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تأثير بعض مصلحات التربة على بعض خواص الأرض الجيرية وإنتاجيتها لمحصولي الفول البلدي والذرة

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الملخص العربي

أجريت هذه التجربة في محطة البحوث الزراعية ـ النوبارية خلال موسمين متعاقبين (شتوي ٢٠٠٨/٢٠٠٩ على محصول الفول البلدي وصيفي ٢٠٠٩ على محصول الذرة) لدراسة تأثير إضافة بعض مصطلحات التربة على بعض الخواص الطبيعية والكيميائية للأرض الجيرية وكذلك إنتاجيتها من الفول البلدي والذرة .

تم استخدام كمبوست قش الأرز والكبريت المعدني والتفاعل بينهما كمصلحات لهذه الأرض في تصميم قطاعات كاملة العشوائية لثلاثة مكررات . كانت معاملات الكمبوست هي (صفر ـ ١٠ م^{٣}/فدان ـ ٢٠ م^{٣}/فدان) ، بينما كانت معاملات الكبريت هي (½ طن ، ١ طن/فدان) ، أما معاملات التفاعل بينهما فكانت (١٠ م^{٣} كمبوست + ½ طن كبريت/فدان، ١٠ م^{٣} كمبوست + ١ طن كبريت/فدان ، ٢٠ م^{٣} كمبوست + ½ طن كبريت/فدان، ٢٠م^{٣} كمبوست + ١ طن كبريت/فدان).

أوضحت النتائج المتحصل عليها ما يلي :

- أدت إضافة كل من الكمبوست والكبريت إما منفردة أو متحدة معاً إلى تحسين خواص التربة حيث انخفضت قيم كل من الكثافة الظاهرية و pH و EC وأيونات (الصوديوم والبوتاسيوم والبيكربونات والكلوريد) الذائبة و SAR و ESP . في حين زادت قيم كل من المسامية الكلية والمادة العضوية والسعة الحقلية والماء الميسر وأيونات (الكالسيوم والماغنسيوم والكبريتات) الذائبة وكذلك صلاحية كل من عناصر النتروجين والفوسفور والبوتاسيوم.
- أدت إضافة كل من الكمبوست والكبريت إما منفردة أو متحدة معا إلى تحسين إنتاجية محصولي الفول البلدي والأذرة وكذلك محتواهما من عناصر النتروجين والفوسفور والبوتاسيوم .

- إضافة الكمبوست كان لها الأثر الأكبر في تحسين خواص التربة الطبيعية في حين كان لإضافة الكبريت الأثر الأكبر في تحسين خواص التربة الكيميائية .
- حققت المعاملة (٢٠م٣ كمبوست/فدان + ١ طن كبريت/فدان) أفضل النتائج المتحصل عليها لكل من التربة والنبات مقارنة بباقى المعاملات .
- لهذا يجب الاهتمام بإضافة الأسمدة العضوية والكبريت معا وبصورة دورية لما لها من دور كبير في تحسين خواص التربة وزيادة محتواها من العناصر الغذائية وزيادة خصوبتها كما ينعكس ذلك بصفة عامة على المحصول.

INFLUENCE OF SOME SOIL AMENDMENTS ON

SOME CHARACTERISTICS OF CALCAREOUS SOIL AND ITS PRODUCTIVITY OF FABA BEAN AND MAIZE

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ABSTRACT: ***A field experiment was carried out in Noubaria Agric. Res. station for two successive seasons (winter season 2008/2009 using faba bean crop followed by summer season 2009 using maize crop) to study the impact of some soil amendments on improving of some physical and chemical properties of calcareous soil and its productivity. The amendments included rice straw compost and elemental sulphur, which added either alone or in combination. Randomized complete block (RCBD) with three replicates was the design of this experiment. The treatments of compost were control, 10m^3 compost /fed and 20m^3 compost/fed, while the treatments of sulphur were 0.5 ton sulphur/fed and 1.0 ton sulphur/fed. The combination treatments were 10m^3 compost/fed + 0.5 ton sulphur/fed, 10m^3 compost/fed + 1.0 ton sulphur/fed, 20m^3 compost/fed + 0.5 ton sulphur/fed and 20m^3 compost/fed + 1.0 ton sulphur/fed.***

The obtained results indicated that, application of organic compost and elemental sulphur alone or in combination improved soil properties. The bulk density, pH, EC, soluble (Na^+, K^+, HCO^-_3 and Cl^-), SAR and ESP values were decreased, while, total porosity, O.M., field capacity, available water, soluble (Ca^{++}, Mg^{++} and $SO^=_4$) and availability of N, P and K values were increased. Application of compost was more positive effect than sulphur application on improving soil physical properties, while, sulphur application was more positive effect than compost application on improved soil chemical properties. Application of compost and sulphur alone or in combination enhancements the seed yield of faba bean and grain yield of maize as well as their uptake of N, P and K. The combined treatment (20 m^3 compost/ fed + 1.0 ton sulphur/fed) was superior in greatly improving soil physical and chemical properties of the studied soil and reflected on faba bean and maize productivity and nutrients uptake.

