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RESPONSE OF PEAS TO ORGANIC MANURE AND NPK FERTILIZATION.

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ABSTRACT:

Two field experiments were conducted at the Farm of Al-Zawia Zone - Libya in the winter seasons of 2006/2007 and 2007/2008 to study the effect of organic manure (cheep manure rates , i.e. 7.5, 15 and 22.5 m^3/ hectare, and NPK fertilization levels, i.e. o-o-o, 100-150-80 and 150-200-120 kg/hectare on plant growth, green pod yield and it's components and the nutritive values of pea seeds cv. Master-B. The results showed that adding 22.5 m^3/hectare caused a highest values of pea plant growth, i.e. plant height, number of leaves and dry weight of leaves, green pod yield of peas and its components, i.e. number of pods/plant, average pod weight, both of total green pod yield per plant and per hectare and number of seeds per pod, as well as the nutritive values of pea seeds, i.e. T.SS., ascorbic acid and total soluble sugars percentages. The highest values of different characters above mentioned were obtained by applying pea plants with 150-200-120 kg NPK fertilization per hectare.

The interaction between organic manure at 22.5 m^3 cheep manure/hectare) and NPK fertilization (150-200-120kg/hectare), increased in most cases, growth parameters, green pod yield and its components of peas as well as the nutritive values of seeds.

***Conclusively,** it could be concluded that the best treatment for high pea plant growth, green pod yield and its components as well as nutritional values of seeds were 22.5 m^3 cheep manure /hectare),150-200-120 kg / hectare NPK fertilization levels, and followed by the interaction between 22.5 m^3 cheep manure /hectare with 150-200-120 kg/hectare NPK fertilization.*

Key words: Pea plants, organic manure and NPK fertilization.

INTRODUCTION

Pea (*Pisum sativum* L.) is one of the most important leguminous vegetable crops grows in winter season. Many attempts were done to reface of chemical fertilization by using the suitable doses of its, as well as adding organic manure. The growth of leguminous plants, dry matter content, chemical composition and yield and its components increased by organic manure (Osman, 1998 and El-Mansi *et al*., 1999 on peas) or NPK application (Bakry *et al;* 1984; and Abdalla *et al.*, 2000 on peas, and Eid,1991 on common bean).

Therefore, the aim of the present study was to obtain the highest pea yield with less pollution resulting from chemical fertilizers by minimizing the NPK application and adding organic manure.

MATERIALS AND METHODS

The experiment of this study was carried out during the two successive winter seasons of 2006/2007 and 2007/2008 at Al-Zawia zone , Libya. The soil was sandy in texture. The soil chemical constituents are presented in Table 1.

Table 1. Soil chemical analysis of the experimental field of the present study.

Characters	Values
Available nitrogen	88 ppm
Available potassium	115 ppm
pH	7.6
Organic matter	0.08 %
CEC(Cation exchangeable Capacity)	19.0 (meq/100g.soil)

The soil was prepared and rhizobium inoculated seeds cv Master-B were sown on the two sides of the rows. Seeds were sown on the 2^{nd} and 1^{st} of November in 2006 and 2007 seasons, respectively.

The treatments were randomly arranged in a split plot design with three replicates in which cheep manure treatments were randomly arranged in the main plots, and nitrogen, phosphorus and potassium fertilization levels were randomly distributed in the sub- plots.

Cheep manure was applied at the rates of 7.5, 15 and 22.5 m^3/ hectare in one dose during soil preparation (Table 2).

Nitrogen fertilizer was in the form of ammonium sulphate (20.5% N), phosphorus fertilizer was in the form of calcium superphosphate (16.5% P_2O_5)

and potassium fertilizer was in the form of potassium sulphate (48 % K_2O). NPK fertilization levels were as follows:

N	P_2O_5	K_2O (kg/hectare)
0	0	0
100	150	80
150	200	120

The treatments of NPK fertilization levels were broadcasted in two equal doses at 15 and 30 days after sowing. Plot area was 10.5 m^2, which were three ridges 5m. length and each 70 cm width. Seeds were sown at 15 cm apart within every ridge.

Sprinkler irrigation system was used. Normal cultural procedures known for commercial pea production, under the condition of Libyan soils were followed.

Table 2. Chemical analysis of the used cheep manure.

Chemical contents and characters	Values
pH	6.8
Electric conductivity (EC)	3.6
Total organic carbon	26.8
C/N ratio	1: 33.5
Total nitrogen (%)	0.9
Total potassium (%)	0.3
Total phosphor (%)	0.4
Aching (%)	6.0
Moisture (%)	55.0

Data recorded:

Vegetative growth :

Sample of five plants from each plot were randomly chosen at 60 days after sowing and the following data were recorded:

1- Plant height (cm).

