J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 5 (9): 1269-1283, 2014

EFFECT OF SOME NATURAL MATERIALS ON PEA PLANT GROWN ON CALCAREOUS SOIL

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ABSTRACT

A pot experiment was conducted at the Agric. Exp. Station of El-Mansoura Univ. during the winter season of (2013/ 2014); to investigate the effect of some amendments on calcareous soil using sugar peas (*Pisum sativum* var . macrocarpon) variety of "mangetout"" ,type (Snow wind).

Thirteen treatments were arranged in a complete block design, which were the simple possible combination between four treatments of soil amendments application (Magnetite (100, 200 and 300 kg fed^{-1}), Sulphur (200, 300 and 400 kg.fed^{-1}), Humic acid (5, 7 and 9 kg fed^{-1}) and Fulvic acid (2, 3 and 4 kg fed^{-1})) compared with control treatment. Each treatment was replicated three times.

The highest mean values of pea plants as fresh, dry weight (g), plant height (cm) and No. of leaves plant^{-1} also NPK% and its uptake mg plant^{-1} in plant foliage, N, P, K% and its uptake g plant^{-1}, Fe ppm in pea seeds were significantly affected after 50 and 90 days during the season and obtained with using magnetite as material amendment at the rate of 300 kg fed^{-1} followed by using soil humic acid at the rate of 9 kg fed^{-1} compared with the other treatments. The same results were obtained with yield parameters (weight of 1000 seeds (g), fresh pods weight (g), fresh pods length and pea yield (g plant)$^{-1}$ and seed quality (Total carbohydrates, Total sugar % and V.C (mg 100g) $^{-1}$ which recorded the highest values with adding magnetite at the rate of 300 kg fed^{-1}. In plant foliage, the highest values of Fe ppm was recorded with using magnetite as a source of iron at the rate of during both stages followed by using humic acid. As for Zn and Mn ppm recorded, the highest mean values with using fulvic acid at the low rate 2kg fed^{-1} comparing the all parameters with the control which recorded the lowest mean values of Fe, Zn and Mn ppm of plant foliage after. This trend was observed during both stages after 50 and 90 days.

Keywords: magnetite,sulphur, humic acid, fulvic acid, pea plant and calcareous soil.

INTRODUCTION

Most cultivated soils in Egypt are clayey to loamy in texture. About 999.600 fed. are sandy calcareous. The low productivity of calcareous soils is often associated with poor plysico-chemical characteristics and with low both organic matter content and available nitrogen. Also, the high pH level results in low availability of phosphate, zinc and iron. Chlorotic symptoms are usually observed on plants grown on calcareous soils. (Fuehring, 1973).Three approaches are often applied for improving calcareous soil physico-chemical characteristics, plant growth and productivity of planted crops: (1) Application of organic materials (2) Supplementation and management of essential nutrients (3) Application of sulfur for partially neutralizing the $CaCO_3$ present in soil.

Pea (*Pisum sativum* L.) is a member of family Fabaceae or Papilionaceae and considered as popular vegetable crop and one of the most important legume crops in Egypt for local consumption and exportation.

This crop is widely used as a source of protein in human diets due to its high content of protein and balanced amino acids composition, in addition, pea plants content ascorbic acid, carbohydrates, and has a good digestibility. In general, this crop gives high yield and ensures high profits, especially when cultivated as green pods. Therefore, it occupies a prominent position among other legumes in the Egyptian agriculture. In addition to its nutritional value, it is rich source of protein, good source of vitamins A, B and C, and also contains a high proportion of minerals . Pea is used as a fresh vegetable, frozen or canned(Baloch*.,* 1994).

Humic substances are important soil components because they constitute a stable fraction of carbon and improve water holding capacity, pH buffering and thermal insulation (McDonnell *et al*., 2001). Studies of the positive effects of humic substances on plant growth have demonstrated the importance of optimum mineral supply, independent of nutrition (Yildirim, 2007). HA is a suspension, based on potassium-humates, which can be applied successfully in many areas of plant production as a plant growth stimulant or soil conditioner for enhancing natural resistance against plant diseases and pests (Scheuerell and Mahaffee, 2006), stimulation plant growth through increased cell division, as well as optimized uptake of nutrients and water, moreover, HA stimulated the soil microorganisms (Chen *et al.,* 2004).