Key words: ***Calcareous soil, Organic compost, Elemental sulphur, Faba bean, Maize, N, P and K uptake.***

INTRODUCTION

The cultivation of newly reclaimed sandy and calcareous soil has become an unavoidable necessity for increasing our agricultural production to meet the over-growing demand for food. Attention should be taken to $CaCO_3$ which cause the high EC and/or pH values, micronutrients fixation and/or precipitation as well as crust formation. Also, the organic matter content of

these soils, generally low due to the high temperature and arid climate, in addition to the shortage of organic manure addition to these soils. Thus, the utilization of organic compost in these soils improved its physical and chemical properties.

Composts are widely used as organic amendments. Use of compost can be beneficial to improve organic matter status. Compost is rich source of nutrients with high organic matter content. physical and chemical properties of soil can be improved by using compost, which may ultimately increase crop yields. Recently, a lot of studies indicated that organic compost showed different beneficial effects in calcareous soil of Egypt, i.e., improving soil-water relationships (Negm *et al.,* 2003 and 2005), controlling soil salinity (El-Kouny, 2005), increased cation exchange capacity and decreased soil pH. (Ali laila *et al.,* 2005, Negm *et al.,* 2005 and Abd El-Gani and Negm, 2006). Physical properties like bulk density, total porosity, water permobility and hydraulic conductivity were significantly improved when compost was applied (Hussain *et al.,* 2001 and El-Sayed *et al.,* 2006).

Sulphur has a variety of uses as soil amendment. The oxidation of sulphur to H_2SO_4 is particularly beneficial in alkaline soils to reduce the pH, supply $SO^{=}_4$ to plants, makes phosphorus and micronutrients more available and reclaim soils (Lindemann *et al.,* 1991). Organic amendments and soil organic carbon content have related to S oxidation rates (Lawrence and Germida, 1988) suggesting that an increase in heterotrophic S oxidizer number after the addition of an organic substrate enhances S oxidation. The addition of S and organic matter stimulates S oxidation in calcareous soil (Cifuentes and Lindemann, 1993). Application of sulphur with compost to calcareous soil raised their efficiencies as reported by El-Sayed *et al.,* (2005), Abd El-Ghani and Negm (2006).

The main target of this study is raising the efficiency of elemental sulphur in combined with organic compost for improving saline calcareous soil properties.

MATERIALS AND METHODS

A field experiment was carried out in Noubaria Agric. Res. station for two successive seasons (wineter season 2008/2009 using faba bean crop followed by summer season 2009 using maize crop) to study the effect of some soil amendments on improving some physical and chemical properties of calcareous soil and its productivity of faba bean and maize plants. Soil amendments included rice straw compost and sulphur. They added either alone or in combination to soil before 15 days from planting and mixed with the surface layer (0 – 30 cm). Some physical and chemical characteristics of the studied soil were determined according to Black (1965) and are presented in Table (1). Also, some characteristics of rice straw compost were determined in the extract of compost: water (1 : 10) which are shown in Table

(2). The design of this experiment was randomized complete block (RCBD) with three replicates. The treatment of compost were 0, 10 and 20 m^3/fed, while, the treatment of sulphur were 0.5 and 1.0 ton/fed. The combination treatments were 10m^3 compost + 0.5 ton sulphur/fed., 10m^3 compost + 1.0 ton sulphur/fed., 20m^3 compost + 0.5 ton sulphur/fed and 20m^3 compost + 1.0 ton sulphur/fed.

In the winter season 2008/2009, faba bean seeds (Vicia faba L.) variety Giza blanka were planted on 21th October. After harvesting of faba bean, maize (crop of summer season 2009) were grown as a rotational crop at the same plots previously treated with compost and sulphur to assess the residual effect. Maize grains (Zea mize L.) cultivar trible hybrid 310 were planted on the first June and harvested after 90 days. The recommended NPK fertilizers rates of faba bean, i.e., 20 N, 30 P_2O_5 and 24 K_2O kg/fed., and the rates for maize, i.e., 120 N, 45 P_2O_5 and 24 K_2O kg/fed were applied for each crop.

Table (1): Some physical and chemical characteristics of the experimental soil.