2- Number of leaves/ plant.
3- Dry weight of leaves (g) /plant.

Green pods yield and its components:

The harvest period was started on the 3rd and 5th of January in 2007 and 2008, respectively. Fresh pods yield of each plot was harvested four times weekly and green pods yield per hectare was calculated. The following data were recorded:

1- Mean number of pods/plant.
2- Average pod weight (g).
3- Total green pods yield/ plant(g).
4- Total green pods yield/ hectare(ton).
5- Average number of seeds / pod.

Nutritional value of the seeds:

1-T.S.S% (Total soluble solids): it was determined with Zeiss hand refract meter.
2-Ascorbic acid (mg/100g.FW): it was determined by the method described by Mattk John (1970).
3-Total soluble sugars (%): it was determined calorimetrically using the method described by Dubois *et al.* (1960).

The results were subjected to standard analysis of variance according to the procedure described by Snedecor and Cochran (1980). For comparison between means, least significant differences (LSD) at 0.05 was used.

RESULTS AND DISCUSSION

Vegetative growth :

a- Effect of organic manure :

Cheep manure treatments significantly increased the vegetative growth of pea plants, expressed as plant height, both number and dry weight of leaves/plant (Table 3). Results in Table 3 indicate that increasing cheep manure level up to its highest level (22.5 m^3/hectare) led to an increase in the vegetative growth of pea plants.

These results were true in the two growing seasons of experiment. Cheep manure plays an important role to providing plants with balance mineral nutrition. Moreover, it encourages plants for the development of

Table 3. Effect of organic manure and NPK fertilization on growth of pea plants during 2006/2007 and 2007/2008 seasons.

Treatments			Plant height (cm)		No. of leaves / plant		Dry weight of leaves / plant (g.)	
Organic manure m^3/hectare			2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008
7.5			57.56	58.01	25.66	25.93	4.64	4.66
15.0			60.59	59.72	26.71	26.87	5.84	5.37
22.5			67.57	62.67	29.06	28.03	6.52	6.1
LSD(0.05)			**0.32**	**0.44**	**0.29**	**0.25**	**0.08**	**0.10**
N	**P**	**K**						
kg/hectare								
0	**0**	**0**	59.38	57.51	24.33	24.88	5.19	4.79
100	**150**	**80**	61.71	59.99	26.34	26.72	5.59	5.35
150	**200**	**120**	64.62	62.90	30.74	29.23	6.22	6.01
LSD(0.05)			**0.31**	**0.44**	**0.30**	**0.24**	**0.09**	**0.10**

better root system and consequently, led to better vegetative growth (Broaldh, 1992). These results are in agreement with those reported by Osman (1998) and El-Mansi *et al*. (1999).

a- Effect of NPK fertilization levels :

Increasing the levels of NPK fertilization till 150-200-120 kg/hectare gradually increased vegetative growth of pea plants (Table 3).

This might be attributed to the role of N, P and K in plants, where N increased the efficiency of the plant in building metabolites (Bakry *et al.*, 1984), phosphorus plays indispensable role in the enzyme system necessary for the energy transform in photosynthesis and respiration (Edmond *et al.*, 1981), and potassium element is very important in the overall metabolism of plant. and has a beneficial effect on water consumption (Bidwell ,1979).

Such results coincided with those obtained by Bakry *et al*. (1984); Singh (1990), Abo Baker *et al.* (1993); and Abdalla *et al.*(2000)on pea plants and Eid (1991) on common bean.

b- Interaction effect between organic manure and NPK fertilization:

Data in Table 4 showed that the best results on vegetative growth of pea plants were obtained from the interaction of (22.5 m^3 cheep manure /hectare) and 150-200-120 kg/hectare NPK fertilizaters followed by (22.5 m^3 cheep manure /hectare) and 100-150-80 kg/hectare fertilizers. The lowest values were obtained by interaction between (7.5 m^3/ hectare) cheep manure and untreated by NPK.

Yield and it's components

a- *Effect of organic manure* :

Data in Table 5 revealed that adding cheep manure resulted in greater yield of peas and its components ,expressed as number of pods/plant, average pod weight, total green pod yield/plant, and /hectare as well as, number of seeds/pod. There are gradually increases in yield and its components with increase cheep manure from 7.5 to 22.5 m^3/ hectare. These results may be attributed to the favorite effects of organic manure on soil and microorganisms which be active and release the minerals to pea plants which encourage vegetative growth and dry matter content and consequently high pod yield and its component (Pyatkin and Krivoshein, 1980).

