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SOIL PHYSICOCHEMICAL CHANGES DURING TREATING SALT AFFECTED SOILS PROBLEMS USING ORGANIC AMENDMENTS

Doaa G. M. Soliman,[1] Ahmed A. Abdel-Khalek, [2] Mahmoud, M. R., [1] Reham A. Mohamed [2]

[1] Soils, Water and Environmental Res. Agric. Res. Center, Giza, Egypt.

[2] Faculty of Sci., Beni-Suef University.

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ABSTRACT

An open air pot experiment was carried out during two successive seasons, winter season 2013/2014 and summer season 2014, to investigate the effect of using gypsum and some organic amendments, crop residues, filter mud cake from sugar industry and chicken manure, each alone or in combination with gypsum on some properties of a salt affected soil as well as their effects on the plant growth (maize and wheat) and the uptake of N, P and K by plants. These organic amendments were subjected to decomposition process for three months before they were applied to the soil under reclamation. The experiment was conducted in the experimental farm of Sids Agricultural Research Station, Beni-suef Governorate, Egypt.

Regarding the soil physical properties, the results revealed that the application of such amendments led to a decrease in the bulk density, as well as increases in the total porosity, field capacity and wilting point, and consequently increased the available water, particularly in the presence of applying 10 ton gypsum + 6 ton chicken manure per feddan compared to the other treatments. The uptake of N, P and K by both plants (maize and wheat) was significantly increased due to the application of these amendments compared to the control, especially for 10 ton gypsum + 6 ton chicken manure per feddan treatment. For the chemical properties, the results showed that the soil pH and ESP gradually decreased due to different amendments, but the

EC, CEC, OM and available N, P and K increased. The better effect was shown by using 10 ton gypsum + 6 ton chicken manure per feddan treatment.

Key words: Salt affected soils – crop residues - sugar industry wastes - chicken manure – gypsum – wheat - maize.

Introduction

Soil salinization and nutrient poorness are considered severe problems throughout the world. They represent around 20% of the world's cultivated land and 50% of the cropland (Flowers and Yeo, 1995). In Egypt, only 5.4 percent of the land resources are intensive cultivated lands, and about 40 percent of them are subjected to salinity, sodicity and waterlogging problems (Malr, 2009). The soil salinization process probably affects the soil chemical and physical properties, soil microbiological processes, plant growth and soil fauna (Sumner *et al*., 1998; Rietz and Haynes, 2003; Tejada and Gonzalez, 2005; Wichern *et al*., 2006; Zhang *et al*., 2010).

Agricultural, chemical and industrial wastes have been advocated to improve salt affected soils. Shainberg *et al*. (1989) reported that gypsum is the most common chemical amendment for saline-sodic and sodic soil reclamation because it is comparatively cheap, generally available, and easy to apply. Also, Misra et al. (2007) found that the pH of the leachate of gypsum treated soils was lower than that of the untreated soils. Moreover, Chi et al. (2012) showed that the deficiency in the EC, SAR and pH for the 200% GR treatment was more than that of the 100% gypsum requirements (GR) treatment compared to the control treatment; this deficiency was due to the application of desulfurized gypsum which led to facilitate the leaching of Na^+ and salts. On the other hand, Rasouli *et al*. (2013) found that amending the soil with gypsum resulted in an increase in the hydraulic conductivity over the un-amended soil treatment. Qadir *et al*., (2002) reported that the increase in crop growth due to the integrated effect of chemical and organic amendments could be associated with the displacement of the exchangeable Na from the solid phase and the improvement in soil physical and chemical conditions. Moreover, Singh *et al*. (2013) reported that application of organic matter as crop residues had a significant effect in decreasing soil pH, EC, exchangeable Na^+, ESP and SAR to a considerable extent. Integrated use of farmyard manure + gypsum (Sharma *et al*., 2001; Sharma and Minhas, 2004; Makoi and Ndakidemi, 2007), pressmud + gypsum (Chauhan, 1995) and pressmud + gypsum + farmyard manure (Devitt *et al*., 1981) were reported better than their sole application in term of soil reclamation and crop yields.