Sulfur (S) is the fourth major plant nutrient after nitrogen (N), phosphorus (P) and potassium (K). It is essential for synthesis of the amino acids like cystine, cysteine and methionine, a component of vitamin A and activates certain enzyme systems in plants (Havlin *et al.,* 2004). Sulphur (S) is one of the elements known to be essential for the legume-rhizobium system with specific physiological and biochemical roles. The S demand of legume crops is higher than that of cereal crops. Studies on different legumes have shown that the concentration of the S-containing amino acids was markedly declined with decreasing S supply.Sulphur fertilization was also found to increase N accumulation and yield of legumes on S deficient soils.

Another essential nutrient is iron (Fe), the lack of which causes chlorosis and is responsible for significant decreases in yield and quality of plants. Although most soils contain adequate total iron, amounts that are available to plants might be inadequate dependent on various soil factors such as very high or low soil temperature, high humidity, poor soil aeration and compaction, high pH, HCO_3^- and $CaCO_3$ contents. Besides the bad physical properties of the soils, Fe chlorosis is also related with PO_4^- and NO_3^- aniona and other heavy metal concentrations such as Zn, Cu, Mn, Co, Ni and Cd (Basar, 2000).

Therefore, the present work was undertaken to investigate the effect of some natural materials as magnetic iron, sulphur and humic substanses such as addition of humic and fulvic acids on vegetative, quality and yield and its components of pea plant.

MATERIALS AND METHODS

A pot experiment was conducted at the Agric. Exp. Station of El-Mansoura Univ. during the winter season of (2013/ 2014); to investigate the effect of some amendments on calcareous soil using sugar peas (*Pisumsativum*var . macrocarpon) variety of "mangetout", type (Snow wind).

Thirteen treatments were arranged in a complete block design, which were the simple possible combination between four treatments of soil amendments application {Magnetite (100, 200 and 300 kg fed^{-1}), Sulphur (200, 300 and 400 kg fed^{-1}), Humic acid (5, 7 and 9 kg fed^{-1}) and Fulvic acid (2, 3 and 4 kg fed^{-1})} compared with control treatment. Each treatment was replicated three times. Thus, the total number of pots were thirty nine for the season.

39 plastic pots; 25 cm diameter and 35 cm height were used in each cultivation. Each pot was filled with 10 kg air dried soil taken from the surface layer (0-30cm) from El-Nobaria Research Station and analysed for some physical and chemical properties as shown in Table (1).

The soil of pots was mixed with farmyard manure at rate of 24 ton fed^{-1} per pot in the surface layer of each pot (0-15 cm) and left after irrigation for 10 days before cultivation.

Eight seeds of sugar peas were inoculated with rhizobium and sown on 24 November 2013 at equal distance and depth. After 21 days from planting (4 true leaves) sugar peas plants were thinned to the most four uniform plants per pot.

Soil moisture was kept at 70 % of field capacity by watering to the constant weight every 5-7 days.

The NPK amendments were added to soil of pots cultivated with sugar peas plants as recommended by the Ministry of Agriculture and Soil Reclamation, 50 kg fed^{-1} N as ammonium sulphate (20.5% N), 100 kg fed^{-1} P_2O_5 as super phosphate (15.5% P_2O_5) and 50 K kg fed^{-1} as potassium sulphate (48%K_2O). Phosphorus fertilizer was added to the soil before planting, while N & K amendments were added in one dose; after 15 days from planting.

Natural materials as magnetite and sulphur were added before one week from planting, but humic acid and fulvic acid were added after two weeks from planting.

After 50 days from planting 2 plants were taken, then at marketing stage (harvest); 90 days after planting of sugar peas plants, another 2 plants were randomly taken from each pot; put in paper bags and carried immediately to the laboratory. Fresh weight of plant was determined; the plant samples were oven dried at 70^{o} c till constant weight. Then, the dried plant samples were weighted (g plant) $^{-1}$ and stored for chemical analysis. At harvesting stage, yield was recorded as weight of 1000 seeds (g) and yield (g plant) $^{-1}$.

Plant samples (foliage) were oven dried at 70^{0}c tell constant weight was reached, and then dry weight in g plant^{-1} was calculated. The dried plant samples were thoroughly ground and stored for chemical analysis in foliage was N, P and K% and Fe, Zn &Mn ppm.

Representative samples of peas pods were randomly taken from each treatment at the harvest stage to determine the quality parameters of peas pods and were expressed as follows: Vitamin C (mg 100g) $^{-1}$, total carbohydrate (%) and total sugar (%).

Table (1): Some physical and chemical properties of the experimental soil before cultivations .