Such results coincided with those obtained by Osman (1998) and El-Mansi *et al*. (1999).

b- Effect of NPK fertilization levels :

Data presented in Table 5 indicated that number of pods/plant, average pod weight, total green pod yield/hectare and number of seeds/pod, responded significantly to NPK fertilization levels. The treatment of NPK fertilization with high level, i.e., 150-200-120, being the most effective level in the two growing seasons. The superiority in total green pod yield of pea by application of relatively high nitrogen, phosphorus and potassium levels might be attributed to their roles in metabolites synthesized by the plant (Bidwell, 1979). In addition potassium at the compound of NPK fertilization level in a part of enzymes and it is needed in formation of protoplasm and translocation the carbohydrates. As well as , phosphorus is a part of energy compounds which it important for the biosynthesis in plant (Bidwell, 1979). Moreover, the high level of fertilization promotes increasing both number and weight of pods of pea plants, consequently increasing the yield.

These results are in a harmony with those reported by Singh (1999) Abo.Baker *et al*. (1993); Hassan *et al.* (1993) and Abdalla *et al.*(2000) on peas and Eid (1991) on common bean.

Table 4. Interaction effect of organic manure and NPK fertilization on growth of pea plants during 2006/2007 and 2007/2008 seasons.

Treatments				Plant height (cm)		No.of leaves / plant		Dry weight of leaves/plant (g.)	
Organic manure m^3/hectare	N	P	K kg/hectare	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008
	0	**0**	**0**	55.13	55.40	23.23	24.17	4.19	4.24
7.5	**100**	**150**	**80**	57.27	58.20	25.27	25.83	4.42	4.37
	150	**200**	**120**	60.27	60.43	28.47	27.80	5.31	5.36
	0	**0**	**0**	57.60	56.97	24.43	24.67	5.56	4.62
15.0	**100**	**150**	**80**	60.63	59.33	26.47	27.23	5.83	5.37
	150	**200**	**120**	63.53	62.87	29.23	28.70	5.14	6.13
	0	**0**	**0**	65.40	60.17	25.33	25.80	5.82	5.50
22.5	**100**	**150**	**80**	67.23	62.43	27.30	27.10	6.52	6.30
	150	**200**	**120**	70.07	65.40	34.53	31.20	7.22	6.53
LSD (0.05)				**0.55**	**0.77**	**0.51**	**0.43**	**0.41**	**0.18**

c- Effect of interaction between organic manure and NPK fertilization levels :

Data shown in Table 6 reveal that the application of (22.5 m^3 cheep manure /hectare) with 150-200-120 kg/ hectare NPK fertilization resulted in the greatest values of green pod yield of peas and its components, i.e. number of pods per plant, average pod weight and both total green pod yield per plant and per hectare. The average pod weight in the second season and the number of seeds per pod in both seasons were not affected by the interaction. The lowest values of green pod yield and its components of peas

were obtained by (7.5 m^3 cheep manure /hectare) and untreated with NPK fertilization.

Nutritive values of seeds

a- Effect of organic manure :

Data illustrated in Table 7 revealed that increasing the rate of cheep manure up to 22.5 m^3/ hectare gradually increased the nutritive value of seeds of peas, i.e. T.S.S %, ascorbic acid and total soluble sugars %. Obtained results are in harmony with those of Browaldh (1992);Osman (1998) and El. Mansi, *et al*.(1999).

Table7. Effect of organic manure and NPK fertilization on the nutritive values of pea seeds during 2006/2007 and 2007/2008 seasons.

Treatments			TSS %		Ascorbic acid mg/100gm f.w.		Total soluble sugars(%)	
Organic manure m^3/hectare			2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008	2006/ 2007	2007/ 2008
7.5			5.88	5.88	3.89	3.88	3.59	3.56
15.0			6.02	5.93	4.05	3.96	3.72	3.65
22.5			6.13	6.14	4.92	4.71	4.04	3.79
LSD(0.05)			**0.08**	**0.05**	**0.06**	**0.02**	**0.09**	**0.08**
N	**P**	**K** kg/hectare						
0	**0**	**0**	5.76	5.77	3.92	3.87	3.57	3.55
100	**150**	**80**	5.96	5.97	4.37	4.26	3.82	3.64
150	**200**	**120**	6.32	6.20	4.57	4.43	3.96	3.81
LSD (0.05)			**0.07**	**0.05**	**0.05**	**0.03**	**0.10**	**0.09**

b- Effect of NPK fertilization levels :

Data in Table 7 showed that the NPK fertilization level of 150-200-120 kg/hectare resulted in the greatest values of nutritive value of peas seeds. These results are in agreement with those reported by Hassan *et al.* (1993)on peas and Eid (1991) on common bean.

c- Effect of interaction between organic manure and NPK fertilization levels :

Data illustrated in Table 8 indicated that the interaction effect between 22.5 m^3 cheep manure / hectare and 150-200-120 kg/ hectare NPK fertilization significantly increased the nutritive values of pea seeds, i.e. T.S.S in the second season, Ascorbic acid in both seasons and total soluble sugars percentages in the first season. The lowest nutritive values of pea seeds were obtained by 7.5 m^3 cheep manure /hectare) with no NPK fertilization.