The objective of this work is to study the efficiency of using gypsum and some organic amendments such as crop residues and sugar industry wastes as well as chicken manure in the reclamation of salt affected soils.

MATERIALS AND METHODS

An open air pot experiment was carried out in the experimental farm of Sids Research Station, Agriculture Research Center, Beni-suef Governorate, Egypt during seasons of summer 2013 (maize) and winter 2013/2014 (wheat) to study the effect of some soil amendments on some properties of salt affected soils, plant growth and NPK uptake by plants. The soil sample under investigation was collected from Beba country at Beni-suef Governorate. Some chemical and physical properties of the studied soil are shown in Table (1). Organic amendments were subjected to decomposition process for three months before using in soil reclamation according to the method described by Abo El-Fadl (1970).

Some chemical and physical properties of the applied organic amendments are given in Table (2). The treatments were applied as follows:

1. Control
2. Gypsum at 10 ton/fed.
3. Crop residues at 3 ton/fed.
4. Crop residues at 6 ton/fed.
5. Filter mud cake at 3 ton/fed.
6. Filter mud cake at 6 ton/fed.
7. Chicken manure at 3 ton/fed.
8. Chicken manure at 6 ton/fed.
9. Gypsum and crop residues at 10 and 3 ton/fed., respectively.
10. Gypsum and crop residues at 10 and 6 ton/fed., respectively.
11. Gypsum and filter mud cake at 10 and 3 ton/fed., respectively.
12. Gypsum and filter mud cake at 10 and 6 ton/fed., respectively.
13. Gypsum and chicken manure at 10 and 3 ton/fed., respectively.
14. Gypsum and chicken manure at 10 and 6 ton/fed., respectively.

The experimental design was completely randomized with five replications for each treatment. The tested soil was mixed throughly with the amendments and then 20 kg of the mixture was filled in 30 cm diameter and 30 cm depth pot.

Maize grains *(Zea mays L.)* were planted on 10 June 2013 where 5 kernels of maize *(Zea mays L.)* were planted in each pot. Only three plants were finally left to grow in each pot. Maize plants received half of the recommended doses of fertilizers at the equivalent rates/fed. as follows: 75 kg of ammonium nitrate (33% N), 75 kg of super phosphate (15.5% P_2O_5) and 25 kg of potassium sulphate (48% K_2O). Irrigation was followed every three days with an amount of water to compensate losses in moisture which maintained at field capacity. Water consumption for plant growth was recorded. The above ground parts of plants in all treatments were cut at 60 days after planting, then dried at 70˚c to a constant weight and the dry weight was recorded. Water use efficiency was calculated as a dry matter production (g) per liter of used water. The dry matter of maize plants was ground in a stainless steel mill and digested with H_2SO_4 and H_2O_2 according to Jackson (1973) and then the digested samples were analyzed for N, P and K content.

Table (1): Some analytical data of the investigated soils before cultivation.

Property	Particle size distribution(%)			Texture grade	Particle density (g/cm^3)	Bulk density (g/cm^3)	Total porosity (%)	Field capacity(%)	Wilting point (%)	Available water (%)	O.M (%)	$CaCO_3$(%)	Gypsum requirements (Ton/fed.)
	Sand	Silt	Clay										
Value	3.48	37.25	59.27	Clay	2.65	1.30	33.00	50.13	15.62	34.51	1.63	2.58	10.00

Property	pH (1:2.5)	EC (dS/m) (1:5)	Soluble cations (mmol/kg)				Soluble anions (mmol/kg)			ESP (%)	CEC (meq/100 gsoil)	Exchangeable cations (cmol/kg)				Available (mg/kg)		
			Ca^{++}	Mg^{++}	Na^+	K^+	CO_3^{--}+ HCO_3^-	Cl^-	SO_4^-			Ca^{++}	Mg^{++}	Na^+	K^+	N	P	K
Value	8.56	6.38	5.85	4.20	21.2	0.75	6.81	16.23	8.86	40.02	36.21	8.11	8.49	14.49	5.12	34.52	5.13	28.15

Table (2): Some chemical properties of the organic amendments.