Soil properties	Value
Particle size distribution (%):	
Coarse sand	38.43
Fine sand	40.81
Silt	9.75
Clay	11.01
Textural class	Sandy loam
Bulk density (g/cm^3)	1.48
Total porosity (%)	44.15
Field capacity (%)	21.35
Chemical properties	
$CaCO_3$ (%)	28.50
Organic matter (%)	0.48
pH (1 : 2.5 soil water suspension)	8.20
EC (dS/m, soil paste extract)	7.25
Soluble cations (meq/L)	
Ca^{++}	12.76
Mg^{++}	8.38
Na^+	50.36
K^+	1.07
Soluble anions (meq/L)	
CO^-_3	--
HCo^-_3	4.15
Cl^-	49.38
$SO^=_4$	19.14
Available nutrients (mg/kg)	
N	25.17
P	7.16
K	75.80

Table (2): Some characteristics of rice straw compost.

Characteristics	Value
PH (1 : 10)	7.63
EC (ds/m)	7.58
O.M. (%)	62.4
O.C (%)	36.2
Total N (%)	2.16
Total P (%)	0.71
Total K (%)	2.8
C/N ratio	16.75
Available nutrients (mg/kg)	
N	913
P	41
K	749

The recommended dose of nitrogen in the form of ammonium sulphate (20.6% N) were applied in three equal doses, the first was applied at planting and the residual were applied every three weaks. Phosphorus and potassium were added before planting.

All the other agricultural practices for faba bean and maize production were followed as common in the area of cultivation. After harvesting of either faba bean or maize crop, soil samples were also taken from each treatment to determine the changes in some physical and chemical properties according to Jackson (1973) and Page *et al.,* (1982).

At harvesting, the yield of faba bean and maize were harvested from each plot and weighted (kg/fed). The seeds and grains for both crops were digested and analyzed to determined N, P and K according to Chapman and Pratt (1961) and estimated as kg/fed. Data obtained were statistically analyzed according to Gomez and Gomez (1984). Means of different treatments were compared by L.S.D. test at 5% level.

RESULTS AND DISCUSSION

Effect of using organic compost and sulphur on:

1. Physical properties:

1.1. Bulk density and total porosity:

Table (3) shown the influence of organic compost, sulphur and mixture of them on soil bulk density (B.D) and total porosity (T.P) after harvesting of each faba bean and maize. The data showed that application of organic compost and sulphur alone or in combination improved soil bulk density during the two seasons. Since it decreased at any rate of addition. The relatively high values obtained of bulk density was attained for the untreated soil (control). The combined treatment (20 m^3 compost/fed + 1.0 ton sulphur/fed) was more effective in decreasing soil bulk density than other

Table 3

treatments. This true was observed after harvesting faba bean. Total porosity take the opposite trend with that obtained for bulk density, where they increased with decreasing soil bulk density. Addition of sulphur individually was less efficient in reducing B.D and increasing T.P than that addition of organic compost individually. Similar results were reported by El-Maghraby, (1997) and Ali Laila, *et al.,* (2005).

Concerning the residual effect of different treatments on B.D and T.P in the soil after harvesting of maize, data in Table (3) showed that the maximum decrease in soil bulk density (B.D) and maximum increase in total porosity (T.P) was observed with the treatments of 20 m^3 compost/fed followed by 20 m^3 compost + 1.0 ton sulphur/fed. These results means that the combination of organic compost + sulphur was more effective than the treatments of compost or suphur individually with faba bean yield (winter season), while with maize yield (summer season), the residual effect of compost at 20 m^3 /fed was more effective than the combination treatments. The decrease in soil bulk density and increase of total porosity may be due to the higher application rates of organic compost and sulphure which having low buk densities.

Similar results were obtained by El-Maghraby (2001), El-Sedfy *et al.,* (2002), Beheiry *et al.,* (2005) and El-Sayed *et al.,* (2006). In this connections, Charles (1991) mentioned that the application of organic matter to the soil provides a substrate for microbial feeding, and the microorganisms in turn produce substances crucial to soil aggregation.

1.2. Soil moisture retention:

With respect to soil moisture retention, data in Table (3) clearly showed that organic compost, elemental sulphur and mixture of them increased the field capacity of the investigated calcareous soil after harvesting of faba bean in winter and maize in summer seasons. Also, wilting point increased with application the treatments but this increase was less than that with field capacity. These variation led to increases of soil available water over the control by 49.28, 58.40, 7.40, 14.90, 62.86, 78.72, 71.60 and 92.30% due to the treatments of 10 m^3 compost/fed, 20 m^3 compost/fed, 0.5 ton sulphur/fed, 1.0 ton sulphur/fed, 20 m^3 compost + 0.5 ton sulphur/fed and 10 m^3 compost + 0.5 ton sulphur/fed, 10m^3 compost + 1.0 ton sulphur/fed., 20m^3 compost + 1.0 ton sulphur/fed, after harvesting faba bean respectively. The corresponding values after maize harvesting were 66.6, 84.30, 4.82, 12.77, 46.98, 56.66, 58.85 and 76.73% in the same order. Data also showed that addition of sulphur treatments alone were less efficient in increasing field capacity and available water than the addition of compost treatments alone. Also, the results showed that the combination treatments at higher rates were more effective on the available water than the compost treatments after faba bean yield (winter season).