Soil characters		Values
Mechanical analysis (%)	Coarse sand	6.8
	Fine sand	54.7
	Silt	30.6
	Clay	7.9
	Texture class	Sandy loam
Chemical analysis	E.C $dS.m^{-1}$ (soil paste)	6.13
	pH (1:2.5)	8.37
	S.P %	37.0
	O.M. %	0.47
	$CaCO_3$ %	24.6
Physical analysis	Real densit	2.76
	Bulk density	1.60
	Porosity%	42
	F.capacity%	18.3
soluble ions meq/100g soil	Ca^{++}	2.34
	Mg^{++}	0.78
	Na^{+}	5.43
	K^{+}	0.40
	CO_3^{--}	0.00
	HCO_3^{-}	2.51
	Cl^{-}	4.96
	SO_4^{--}	1.35
Available (mg/kg)	N	37.8
	P	6.24
	K	215
	Fe	14.9
	Mn	12.6
	Zn	0.95

Soil analysis:

The electrical conductivity of soil paste was measured by EC meter **,**Soil reaction (pH) was measured in 1:2.5 soil water suspension ,Soil particle size distribution was determined following the international pipette, using (NH_4OH) as a dispersing agent ,Calcium carbonate was determined using Collin's calcimeter, Organic matter content was determined using Walkely's& Black method ,Available N was extracted by determined using the conventional method of Kjeldahl , Available P was extracted with 0.5 M ($NaHCO_3$) adjusted at pH of 8.5 and was determined at a wavelength 660 nm by a spectrophotometer ,Available K was determined by extraction with ammonium acetate at pH 7 and measured using a flam photometer ,Soluble cations and anions in soil paste extract and Available Fe, Mn and Zn in soil were extracted using DTPA-TEA (pH 7.3) and determined using atomic absorption spectrophotometer as described by (*Chapman and Pratt, 1982*)

Plant Analysis*:*

The oven dried material of plant was ground and wet digested by a sulfuric-perchloric acids mixture as described by *Peterburgski,(1968).* The total N, P, K, Fe, Mn and Zn were determined using the following methods.

-Total nitrogen (%) was determined using Kjeldah ,Total phosphorus (%) was determined colorimetrically using the chlorostannus reduce molybdo phosphoric blue colour method in sulphoric system ,Potassium (%) were determined using a flame photometer and Fe, Zn and Mn concentrations were determined using atomic absorption spectrophotometer; model 1100 B as described by (*Chapman and Pratt, 1982*).

-Total carbohydrates were estimated according to the methods of *Sadasivam and Manickam, (1996*).

-Ascorbic acid (vitamin C) in pea seeds was determined by titration with 2.6 diclorophenol indophenol blue dye according to the method reported in *(A.O.A.C.; 1975)*.

-Total soluble sugar, was determined according to the method described by *Sadasivam and Manickam,(1996).*

All data were statistically analyzed according to the technique of analysis variance (ANOVA) and the least significant difference (L.S.D) method was used to compare the difference between the means of treatment values to the methods described by Gomez and Gomez, (1984). All statistical analyses were performed using analysis of variance technique by means of CoSTATE Computer Software.

RESULTS AND DISCUSSION

Effect of using some natural materials on vegetative growth parameters:-

Data in Table 2 show that using some natural materials (magnetite, sulphur, humic and fulvic acid) on vegetative growth of pea plants as fresh, dry weight (g), plant height (cm) and No. of leaves plant^{-1} under different levels from each one were significantly affected after 50 and 90 days during the season.

It was found that the highest mean values of parameters were obtained with using magnetite as material amendment at the rate of 300 kg fed^{-1} followed by using soil humic acid at the rate of 9 kg fed^{-1} compared with the other treatments. On the other hand, the lowest mean values recorded with using control treatments. The same trend were happened after 50 and 90 days

Table (2): Effect of using some natural materials on growth parameters of pea plant .