Amendment	Organic matter (%)	Total organic carbon (%)	Total nitrogen (%)	C/Nratio	pH(1:2.5)	EC (dS/m)(1-5)	Available P (mg/kg)	Available K (mg/kg)	$CaCO_3$(%)	CEC(cmol/kg)
Crop residues	19.23	20.23	1.52	13.31	7.10	1.32	12.85	89.21	0.82	65.32
Filter mud cake	61.28	38.82	2.45	16.00	5.96	1.58	40.35	65.23	2.13	95.15
Chickenmanure	56.01	30.15	2.25	13.40	7.22	2.18	8.90	160.21	1.18	89.53

After cutting maize plants, the treated soil in each pot was well re-mixed and then the second plant, wheat (*Triticum aestivum L.*), was planted in the same pot on 10 December 2013 where 20 grains were planted in each pot. Wheat plants received half of the recommended doses of fertilizers at the equivalent levels/fed. as follows: 125 kg of ammonium nitrate (33% N), 100 kg of super phosphate (15.5% P_2O_5) and 25 kg of potassium sulphate (48% K_2O). Irrigation was followed every three days with an amount of water to compensate losses in moisture which maintained at field capacity. At 30 days of planting, each pot was sprayed with 750 ml of modified Hoagland's No. 1 solution. At the end period of plant growth, water consumption for plant growth was recorded. The above ground part of wheat plants was cut at 90 days after sowing, then dried at 70˚c to a constant weight and the dry weight was recorded. Water use efficiency was calculated as a dry matter production (g) per liter of used water. The dry matter of wheat plants was ground in stainless steel mill and digested with H_2SO_4 and H_2O_2 according to Jackson (1973) and then the digested samples were analyzed for N, P and K content.

Soil samples were taken from all replications for all treatments after the first and the second seasons. Changes in the physical and chemical properties as well as NPK content of the treated soils due to application of the studied amendments were recorded.

The proper statistical analysis of the data was carried out according to Snedecor (1965).The differences between means of treatments were compared using the least significant difference (LSD) at 1 and 5% level of probability.

RESULTS AND DISCUSSION

Soil physical properties:

1. **Soil density and total porosity:**

Total porosity is an index of the relative volume of pores in the soil. Also, it is a special formula which explains the relationship between both the soil real and bulk densities. Data in Table (3) show a decrease in bulk density and a positive change in total porosity, where (G+Ch 2) treatment gave the highest responding followed by (G+Ch 1) treatment. This probably due to the favorable effect of organic matter on improving soil structure, which was reflected in the soil bulk density and subsequently in the total porosity. These results are in an agreement with the results of Aza and Mahmoud (2013).

Data in Table (3) reveal that the application of such amendments increased the values of field capacity (FC) and wilting point (WP). The increase magnitude of moisture at FC was more than at WP and it was reflected on increasing the available water in the treated soil. The highest response was for (G+Ch 2) treatment. These results may be attributed to their effect on increasing the amount of pores and due to their action like a super sponge, absorbing and storing available water in the root media. These results are in a harmony with the results of Makoi and Ndakidemi (2007).

Table (3): Effect of soil amendments on some soil physical properties of the investigated soil.