On the other hand, the residual effect of compost at high rate was more effective on the available water than the other treatments after harvesting maize. Similar results were reported by El-Maghraby (2001) and El-Shouny (2006). The increase of water retention and available water upon using the soil amendments may be attributed to the beneficial effect of such materials on soil aggregation. In addition, the humus produced from microbial decomposition of compost as an organic manure can absorb water more than six times of its own weight, thereby the soil moisture retention capacity increase (Tester, 1990).

1.3. Soil organic matter (OM):

Organic matter states of soil was improved with application of compost and sulphur. Addition of compost alone and in combination with sulphur enhanced organic matter states of soil after faba bean crop (Table 3). Addition of sulphur alone was inferior of compost, which remained at par with control. The efficiency of the used compost and sulphur on increasing soil OM content after faba bean yield could be arranged in the following order 20 m^3 compost + 1.0 ton S/fed > 20 m^3 compost + 0.5 ton S/fed > 10 m^3 compost + 1.0 ton S/fed > 10 m^3 compost + 0.5 ton S/fed > 20 m^3 compost/fed > 10 m^3 compost/fed > 1.0 ton S/fed > 0.5 ton S/fed > control.

Also, similar trend was noticed after maize crop whereas organic matter status of soil enhancement with different treatments. The treatment receiving 20 m^3 compost/fed in combination with 1.0 ton sulphur/fed gave the maximum content of organic matter which reached to 0.92%.

Data also reaveld that the content of organic matter in the soil mainly depended upon the quantity applied of compost. Comparatively more biomass production in different treatments also contributed towards the improvement of organic matter status of the soil. Similar results were also obtained by Ali Laila, *et al.,* (2005), Abd El-Gani and Negm (2006), Beheiry *et al.,* (2005), El-Sedfy *et al.,* (2007) and Sarwer *et al.,* (2008).

2. Chemical properties:

2.1. Soil reaction (pH):

Results in Tables (4 and 5) showed that the application of organic compost and sulphur alone or in combination reduced the soil pH as compared to control after harvesting faba bean and maize. The combined treatment (20 m^3 compost/fed + 1.0 ton sulphur/fed) was more positive effect than other treatments after both of faba bean and maize harvested on reducing soil pH values. The positive effect of sulphur on reducing soil pH values may be due to the oxidation of sulphur to sulphuric acid by soil microorganisms. On the other hand, the reduction of soil pH values in the plots treated with organic compost compared to control may be due to the production of organic acids during decomposition which led to the decrease in soil pH.

Table 4

Table 5

The efficiency of the studies treatments on reducing soil pH values could be arranged in the following order 20m^3 compost + 1.0 ton S/fed> 20m^3 compost + 0.5 ton S/fed> 10m^3 compost + 0.5 ton S/fed> 10m^3 compost + 1.0 ton S/fed = 1.0 ton S/fed > 0.5 ton S/fed > 20m^3 compost/fed > 10m^3 compost/fed > control after faba bean harvested, while they were 20m^3 compost + 1.0 ton S/fed > 20m^3 compost + 0.5 ton S/fed > 1.0 ton S/fed > 0.5 ton S/fed = 10 m^3 compost/fed > 1.0 ton S/fed > 10m^3 compost + 0.5 ton S/fed > 20m^3 compost/fed > 10m^3 compost/fed > control after maize harvested. Numerical values were a bit lower after maize in the same treatments indicating consistent positive impact of compost and sulphur on this soil parameter. Similar results were obtained by Negm *et al.,* (2002), Ali Laila *et al.,* (2005) and Sarwar *et al.,* (2008).

2.2. Soil electrical conductivity (EC):

Data presented in Tables (4 and 5) revealed that the initial electrical conductivity values (EC) of soil dropped at the end of the two seasons (faba bean in winter and maize in summer) as the application of organic compost and sulphure either individually or in combination. The decrease of EC values increased with raising the soil amendments rate. The previos effect were pronounced after the harvesting of maize (during the second season) rather than after the harvesting of faba bean (during the first season). Application of both compost and sulphur individually or in combination led to decrease soluble ions of Na, K, HCO_3 and Cl, while, soluble ions of Ca, Mg and SO_4 were increased. Application of sulphur was more effective than organic compost on reducing EC values, mainly due to the oxidation of elemental sulphur and producing sulphuric acid which desolved the $CaCO_3$ and release Ca ions thereby, enhancing the replacement of Na^+ from the exchange site and improve soil structure as exchangeable Ca increases. Soil structure will enhance water penetration and thus help to leach the salt more easly and effectively. Similar finding was reported by Ali (2006) and Mohamed *et al.,* (2007).