Char. / Treat.		F.W g/plant		D.W g/plant		Plant height cm		No. of leaves/plant	
		50 days	90 days	50 days	90 days	50 days	90 days	50 days	90 days
Control		5.27	6.04	0.70	0.90	8.49	12.13	30.95	44.22
Magnetite	100 kg.fed^{-1}	6.17	7.07	0.82	1.07	9.28	13.26	33.85	48.36
	200 kg.fed^{-1}	7.12	8.13	0.95	1.21	10.21	14.59	37.24	53.20
	300 kg.fed^{-1}	8.24	9.44	1.24	1.42	11.57	16.53	42.18	60.26
Sulphur	200 kg.fed^{-1}	5.75	6.59	0.74	0.99	8.89	12.70	32.42	46.32
	300 kg.fed^{-1}	6.63	7.86	0.88	1.17	9.82	14.03	35.81	51.16
	400 kg.fed^{-1}	7.62	8.79	1.02	1.33	10.83	15.47	39.49	56.41
Humic acid	5 kg.fed^{-1}	5.90	6.75	0.78	1.02	9.00	12.86	32.83	46.90
	7 kg.fed^{-1}	6.85	7.91	0.91	1.19	10.00	14.29	36.46	52.09
	9 kg.fed^{-1}	7.93	9.11	1.05	1.37	11.10	15.86	40.47	57.81
Fulvic acid	2 kg.fed^{-1}	5.48	6.31	0.71	0.96	8.62	12.32	31.44	44.92
	3 kg.fed^{-1}	6.34	7.26	0.84	1.09	9.56	13.66	34.87	49.82
	4 kg.fed^{-1}	7.38	8.47	0.98	1.26	10.57	15.10	38.55	55.07
L.S.D $_{at\ 5\%}$		0.07	0.09	0.03	0.03	0.22	0.32	0.81	1.12

The benefit gained from magnetite application could be referred to the indirect role of magnetite on soil which increase the availability of some nutrients as ,Fe, The role of iron in plant metabolism and its deficiency resulted in a weak plant stature. The potency of iron could be due to their role in many metabolic aspects in plant cell. Goodwin and Mercer, (1985) stated that iron prophyrins are prosthetic groups of cytochromes, hemoglobin in root nodules and enzyme such as catalase. Sometimes nitrogen application desperately required iron to cure yellowing owing to the role of iron in chlorophyll synthesis. Thus, Improvements in growth and yield of faba bean that achieved by magnetite application were expected. Additionally, iron can substitute Mo as the metal cofactor necessary for the functioning of nitrate reductase the most effective growth enzyme (Prasad and Power, 1997).

On frensh bean, Singh *et al.,* (2001) resulted that S at 40 kg/ha recorded the highest grain yield and the highest total N and S uptake. S at 60 kg/ha recorded the highest straw yield, which was significantly at par with that obtained with S at 40 kg/ha.Teotia *et al.,* (2001) said that S applied individually increased the N and K content of the grain and straw, and the yield of the plant. S affected the Ca content only in straw, but it did not affect the Mg content of both grain and straw of moong bean.

The indirect effects of humic compounds on soil fertility include, increase in the soil microbial population including beneficial microorganisms, improved soil structure and increase in the cation exchange capacity and the pH buffering capacity of the soil (Saruhan *et al.,* 2011) Furthermore, directly, humic acid compounds may have various biochemical effects either at cell wall, membrane level or in the cytoplasm, including increased photosynthesis and respiration rates in plants, enhanced protein synthesis and plant hormone like activity (Chen and Aviad, 1990). In other words, humic substances may possibly enhance the uptake of minerals through the stimulation of microbiological activity (Mayhew, 2004).

As for the effect of magnetite, similar observation was made by El-Gizawy, (2003), El-Tantawy and Nawar, (2013), and Meena and Meena, (2013) resulted that 25 kg $FeSO_4$/ha as basal application significantly increased growth parameters. For humus substances Aknc *et al.,* (2009), El-Bassiony*et al.,* (2010), Buyukkeskin and Akinci, (2011) and Shafeek *et al.,* (2013)stated that using humic acid on broad bean recorded the high values of growth characters, i.e. number of leaves and branches, fresh weight of whole plant.

Effect of using some natural materials on yield and its components of pea plant:-

Data in Table 3 show the effect of using some natural materials on seed yield and its component after harvesting..

Results revealed that adding these materials at different levels caused significant increase in weight of 1000 seeds (g), fresh pods weight (g), fresh pods length and pea yield (g plant) $^{-1}$ compared to control treatment .

It can be arrange these materials from which its effect as magnetite > humic acid >sulphur>fulvic acid comparing with control. Increasing level application for these materials often increase all parameters of yield . On the other hand, the highest mean values of yield parameters were recorded with using magnetite at the rate of 300 kg fed^{-1} followed by soil humic acid at the rate of 9 kg fed^{-1} then sulphur at 400 Kg fed^{-1} and finally with fulvic acid at 4 Kg fed^{-1} after harvesting.