No.	Treatment	Bulk density (g/cm^3)	Total porosity (%)	Field capacity (%)	Wilting point (%)	Available water (%)
1	Control	1.75	33.00	43.52	15.43	28.09
2	G	1.25	53.70	43.58	15.48	28.10
3	WC 1	1.23	54.44	43.60	15.62	27.98
4	WC 2	1.21	54.85	43.78	15.97	27.81
5	WS 1	1.23	54.10	45.61	16.43	29.18
6	WS 2	1.20	54.37	46.92	17.12	29.80
7	Ch 1	1.21	54.17	45.63	16.89	28.74
8	Ch 2	1.19	53.88	47.45	18.61	28.84
9	G+WC 1	1.21	54.68	45.72	16.63	29.09
10	G+WC 2	1.18	55.30	46.83	18.15	28.68
11	G+WS 1	1.17	54.98	48.13	17.21	30.92
12	G+WS 2	1.14	55.04	49.65	18.65	31.00
13	G+Ch 1	1.16	55.17	48.63	17.65	30.98
14	G+Ch 2	1.13	55.64	52.21	19.42	32.79

2. **Moisture indices:**

Plant indices (direct effect):

1. **Dry weight:**

The results of the dry weight of the whole maize plants after 60 days from sowing are present in Table (4). There was a significant increase in the dry weight and the G+Ch 2 treatment gave the highest significant increase when compared to the other treatments. This result is probably due to the improvement of soil physico-chemical properties; consequently, high efficient utilization of all nutrients by plants and in turn good growth was observed. Similar results were obtained by Mahdy (2011).2. Water consumption (WC) and water use efficiency (WUE):

Table (4) indicates that water consumed by maize plants grown in the investigated soil and WUE significantly increased due to amendment applications, except for G-treatment. The G+Ch 2 treatment gave the highest significant WUE increase compared to the other treatments. This increase may be attributed to the effect of organic matter that applied to the soil on enhancing water holding capacity of the treated soil and decreasing the evaporation from soil surface. Therefore, increasing the available water to plants could be used in producing more plant materials and consequently more water use efficiency. These results were reported by Aly (1999).

Table (4): The direct effect of soil amendments on dry weight, water use efficiency, and the uptake of N, P and K by maize plants.

No.	Treatment	Dry matter (g/pot)	Water consumption (L/pot)	Water use efficiency (g/L)	Uptake (mg/pot)		
					N	P	K
1	Control	7.14	6.12	1.16	10.05	0.66	12.46
2	G	7.16	6.12	1.17	10.06	0.81	13.23
3	WC 1	7.31	6.20	1.18	15.15	0.85	13.37
4	WC 2	7.43	6.25	1.19	16.41	0.95	15.13
5	WS 1	8.04	6.60	1.21	16.57	1.22	16.54
6	WS 2	8.29	6.78	1.22	18.61	1.69	18.68
7	Ch 1	8.33	6.86	1.21	19.81	1.5	18.18
8	Ch 2	8.86	7.18	1.23	20.94	1.93	21.61
9	G+WC 1	7.63	6.39	1.19	16.36	1.26	14.92
10	G+WC 2	7.77	6.42	1.21	17.33	1.63	17.29
11	G+WS 1	8.19	6.77	1.21	18.45	1.57	18.69
12	G+WS 2	8.41	6.94	1.22	20.23	1.93	19.59
13	G+Ch 1	8.89	7.23	1.23	21.18	1.76	20.56
14	G+Ch 2	9.38	7.50	1.25	23.88	2.45	24.38
	L.S.D $_{0.05}$	0.18	0.03	0.03	0.91	0.17	1.05
	L.S.D $_{0.01}$	0.25	0.04	0.04	1.31	0.24	1.51

3. Uptake of N, P and K by maize plants:

There are significant increases in the uptake of N, P and K by maize (Table 4). The treatment of (G+Ch 2) gave the highest significant increases in the uptake of NPK by maize plants compared to the other ones. This could be attributed to the effect of soil amendments on improving soil physico-chemical properties and in turn good growth, more penetration of root and consequently high efficient utilization of all nutrients by plants. Similar results were obtained by Shaimaa et *al*. (2012).