2.3 Sodium adsorption ratio (SAR):

Regarding the effect of compost and sulphur on the values of SAR, data in tables (4 and 5) indicated that application of compost and sulphur lowered sodium adsorption ratio (SAR) of the soil after faba bean and maize crop over control. The highest values (14.48 and 13.58) of SAR were recorded in the control after harvesting faba bean and maize crop respectively. They decreased to minimum values (4.39 and 2.73) in the treatment 20m^3 compost + 1.0 ton S/fed. The highly reduction in Na^+ ion compared to those in Ca^{++} and Mg^{++} ions reflected in decreasing the soil SAR. Studies of Zaka *et al.,* (2003) indicated the same trend of decrease in soil SAR with the use of FYM, rice straw and sesbaia green manure.

They attributed the reduction in SAR of the soil with organic materials due to the release of organic acids causing mobilization of native calcium present as $CaCO_3$ in the soil. The values of SAR become lesser either due to an increase in divalent calions (Ca^{++} and Mg^{++}) or decrease in mono-valent cation (Na). Values of Na could decrease during leaching, while Ca^{++} and Mg^{++} increased due to reactions of organic acids with $CaCO_3$ after the application of compost. The chemical reactions proposed under soil pH section above further carbonate show a net increase in Ca^{++} and Mg^{++} and decrease in Na in the soil solution occurred.

Application of sulphur at any rate reducing SAR values, mainly due to oxidation of sulphur by microorganisms and sulphuric acid act with $CaCO_3$ and increasing soluble Ca^{++} and Mg^{++} content of the soil and subsequently reduced the SAR values. Similar results were obtained by El-Maghraby (2001), Mohamed *et al.,* (2007) and Sarwar *et al.,* (2008).

2.4. Exchangable sodium percentage (ESP):

The effect of studied soil amendments on the ESP of investigated soil is shown in Tables (4 and 5). The data showed that the ESP values of the soil after two seasons decreased than that found before cropping (initial values). The combined treatment (20 m^3 compost/fed + 1.0 ton sulphur/fed) recorded the greatest decrease in ESP values in both winter and summer seasons where the relative decrease reached to 66.79% and 81.86% relative to the control, respectively. These results were expected because the compost has high organic matter content, and it is know that increasing organic matter would increasing the CEC values and subsequently decreased the ESP values. In this respect, Hill and James (1995) reported that the addition of organic amendment to soil is likely to increase the soil CEC simply from the additive effect of the organic matter and the high CEC assoiated with organic matter depending on soil pH. Application of sulphur was more effective than organic compost on decreasing the ESP values, this may be due to the effect of sulphur on reducing Na^+ to Ca^{++} ratio resulted from dissolving of $CaCO_3$. Similar conclusion was reported by Wassif *et al.,* (1997), who found that the application of sulphur caused remarkable decrease in soil ESP values and this result may be rendered to its transformation by soil organisms to sulphuric acid and its affect on $CaCO_3$ and dissolving of Ca^{++} ions.

3. Availability of N, P and K :

3.1. Available N and P :

Data in Table (6) depicts the effect of soil amendments applied to calcareous soil on its availability of N and P after faba bean and maize harvested. It is clear that, application of organic compost and sulphur individually or in combinations increased available N and P as compared to the untreated soil plots (control). Treatment 20m^3 compost + 1.0 ton S/fed gave the highest available N and P after harvest of faba bean and maize

plants. The values of available N and P were much more after maize harvested than that after faba bean harvested probably due to the continues decomposition of soil amendments applied to the soil by soil microorganisms and improved soil physical, chemical and biological properties. This result may be due to (1) the influence of compost and sulphur on reducing soil pH values as reported in (Tables 4 and 5), (2) the high nitrogen in organic matter content of applied compost or (3) release of phosphate ions from soil collides by sulphate ions (Ismail *et al.,* 1990), (4) when the compost is applied, the bond of phosphorus components with $CaCO_3$ is higher amounts of available form.

Table (6): Available nutrients (N, P and K) as affected by the experimental treatments.

Soil amendments	Available nutrients (mg/kg soil)					
	After faba bean harvesting			After maize harvesting		
	N	P	K	N	P	K
Control	27.60	7.37	75.50	24.52	6.17	73.40
10m^3 compost/fed	33.40	14.00	89.70	36.74	15.58	81.35
20m^3 compost/fed	38.40	16.78	109.45	50.41	18.28	90.53
0.5 ton sulphur/fed	26.30	10.90	82.60	28.93	10.99	76.81
1.0 ton sulphur/fed	28.60	12.90	85.60	31.46	14.08	81.32
10m^3 compost + 0.5 ton sulphur/fed	35.90	15.50	92.30	39.49	18.12	85.83
10m^3 compost + 1.0 ton sulphur/fed	40.90	17.10	100.10	49.49	20.92	90.33
20m^3 compost + 0.5 ton sulphur/fed	48.50	18.16	121.32	62.35	20.18	94.22
20m^3 compost + 1.0 ton sulphur/fed	50.40	19.00	128.50	64.45	23.60	98.36