Most soils contain adequate total iron amounts that are available to plants. However, it might be inadequate dependent on various soil factors. Especially on calcareous soils, high pH and $CaCO_3$ content, ion imbalance and poor physical properties such as very high or low soil temperature, high humidity, poor soil aeration, and compaction can induce iron deficiency (Lucena, 2000). Mishra *et al.*, (2003) found that application of iron significantly increased the yield components. As for magnetite iron, the results of the present study were in conformity with those earlier recorded by Kumawat and Rathore, (2006); El-Tantawy and Nawar, (2013) and Nadi *et al.,* (2013) investigated the effect of concentration of Nano-Iron on yield and yield components of faba bean. Results showed that the highest and lowest grain yield belonged to Nano-Iron 6 g/L and control, respectively.

Sulphur also may be increased the availability of some elements in calcareous soils, Kumawat and Khangarot, (2001) showed that application of 80 kg S/ha significantly increased the content of protein, seed yield and gum in seeds of cluster bean, Bohra *et al.,* (2006) resulted that application of graded doses of S up to 40 kg ha^{-1} increased chlorophyll content and active Fe significantly in young emerged leaves at flowering. Sulphur application increased the shoot weight and root nodule weight at flowering and total plant dry matter, pod weight plant^{-1} at maturity over S0. In the experiment, effect of sulphur on the concentration of S was most marked at maturity whereas on the concentration of Fe and N was at flowering. Yield attributes and harvest index also responded favourably to the application to S in soil.

This could be explained that humic acid is rich in both organic and mineral substances which are essential to plant growth and consequently increase yield quality and quantity. Many investigators e.g. El-Bassiony*et al.,* (2010),Vijayakumari*et al*., (2012) and Shafeek *et al.,* (2013) illustrated that high rates of humic acid on broad bean recorded the high values of total yield and its components (pod length and number of pods/plant).

Fulvic acid also play an important role on plant Bama *et al.,* (2005) found that among the treatments, combined application of HA, FA and fertilizer applied by blending recorded the highest soluble protein, and nitrate reductase activity of green gram. The same treatment also recorded the highest available N, available P and available K.

Table (3): Effect of using some natural materials on yield and its components of pea plant.

Treat. / Char.		weight of 1000 seeds (g)	Yield (g plant^{-1})	pods F.w (g)	pods length(cm)
Control		41.63	34.31	6.06	9.10
Magnetite	100 kg.fed^{-1}	42.16	34.42	6.63	9.95
	200 kg.fed^{-1}	43.14	35.15	7.30	10.94
	300 kg.fed^{-1}	43.98	36.16	8.26	12.40
Sulphur	200 kg.fed^{-1}	41.74	34.02	6.35	9.53
	300 kg.fed^{-1}	42.64	34.78	7.02	10.52
	400 kg.fed^{-1}	43.55	35.59	7.74	11.60
Humic acid	5 kg.fed^{-1}	41.91	34.23	6.43	9.65
	7 kg.fed^{-1}	42.83	34.95	7.14	10.72
	9 kg.fed^{-1}	43.81	35.92	7.93	11.89
Fulvic acid	2 kg.fed^{-1}	41.59	33.85	6.16	9.24
	3 kg.fed^{-1}	42.38	34.54	6.83	10.25
	4 kg.fed^{-1}	43.29	35.41	7.55	11.33
L.S.D $_{at\ 5\%}$		0.11	0.55	0.16	0.24

Effect using some natural materials on chemical composition of pea plant:-

N, P and K% of plant foliage:

Data in Tables 4 show the effect of using some natural materials (magnetite, sulphur, humic and fulvic acid) on N, P and K% of plant foliage of 50 and 90 days.

Application of magnetite to soil at the rate of 300 kg.fed^{-1}recorded the higher mean values of NPK% followed by using humic acid at the rate of 9 kg.fed^{-1}. This trend was true during two stages.

