.)	Average of plant yield (g.)	Yield kg. / Fedd.
NPK	2.9	3.9	11.5	1247	3.6	2.8	11.2	1068
Farm yard manure (FYM)	6.2	5.3	32.8	4123	6.3	4.7	30.0	3833
Sheep dung (Sh.D.)	5.1	5.4	27.7	3337	5.5	4.8	26.6	2947
Chicken manure (Ch.M.)	6.1	5.1	31.2	3573	5.9	4.7	27.4	3297
½ FYM + ½ Ch. M.	6.1	5.7	34.7	4884	6.0	5.2	30.9	4181
½ FYM + ½ Sh.D.	5.8	5.6	32.4	4476	5.8	5.1	29.7	3857
½ Ch. M. + ½ Sh. D.	5.6	5.4	30.6	3495	5.6	4.8	27.2	3151
½ FYM + ½ Sh.D. + ½ Ch. M.	6.9	5.9	40.4	5947	6.7	5.3	35.6	5028
LSD at 0.05	**0.2**	**0.2**	**1.9**	**264**	**0.3**	**0.2**	**1.8**	**349**

Wherever, the highest values of number and weight of pods per plant and the total yield per fed. were achieved from the application of the combination of half amount of farm yard manure plus half amount of sheep dung plus half amount of chicken manure in two respectively growing seasons.

With respect to the effect of organic manure on the yield and its components of peas, obtained results are in agreement with those indicated by **Farrag, *et al.* (1993), Jasrotia and Sharma (1999), Arisha and Abd El- Bary (2000)** and **Ahmed *et al.* (2003)** on pea as well as **Guu *et al.* (1995), Tamayo and Munoz (1996), El-Sheikh and El-Zidany (1997), Guu *et al.* (1997), Singer *et al.* (1998), Hanna and El-Gizy (1999), Gaber (2000), Santos *et al.* (2001)** and **El-Shimi (2004)** on common bean (*Phaseolus vulgaris*).

4.2.4. Physical characteristics of green pods:-

The physical characteristic of the produced green pod expressed as average pod length, pod diameter, number of seeds per pod, 100-seeds weight and netting percentage as affected with recommended dose of NPK fertilizer, farm yard manure, sheep dung and chicken manure as a single form and or half amount of such studied organic manures as a mixture are tabulated in Table (20).

Data showed that application of the individual or combined organic manure treatments significantly increased all studied parameters of green pods compared with NPK treatment. In this respect, the application of FYM at rate of 20 m^3/fed +

Table (20): Effect of NPK and different organic manures on some physical characteristic of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000					2000 - 2001				
	Average pod length (cm)	Average pod diameter (mm)	Number of seeds / pod	100 seed weight (g)	Net weight (%)	Average of pod length (cm)	Average of pod diameter (mm)	Number of seeds / pod	100 seed weight (g)	Net weight (%)
NPK	4.6	8.4	3.8	34.0	43.6	5.1	7.6	4.2	33.5	41.4
Farm yard manure (FYM)	7.3	11.2	6.4	40.5	56.3	7.1	11.2	6.0	40.2	55.1
Sheep dung (Sh.D.)	6.8	10.9	6.4	41.5	55.4	6.7	10.6	6.2	41.2	53.7
Chicken manure (Ch.M.)	7.0	11.3	6.0	43.9	58.8	6.9	11.3	5.7	41.8	57.6
½ FYM + ½ Ch. M.	6.9	11.4	6.7	44.7	57.7	6.7	11.5	6.2	42.0	56.9
½ FYM + ½ Sh.D.	6.8	11.0	6.9	42.1	59.5	6.7	11.1	6.3	41.3	58.3
½ Ch. M. + ½ Sh. D.	6.5	11.0	6.4	42.6	59.9	6.5	11.0	6.0	41.3	59.1
½ FYM + ½ Sh.D. + ½ Ch. M.	7.5	11.6	7.1	44.7	61.6	7.2	11.7	6.6	42.2	60.4
LSD at 0.05	**0.4**	**0.2**	**0.3**	**1.5**	**4.4**	**0.2**	**0.3**	**0.3**	**4.8**	**3.7**

Sh.D at rate of 15 m^3/fed + Ch.M at rate 5 m^3/fed treatment accomplished the superiority values in all studied pod parameters.

Such increments due to the effect of organic manures on physical characteristic of pea green pods were due to the enhancing effect of biological process on vegetative growth (Table 15) and increasing the accumulation of macro-nutrients as well as decreasing salt harmful effect on plant foliage (Table 18) which in turn translocated to the fruits.