3.2. Available potassium (K):

Data in Table (6) revealed that available potassium showed a similar trend with that obtained in case of N and P after faba bean harvesting. Results indicated an increase in available potassium in the soil treated with compost over control. It may be attributed to the release of K from the compost as well as from the native sources and the retention of K by organic colloids against leaching. Sulphur application did not affect K availability. The results indicated a decreasing in available K after maize than that after faba bean plants, probably due to the removal of K either by plant uptake or by leaching from the soil. These results are in agreement with those of El-Sayed *et al.,* (2005), Mahmoud (2006) and Bakry *et al.,* (2009). Negm *et al.,* (2002) found that the available K declined after second crop (sorghum) consumption than after first crop (wheat) only.

4. Faba bean and maize production:

4.1. The yields:

The improvement of physical and chemical properties of the studied soil as a result of using organic compost and sulphur and mixture of them induced an enhancements in the yields of faba bean and maize (Table 7).

Table 7

All treatments caused an increase in seed yield of faba bean and grain yield of maize. Application of 20 m^3 compost/fed + 1.0 ton sulphur/fed, produced the highest values of faba bean seed (7.5 ardab/fed) and grain yield of maize (15.82 ardab/fed). The treatments could be arranged in the following order 20m^3 compost + 1.0 ton S/fed> 20m^3 compost/fed> 20m^3 compost + 0.5 ton S/fed> 10m^3 compost + 1.0 ton S/fed> 10m^3 compost/fed> 10m^3 compost + 0.5 ton S/fed> 0.5 ton S/fed> 1.0 ton S/fed> control for faba bean, while they were 20m^3 compost + 1.0 ton S/fed> 20m^3 compost + 0.5 ton S/fed> 10m^3 compost + 1.0 ton S/fed> 10m^3 compost + 0.5 ton S/fed> 20m^3 compost/fed> 10m^3 compost/fed> 1.0 ton S/fed> 0.5 ton S/fed> control for maize. Similar results were also obtained by Ali Laila *et al.,* (2005), and Mahmoud (2006).

4.2. Nutrients uptake:

The results presented in Table (7) showed significant increase in N, P and K uptake (kg/fed) by seeds of faba bean and grains of maize plants due to the effect of added organic compost and elemental sulphur alone or in combination. The combined treatment (20m^3 compost + 1.0 ton S/fed) was more positive effect than other treatments after faba bean and maize harvested on increasing NPK uptake. The favorable effect of compost and sulphur may be refered to their influence on increasing the availability of such nutrients as previously mentioned. Similar results were obtained by Negm *et al.,* (2002), Ali Laila *et al.,* (2005) El-Sayed *et al.,* (2007) and Bakry *et al.,* (2009).

Conclusion:

From the abovementioned results it could be concluded that, compost and sulphur as soil amendments enhanced the soil physical and chemical properties and may be the bedding materials of root zone area as well as, to some extent, the availability of nutrients in soil which positively reflected on the productivity of faba bean and maize. The best treatment with regard to improving soil properties as well as increasing faba bean and maize yields and nutrients uptake was the combined treatment of 20m^3 compost/fed + 1.0 ton sulphur/fed.

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تأثير بعض مصلحات التربة على بعض خواص الأرض الجيرية وإنتاجيتها لمحصولي الفول البلدي والذرة

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أجريت هذه التجربة في محطة البحوث الزراعية . النوبارية خلال موسمين متعاقبين (شتوي ٢٠٠٨/٢٠٠٩ على محصول الفول البلدي وصيفي ٢٠٠٩ على محصول الذرة) لدراسة تأثير إضافة بعض مصطلحات التربة على بعض الخواص الطبيعية والكيميائية للأرض الجيرية وكذلك إنتاجيتها من الفول البلدي والذرة .

تم استخدام كمبوست قش الأرز والكبريت المعدني والتفاعل بينهما كمصلحات لهذه الأرض في تصميم قطاعات كاملة العشوائية لثلاثة مكررات . كانت معاملات الكمبوست هي (صفر . ١٠ م^{٣}/فدان . ٢٠ م^{٣}/فدان) ، بينما كانت معاملات الكبريت هي (½ طن ، ١ طن/فدان) ، أما معاملات التفاعل بينهما فكانت (١٠ م^{٣} كمبوست + ½ طن كبريت/فدان، ١٠ م^{٣} كمبوست + ١ طن كبريت/فدان ، ٢٠ م^{٣} كمبوست + ½ طن كبريت/فدان، ٢٠م^{٣} كمبوست + ١ طن كبريت/فدان).