Char.	N%	P%	K%

		50 days	90 days	50 days	90 days	50 days	90 days
Control		2.78	2.53	0.240	0.216	3.26	2.87
Magnetite	100 kg.fed^{-1}	3.06	2.76	0.264	0.241	3.44	3.11
	200 kg.fed^{-1}	3.42	3.04	0.295	0.278	3.77	3.44
	300 kg.fed^{-1}	3.80	3.44	0.335	0.308	3.97	3.65
Sulphur	200 kg.fed^{-1}	2.87	2.65	0.246	0.226	3.25	2.97
	300 kg.fed^{-1}	3.22	2.92	0.281	0.263	3.59	3.26
	400 kg.fed^{-1}	3.52	3.22	0.309	0.290	3.87	3.57
Humic acid	5 kg.fed^{-1}	2.96	2.68	0.255	0.237	3.34	3.03
	7 kg.fed^{-1}	3.34	2.98	0.289	0.273	3.66	3.33
	9 kg.fed^{-1}	3.67	3.30	0.327	0.302	3.93	3.62
Fulvic acid	2 kg.fed^{-1}	2.82	2.57	0.240	0.226	3.17	2.89
	3 kg.fed^{-1}	3.17	2.85	0.273	0.256	3.47	3.21
	4 kg.fed^{-1}	3.45	3.15	0.307	0.283	3.72	3.47
L.S.D $_{at\ 5\%}$		0.07	0.07	0.008	0.008	0.15	0.07

Table (4): Effect of using some natural materials on N, P and K% of pea foliage after 50 and 90 days .

Fe, Zn and Mn ppm of plant foliage:

Referring the effect of using some natural materials as (magnetite, sulphur, humic and fulvic acid) on Fe, Zn and Mn ppm of plant foliage of 50 and 90 days .

It is clear from the data of Table 5 that the mean values of Fe, Zn and Mn ppm of plant foliage after 50 and 90 days during season 2013/2014 increased significantly by using some natural materials magnetite, sulphur, humic and fulvic acid). The highest values of Fe ppm was recorded with using magnetite as a source of iron at the rate of 300 kg fed^{-1} during both stages followed by using humic acid. As for Zn and Mn ppm recorded the highest mean values with using fulvic acid at the low rate 2kg.fed^{-1} comparing the all parameters with the control which recorded the lowest mean values of Fe, Zn and Mn ppm of plant foliage after. This trend was observed during both stages after 50 and 90 days.

Table (5): Effect of using some natural materials on Fe, Zn and Mn ppmof plant foliage after 50 and 90 days .

Char. / **Treat.**		**Fe ppm**		**Zn ppm**		**Mn ppm**	
		50 days	**90 days**	**50 days**	**90 days**	**50 days**	**90 days**
Control		41.73	39.90	12.07	11.00	22.00	21.13
Magnetite	100 kg.fed^{-1}	62.60	59.63	14.47	13.96	25.43	24.75
	200 kg.fed^{-1}	70.00	67.20	13.73	13.24	24.63	23.89
	300 kg.fed^{-1}	74.47	70.33	13.15	12.51	23.86	23.13
Sulphur	200 kg.fed^{-1}	50.87	48.93	16.73	16.07	27.63	26.92
	300 kg.fed^{-1}	51.93	50.30	15.97	15.43	26.92	26.18
	400 kg.fed^{-1}	54.17	52.23	15.22	14.63	26.00	25.30
Humic acid	5 kg.fed^{-1}	47.03	45.13	18.95	18.24	30.03	29.14
	7 kg.fed^{-1}	48.87	46.80	18.22	17.52	29.21	28.38
	9 kg.fed^{-1}	49.17	47.67	17.49	16.78	28.42	27.56
Fulvic acid	2 kg.fed^{-1}	42.53	40.30	21.65	20.92	33.48	32.60
	3 kg.fed^{-1}	43.83	42.13	20.31	19.66	32.46	31.70
	4 kg.fed^{-1}	45.83	44.07	19.64	18.89	30.88	30.03
L.S.D $_{at\ 5\%}$		0.96	0.78	0.08	0.08	0.08	0.08

Nutrients in seed pea:

Results in Table 6 show that using some natural materials (magnetite, sulphur, humic and fulvic acid) were affected significantly the average values of N, P, K%, Fe, Zn and Mn ppm of seeds after harvesting under any levels of amendments.

Such data at the same Table also, reveal that application of magnetite at the high rate 300 kg fed^{-1} followed by adding soil sulphur at 9 kg fed^{-1} recorded the highest mean values of N, P, K% and its uptake g/plant and Fe ppm of pea seeds. On the other hand, the mean values of Zn and Mn ppm of pea seeds recorded with adding fulvic acids at the low rate 2 $kg.fed^{-1}$ comparing with control.

Table (6): Effect of using some natural materials on N, P, K% and its uptake, Fe, Zn and Mn ppm of pea seeds after harvesting.