The results regarding the effect of organic manures on physical characteristics of pea green pod are in agreement with those of **Farrag (1996), Jasrotia and Sharma (1999)** and **Arisha and Abd El- Bary (2000)** on peas as well as **Guu *et al.* (1995), Tamayo and Munoz (1996), Guu *et al.* (1997) , Singer *et al.* (1998)** and at last with those **El-Shimi (2004)** on *Phaseolus vulgaris*. In addition, **El-Sheikh and El-Zidany (1997), Hanna and El-Gizy (1999), Gaber (2000)** and **Singer *et al.* (2001)** on bean plants.

4.2.5. Nutritional value of green pea seeds:

4.2.5.1. Organic chemical constituents:

Data in Table (21) represent the organic chemical constituents of dried green pea seeds expressed as crude protein, total carbohydrates and fiber percentage as affected by the application of recommended dose of mineral fertilizer and organic manures treatments either as individual or in

Table (21): Effect of NPK and different organic manures on percentage of chemical composition in dried green seeds of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000			2000 - 2001		
	Protein	Carbo-hydrates	Fibers	Protein	Carbo-hydrates	Fibers
NPK	16.9	63.6	6.3	16.0	64.4	6.6
Farm yard manure (FYM)	19.1	59.3	4.8	18.3	59.8	5.0
Sheep dung (Sh.D.)	18.2	61.3	5.2	17.1	62.1	5.4
Chicken manure (Ch.M.)	19.4	58.8	4.7	18.8	59.2	4.8
½ FYM + ½ Ch. M.	20.0	58.2	4.6	18.9	58.6	4.8
½ FYM + ½ Sh.D.	18.9	60.2	5.0	17.6	61.3	5.0
½ Ch. M. + ½ Sh. D.	18.5	60.8	5.0	17.8	60.6	5.1
½ FYM + ½ Sh.D. + ½ Ch. M.	20.2	57.3	4.5	19.4	58.4	4.6
LSD at 0.05	**1.1**	**3.7**	**0.4**	**0.5**	**2.9**	**0.3**

combination form. The results indicate that significant differences in crude protein, total carbohydrates and fiber percentage in seeds were achieved from application of the organic manure treatments compared with using the recommended dose of mineral fertilizer. In this respect, using organic fertilizers as a mixture at rate of 20 m^3 FYM + 15 m^3 Sh.D + 5 m^3 Ch.M/ fed. followed by treatment contains 20 m^3 FYM + 5 m^3 Ch.M reflected the highest values of total crude protein during both seasons of study. On the other hand, using mineral fertilizers at the recommended dose exhibited the highest values of total carbohydrates and fiber percentage. The results were in the same trend in the two experimental seasons.

Similar results were reported by **El-Gizy (1990)** on common bean, **Singh et al. (1992)** on pea, **El-Sheikh and El-Zidany (1997)** on faba bean, **Jasrotia and Sharma (1999)**, **Singer *et al.* (2001)** and **El-Shimi (2004)** on snap bean.

4.2.5.2. Mineral chemical constituents:

Data presented in Table (22) show the effect of recommended dose of NPK fertilizer, farm yard manure, sheep dung and chicken manure on mineral content of dried green pea seeds expressed as total nitrogen, phosphorus, potassium, calcium and sodium. The results indicated that the combination of organic manure, *i.e.*, FYM + Sh.D + Ch.M treatment at half of tested rate for each significantly increased the concentration of total nitrogen, phosphorus and calcium content. However, it decreased sodium content in dried green pea seeds. Meanwhile,

Table (22): Effect of NPK and different organic manures on mineral content (mg. / 100g.) in dried green seeds of pea plants cv. Little marvel.

Characters / Treatments	1999 - 2000					2000 - 2001				
	N	P	K	Ca	Na	N	P	K	Ca	Na
NPK	2944	217	1887	495	127	2784	214	1924	461	135
Farm yard manure (FYM)	3323	289	1752	717	102	3175	271	1683	669	107
Sheep dung (Sh.D.)	3158	261	1694	680	114	2967	248	1531	662	123
Chicken manure (Ch.M.)	3363	253	1523	635	110	3260	240	1401	594	117
½ FYM + ½ Ch. M.	3484	297	1679	751	106	3293	286	1514	696	113
½ FYM + ½ Sh.D.	3286	311	1733	784	107	3086	298	1634	727	115
½ Ch. M. + ½ Sh. D.	3217	283	1610	670	112	3053	263	1473	630	120
½ FYM + ½ Sh.D. + ½ Ch. M.	3515	319	1787	788	95	3377	306	1729	738	99
LSD at 0.05	**177**	**14**	**46**	**17**	**9**	**84**	**17**	**42**	**11**	**8**

the concentration of potassium in seeds significantly increased with the application of NPK fertilizer. These results agree with those obtained by **Arisha and Abd El-Bary (2000)**, **Ahmed *et al.* (2003)** on peas, **Araujo *et al.* (1982)**, **Soliman *et al* (1991)**, **El-Bassiony (2003)** and **El-Shimi (2004)** on common bean.