Table 8. Interaction effect of organic manure and NPK fertilization on the nutritive values of pea seeds during 2006 / 2007 and 2007 / 2008 seasons.

Treatments				TSS %		Ascorbic acid mg/100gm f.w.		Total soluble sugars(%)	
Organic manure m^3/hectare	**N**	**P**	**K**	**2006/ 2007**	**2007/ 2008**	**2006/ 2007**	**2007/ 2008**	**2006/ 2007**	**2007/ 2008**
	kg/hectare								
	0	0	0	5.70	5.71	3.71	3.71	3.45	3.43
7.5	**100**	**150**	**80**	5.86	5.88	3.91	3.90	3.63	3.57
	150	**200**	**120**	6.10	6.03	4.06	4.03	3.70	3.69
	0	**0**	**0**	5.77	5.77	3.83	3.77	3.59	3.58
15.0	**100**	**150**	**80**	5.94	5.92	4.09	3.97	3.72	3.62
	150	**200**	**120**	6.35	6.10	4.23	4.14	3.84	3.74
	0	**0**	**0**	5.81	5.82	4.21	4.13	3.66	3.65
22.5	**100**	**150**	**80**	6.10	6.10	5.10	4.91	4.12	3.72
	150	**200**	**120**	6.50	6.49	5.44	5.10	4.34	4.00
LSD (0.05)				**NS**	**0.09**	**0.10**	**0.13**	**0.16**	**NS**

Conclusively, it could be concluded that the best treatment for high pea plant growth, green pod yield and its components as well as nutritional values of seeds were 22.5 m^3 cheep manure /hectare),150-200-120 kg / hectare NPK

fertilization levels, and followed by the interaction between 22.5 m^3 cheep manure /hectare with 150-200-120 kg/hectare NPK fertilization.

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استجابة البسلة للتسميد العضوي والنتروجيني الفوسفاتي البوتاسي

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أجريت تجربة حقلية بمزرعة بمنطقة الزاوية- ليبيا ، خلال موسمي ٢٠٠٦/٢٠٠٧، ٢٠٠٧/٢٠٠٨ لدراسة تأثير التسميد العضوي (سماد الغنم) بمعدلات ٠، ٧.٥، ١٥، ٢٢.٥ م^{3} / هكتار،وسماد نتروجيني فوسفاتي بوتاسي بمستويات 0-0-0 ، ٨٠-١٥٠-١٠٠ ، ١٥٠ -٢٠٠ -١٢٠ كجم / هكتار،علي الترتيب علي نمو النبات ، محصول القرون الخضراء ومكوناته والقيمة الغذائية لبذور البسلة صنف ماستر– ب .

وأوضحت النتائج أن اضافة ٢٢.٥ م^{3}سماد الغنم / هكتار أعطي أعلي القيم لنمو نبات البسلة معبراً عنها بارتفاع النبات،عدد الأوراق ووزنها الجاف، محصول القرون الخضراء ومكوناته معبراً عنها بعدد القرون / نبات،متوسط وزن القرن،محصول القرون الخضراء الكلي للنبات والهكتار،وعدد البذور بالقرن وكذلك القيمة الغذائية لبذور البسلة وهي النسب المئوية لكل من المواد الصلبة الذائبة الكلية،حامض الأسكوربيك والسكريات الذائبة الكلية. وأيضا تم الحصول علي أعلي القيم للصفات المذكورة سابقا بإضافة معدل ١٥٠-٢٠٠-١٢٠ كجم نتروجين فوسفور بوتاسيوم / هكتار، علي الترتيب.

كما أدي التفاعل بين التسميد العضوي بمعدل ٢٢.٥ م^{3} / هكتار من سماد الغنم ومعدل ١٥٠-٢٠٠-١٢٠ كجم نتروجين فوسفور بوتاسيوم / هكتار إلي أعلي زيادة معنوية لمعظم صفات النمو ،محصول القرون الخضراء ومكوناته والقيمة الغذائية للبذور.