Treat. / Char.		N%	P%	K%	Fe ppm	Zn ppm	Mn ppm
Control		2.90	0.241	3.23	34.55	10.98	22.00
Magnetite	100 $kg.fed^{-1}$	3.26	0.278	3.56	52.11	12.26	23.93
	200 $kg.fed^{-1}$	3.61	0.318	3.85	56.04	11.95	23.61
	300 $kg.fed^{-1}$	3.94	0.361	4.10	62.47	11.68	23.31
Sulphur	200 $kg.fed^{-1}$	3.09	0.259	3.40	45.03	12.86	24.88
	300 $kg.fed^{-1}$	3.46	0.300	3.65	46.93	12.68	24.55
	400 $kg.fed^{-1}$	3.85	0.351	3.96	48.12	12.52	24.23
Humic acid	5 $kg.fed^{-1}$	3.13	0.271	3.41	39.14	13.82	25.76
	7 $kg.fed^{-1}$	3.56	0.311	3.76	41.23	13.46	25.51
	9 $kg.fed^{-1}$	3.88	0.345	3.98	43.24	13.16	25.13
Fulvic acid	2 $kg.fed^{-1}$	2.96	0.252	3.29	35.57	14.87	26.89
	3 $kg.fed^{-1}$	3.43	0.288	3.59	36.73	14.42	26.41
	4 $kg.fed^{-1}$	3.71	0.329	3.94	37.86	14.07	26.02
$L.S.D_{\text{at 5\%}}$		0.06	0.010	0.07	0.13	0.10	0.09

These increases in elemental constituents of pea seeds may be due to the effect of magnetite which increased active iron content of green leaves, iron on stimulating biological activities, i.e., enzyme activity, chlorophyll synthesis, rate of translocation of photosynthetic products and increased nutrient uptake through roots after foliar fertilization. Similar results were reported by Henry *et al.,* (2003), Bohra *et al.,* (2006) and Singh *et al.,* (2013).

Sulphur also has important role , Hell (1998) stated that plants absorb sulphur from the soil through their root system in the sulfate form and transport it to the chloroplasts of leaf cells, where sulfate are reduced to sulphide and built into organic compounds. Elemental form of sulphur is not directly available for plants and has to be transformed in the soil into sulfate form. Kumawat and Khangarot, (2002) found that application of 80 kg S ha^{-1} significantly increased the seed yield of cluster bean over control. Also, significantly increased N, P, S, protein and gum content in the seed, and total uptake of N, P and S, compared to lower S. **Habtemichial *et al.,* (2007)** reported that sulphur application has an important potential of increasing the amount of N fixed by legumes, thus improving the fertility status of soil.

On the other side, El-Hefny, (2010) claimed that humic acid application up to 6kg/fed increased the highest N, P and K uptake and increased K/Na, Ca/ Na ratio, protein and carbohydrates contents of cowpea plants.Humic substances have a very profound influence on the growth of plant roots. When humic acids and fulvic acids are applied to the soil, enhancement of root initiation and increased root growth may be observed (Pettit, 2004). The stimulatory effects of humic substances have been directly correlated with enhanced uptake of macronutrients, such as nitrogen, phosphorus and sulfur (Chen and Aviad, 1990), and micronutrients, that is, Fe, Zn, Cu and Mn (Chen *et al.,* 1999).

Seed quality:

Data in Table 7 show the effect of using some natural materials (magnetite, sulphur, humic and fulvic acid) on total carbohydrates, total sugar % and V.C mg $100g^{-1}$ of seeds after harvesting.

Table (7): Effect of using some natural materials on seed quality of pea after harvesting.

Treat. / Char.		T.carbohydrates %	T.sugar %	V.C mg/100g
Control		49.69	15.66	36.83
Magnetite	100 $kg.fed^{-1}$	50.59	16.37	40.13
	200 $kg.fed^{-1}$	51.51	17.06	43.33
	300 $kg.fed^{-1}$	52.23	17.91	46.73
Sulphur	200 $kg.fed^{-1}$	50.12	16.00	38.40
	300 $kg.fed^{-1}$	50.98	16.80	41.70
	400 $kg.fed^{-1}$	51.86	17.52	44.80
Humic acid	5 $kg.fed^{-1}$	50.29	16.41	38.97
	7 $kg.fed^{-1}$	51.18	16.94	42.30
	9 $kg.fed^{-1}$	52.09	16.73	45.83
Fulvic acid	2 $kg.fed^{-1}$	49.87	15.86	37.83
	3 $kg.fed^{-1}$	50.73	16.61	40.63
	4 $kg.fed^{-1}$	51.70	17.32	44.10
$L.S.D_{at\ 5\%}$		0.10	0.18	0.67

The highest total carbohydrates, total sugar % and V.C mg/100g were attained in seeds treated with magnetite at the rate of 300 kg fed^{-1} followed by adding humic acid at the rate of 9 $kg.fed^{-1}$and the lowest was attained in control group. The highest mean values with using Magnetite were 52.23, 17.91 and 46.73 for total carbohydrates, total sugar % and V.C mg $100g^{-1}$ of seeds. This significantly increased observed with increasing all natural materials under increasing its levels.