أوضحت النتائج المتحصل عليها ما يلي :

- أدت إضافة كل من الكمبوست والكبريت إما منفردة أو متحدة معاً إلى تحسين خواص التربة حيث انخفضت قيم كل من الكثافة الظاهرية و pH و EC وأيونات (الصوديوم والبوتاسيوم والبيكربونات والكلوريد) الذائبة و SAR و ESP . في حين زادت قيم كل من المسامية الكلية والمادة العضوية والسعة الحقلية والماء الميسر وأيونات (الكالسيوم والماغنسيوم والكبريتات) الذائبة وكذلك صلاحية كل من عناصر النتروجين والفوسفور والبوتاسيوم.
- أدت إضافة كل من الكمبوست والكبريت إما منفردة أو متحدة معا إلى تحسين إنتاجية محصولي الفول البلدي والأذرة وكذلك محتواهما من عناصر النتروجين والفوسفور والبوتاسيوم .

. إضافة الكمبوست كان لها الأثر الأكبر في تحسين خواص التربة الطبيعية في حين كان لإضافة الكبريت الأثر الأكبر في تحسين خواص التربة الكيميائية .

ـ حققت المعاملة (٢٠م٣ كمبوست/فدان + ١ طن كبريت/فدان) أفضل النتائج المتحصل عليها لكل من التربة والنبات مقارنة بباقى المعاملات .

. لهذا يجب الاهتمام بإضافة الأسمدة العضوية والكبريت معا وبصورة دورية لما لها من دور كبير في تحسين خواص التربة وزيادة محتواها من العناصر الغذائية وزيادة خصوبتها كما ينعكس ذلك بصفة عامة على المحصول.

Table (3): Physical properties of calcareous soil under investigation as affected by the experimental treatments.

Soil amendments	After faba bean crop (first season)						After maize crop (second season)					
	O.M (%)	Bulk density (g/cm^3)	Total porosity (%)	Soil moisture retention (%)			O.M (%)	Bulk density (g/cm^3)	Total porosity (%)	Soil moisture retention (%)		
				Field capacity	Wilting point	Available water				Field capacity	Wilting point	Available water
Control	0.49	1.46	44.90	21.51	10.98	10.53	0.43	1.44	46.26	22.09	11.13	10.96
$10m^3$ compost/fed	0.62	1.37	48.30	28.17	12.45	15.72	0.78	1.27	52.45	31.22	12.69	18.26
$20m^3$ compost/fed	0.65	1.34	49.43	29.28	12.60	16.68	0.86	1.25	53.35	33.16	12.69	20.20
0.5 ton sulphur/fed	0.52	1.44	45.66	22.43	11.12	11.31	0.57	1.41	46.79	22.81	11.30	11.50
1.0 ton sulphur/fed	0.55	1.41	46.79	23.38	11.28	12.10	0.61	1.38	47.92	23.86	11.50	12.36
$10m^3$ compost + 0.5 ton sulphur/fed	0.69	1.35	49.05	29.64	12.49	17.15	0.79	1.33	50.39	28.72	12.61	16.11
$10m^3$ compost + 1.0 ton sulphur/fed	0.75	1.33	49.81	31.40	12.58	18.82	0.83	1.29	51.86	29.93	12.76	17.17
$20m^3$ compost + 0.5 ton sulphur/fed	0.79	1.32	50.18	30.73	12.66	18.07	0.88	1.30	51.49	30.24	12.83	17.41
$20m^3$ compost + 1.0 ton sulphur/fed	0.83	1.30	50.49	33.13	12.87	20.25	0.92	1.29	51.86	32.01	12.64	19.37

Table (4): Chemical properties of calcareous soil as affected by the experimental treatments. (After faba bean harvested, first season).

Soil amendments	pH (1 : 2.5 susp.)	EC (dSm^{-1})	Soluble ions in soil paste extract (meq/L)								SAR	ESP (%)
			Cations				Anions					
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$		
Control	8.19	7.07	15.62	8.59	50.12	1.45	--	4.30	51.17	20.31	14.48	15.81
$10m^3$ compost/fed	7.72	5.79	13.26	8.31	37.41	0.96	--	4.74	33.14	22.06	11.40	13.31
$20m^3$ compost/fed	7.57	5.35	13.08	7.12	30.00	1.09	--	4.93	24.71	21.65	9.46	11.24
0.5 ton sulphur/fed	7.45	4.32	13.15	7.75	21.64	0.75	--	3.64	21.55	18.10	6.17	7.31
1.0 ton sulphur/fed	7.43	4.12	14.76	8.25	17.34	0.96	--	3.64	18.61	19.06	4.57	5.28
$10m^3$ compost + 0.5 ton sulphur/fed	7.42	4.22	12.69	7.33	21.59	0.64	--	3.03	18.04	21.81	6.29	7.46
$10m^3$ compost + 1.0 ton sulphur/fed	7.44	3.90	11.65	7.47	19.31	0.69	--	3.38	17.28	18.46	5.65	6.66
$20m^3$ compost + 0.5 ton sulphur/fed	7.38	3.52	9.89	6.96	17.63	0.75	--	3.64	16.38	16.18	5.44	6.39
$20m^3$ compost + 1.0 ton sulphur/fed	7.35	3.84	12.46	8.99	16.27	0.78	--	3.64	16.04	18.72	4.39	5.25

Table (5): Chemical properties of calcareous soil as affected by the experimental treatments. (After maize harvested, second season).

Soil amendments	pH (1 : 2.5 susp.)	EC (dSm^{-1})	Soluble ions in soil paste extract (meq/L)								SAR	ESP (%)
			Cations				Anions					
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO^{=}_{3}$	HCO^{-}_{3}	Cl^{-}	$SO^{=}_{4}$		
Control	8.02	6.60	13.70	7.25	45.96	0.93	--	3.74	38.13	25.17	13.58	14.17
$10m^3$ compost/fed	7.56	5.01	12.53	6.67	30.26	0.61	--	3.14	27.84	19.09	9.79	11.58
$20m^3$ compost/fed	7.40	4.36	13.83	6.72	22.50	0.80	--	2.88	21.04	19.93	6.40	7.63
0.5 ton sulphur/fed	7.34	3.12	10.87	6.44	13.39	0.73	--	2.74	12.29	16.40	4.12	4.70
1.0 ton sulphur/fed	7.32	3.08	12.24	7.24	10.66	0.78	--	2.35	12.11	15.63	3.05	3.29
$10m^3$ compost + 0.5 ton sulphur/fed	7.35	3.16	11.34	5.34	14.52	0.66	--	2.12	13.54	16.20	4.49	5.18
$10m^3$ compost + 1.0 ton sulphur/fed	7.34	2.83	10.37	5.69	11.84	0.70	--	2.70	13.82	12.08	3.68	4.12
$20m^3$ compost + 0.5 ton sulphur/fed	7.30	2.37	9.06	4.80	9.36	0.72	--	2.48	11.33	10.13	3.08	3.33
$20m^3$ compost + 1.0 ton sulphur/fed	7.29	2.35	9.49	4.83	8.75	0.86	--	2.02	10.89	11.02	2.73	2.86

Table (7): Seeds and grain yield and nutrients concentration and uptake by faba bean and miaze as affected by experimental treatments.

Soil amendments	Faba bean (first season)							Maize (second season)						
	Winter season 2008/2009							Summer season 2009						
	Seeds yield (Ardab/ fed.)	N		P		K		Grain yield (Ardab/ fed.)	N		P		K	
		(%)	Uptake (kg/fed)	(%)	Uptake (kg/fed)	(%)	Uptake (kg/fed)		(%)	Uptake (kg/fed)	(%)	Uptake (kg/fed)	(%)	Uptake (kg/fed)
Control	5.56	1.74	15.02	0.17	1.55	0.40	3.50	11.55	1.53	26.52	0.18	3.17	1.02	17.68
$10m^3$ compost/fed	6.66	2.28	23.65	0.32	3.33	0.48	5.00	12.77	1.67	32.10	0.25	4.82	1.20	23.28
$20m^3$ compost/fed	7.27	2.73	30.86	0.32	3.61	0.56	6.32	13.70	1.63	33.65	0.27	5.73	1.21	24.92
0.5 ton sulphur/fed	6.28	2.18	21.29	0.29	2.85	0.48	4.70	12.18	1.60	29.32	0.25	4.61	1.17	21.56
1.0 ton sulphur/fed	6.21	2.53	24.45	0.44	4.28	0.60	5.85	12.76	1.64	31.53	0.27	5.33	1.20	22.91
$10m^3$ compost + 0.5 ton sulphur/fed	6.49	3.01	30.35	0.38	3.83	0.66	6.65	14.26	1.61	34.44	0.28	6.04	1.21	24.01
$10m^3$ compost + 1.0 ton sulphur/fed	6.94	3.18	34.23	0.43	4.84	0.68	7.33	15.06	1.59	36.01	0.29	6.45	1.15	26.12
$20m^3$ compost + 0.5 ton sulphur/fed	7.12	3.23	35.73	0.41	4.55	0.64	7.04	15.64	1.55	36.47	0.29	6.84	1.14	26.78
$20m^3$ compost + 1.0 ton sulphur/fed	7.50	3.51	40.95	0.48	5.61	0.66	7.72	15.82	1.56	37.16	0.30	7.07	1.17	27.68
L.S.D. 50%	0.26	--	0.48	--	0.19	--	0.27	0.43	--	0.39	--	0.16	--	0.21

Ardab = 155 kg

Ardab = 140 kg