Kumawat and Rathore, (2006) studied the effect of S (0, 20, 40 and 60 kg/ha) and Fe (0, 12.5 and 25.0 kg/ha) S at 60 kg/ha and Fe at 25.0 kg/ha gave the highest chlorophyll content, active Fe, shoot weight, root nodule weight, pods per plant, seeds per pod, test weight and harvest index of mung bean.

Abbas (2013) illustrated that the addition of humic acid significantly increased pigments, carotenoids concentrations and total carbohydrates.

CONCLUSION

From this study it is concluded that for enhancing the nutrient content and uptake of sugar peas under the same conditions can using some natural materials (magnetite, sulphur, humic and fulvic acids) .

Under the same condition in calcareous soil, the best result of yield and its components recorded with the best materials magnetite at rate of 300 kg.fed^{-1}.

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تأثير إضافة بعض محسنات التربة على نبات البسلة النامية فى الاراضى الجيرية

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نفذت تجربة أصص فى المزرعة التجريبية، كلية الزراعة، جامعة المنصورة فى خلال الموسم الشتوى 2014/2013 لدراسه تاثير اضافة بعض محسنات التربة للاراضى الجيرية باستخدام البسلة السكرية من طراز "شوجر بيس" ،صنف "سنو ويند"

اشتملت التجربة على ثلاثة عشر معاملة فى تصميم كامل العشوائية والتى تتمثل فى أربع معاملات أرضية تمت إضافتها لكل معاملة ثلاث مستويات ماجنتيت (100، 200 و 300 كجم/ف)، كبريت (200، 300 و 400 كجم/ف)، حمض الهيوميك (5، 7 و 9 كجم/ف) و حمض الفلفيك (2، 3 و4 كجم/ف) مقارنة بالكنترول و احتوت كل معاملة على 3 مكررات.

وقد أظهرت نتائج التجربة أن أعلى متوسطات القيم لكل من الوزن الطازج ، الجاف ، طول النبات، عدد الأوراق كذلك النسبة المئوية للنيتروجين و الفوسفور والبوتاسيوم وامتصاصهم فى النبات والبذور وايضا الحديد فى البذور بعد 50 و 90 يوم خلال موسم النمو جميعها تاثرت معنويا باضافه جميع محسنات التربة وسجلت أعلى القيم عند إضافة الماجنتيت بمعدل 300 كجم/فدان يليه إضافة حمض الهيوميك بمعدل 9 كجم/فدان. نفس النتيجه سجلت لكل من المحصول ومكوناته من وزن 1000 حبة والمحصول بالجم للنبات كذلك لجودة الحبوب (الكربوهيدرات الكلية والسكريات وفيتامين س) والتى سجلت أعلى القراءات عند إضافة الماجنتيت بمعدل 300 كجم/ فدان.

فى النبات سجلت أعلى قيم الحديد عند إضافة الماجنتيت بمعدل 300 كجم/فدان أما الزنك أعلى القيم عند إضافة الكبريت بمعدل 300 كجم/فدان وبالنسبه للمنجنيز فكانت أعلى القيم عند إضافة حمض الفالفيك بمعدل 2 كجم/فدان بعد 50 و 90 يوم من الزراعة مقارنة بالنباتات الغير معاملة (كنترول).

من خلال التجربة تحت الدراسة يمكن التوصية بأنه يمكن زيادة صلاحية العناصر و امتصاصها فى الأراضي الجيرية تحت نفس ظروف التجربة و ذلك باستخدام بعض المواد الطبيعية مثل (الماجنتيت، الكبريت، حمض الهيوميك و حمض الفلفيك) .

وتحت نفس ظروف التجربة وجد أنه لزيادة المحصول ومكوناته من نبات البسلة ينصح باستخدام الماجنتيت كمادة طبيعية بمعدل 300 كجم/ فدان.