Plant indices (residual effect)

1. Dry weight:

The dry weight of the whole wheat plant after 90 days from sowing are present in Table (5). The soil amendments significantly affected the dry weight / plant after 90 days compared to control. It could be observed that dry weight / plant gave the highest significant increase with the treatment of (G+Ch 2).These findings may be due to the ameliorative effect of (G+Ch 2) treatment on physical and chemical conditions which allow more deep penetration of plant roots and the adsorption of more nutrients. These

Table (5): The residual effect of soil amendments on dry weight, water use efficiency, and the uptake of N, P and K by the wheat.

No.	Treatment	Dry matter (g/pot)	Water consumption (L/pot)	Water use efficiency (g/L)	Uptake (mg/pot)		
					N	P	K
1	Control	5.79	4.18	1.40	11.9	1.04	18.6
2	G	5.92	4.18	1.42	13.98	1.09	19.6
3	WC 1	6.16	4.28	1.44	18.06	1.25	20.28
4	WC 2	6.32	4.34	1.46	19.86	1.4	21.2
5	WS 1	6.48	4.41	1.47	19.75	1.27	21.24
6	WS 2	6.55	4.49	1.46	21.34	1.53	22.47
7	Ch 1	6.69	4.55	1.47	20.66	1.38	21.12
8	Ch 2	6.84	4.62	1.48	22.07	1.66	22.83
9	G+WC 1	6.77	4.64	1.46	21.31	1.35	21.91
10	G+WC 2	6.99	4.70	1.49	23.34	1.58	23.95
11	G+WS 1	7.16	4.75	1.51	22.84	1.58	23.13
12	G+WS 2	7.39	4.82	1.53	26.74	2.13	26.52
13	G+Ch 1	7.50	4.88	1.54	24.54	1.84	24.59
14	G+Ch 2	7.64	4.93	1.55	27.96	2.74	29.31
	$L.S.D_{0.05}$	0.18	0.04	0.04	0.79	0.16	0.71
	$L.S.D_{0.01}$	0.25	0.05	0.06	1.14	0.23	1.02

results are partially in an agreement with those of El-Masry (2001).

2. Water consumption (WC), and water use efficiency (WUE):

Results given in Table (5) confirm the results of those found after maize cutting where the application of (G+Ch 2) treatment gave the highest significant increase in the water consumed by wheat plants and in WUE compared with other treatments. However, it could be noticed that the significant increase in water use efficiency after wheat cutting were less than those estimated after maize cutting. This increase may be attributed to the residual effect of organic matter on enhancing water holding capacity of the treated soils and decreasing the evaporation from soil surface. Therefore, the decrease in the available water that occurred after wheat cutting may be due to the decreasing occurred in the soil organic matter content with time because the decomposition rate of applied manures increased with increasing decomposition period.

3. Uptake of N, P and K by wheat plants:

The soil amendments gave significant increase in the uptake of N, P and K by wheat plants compared to the control treatment (Table 5). Apparently, the treatment of (G+Ch 2) significantly gave the highest NPK uptake values compared to other treatments. This may be due to the favorable effect of such amendments in decreasing the values of pH and ESP which in turn resulted in increasing the availability of nutrients, and consequently increasing their uptake by plants. These results are in accordance with those of El-Saadany (2004).

Soil chemical properties:

1. Soil pH:

Soil pH is probably the most useful chemical soil property. It helps to predict the relative availability of most inorganic nutrients in soils. Tables (6A, B) show that soil pH values slightly decreased after cutting the first plants (maize), and there was a gradual pH decrease after cutting the second plants (wheat). The reduction in the soil pH was more pronounced with the (G+Ch 2) treatment. This reduction may be due to the production of CO_2 and organic acids such as fluvic and humic acids by soil microorganisms, acting on the soil organic matter. Moreover, the slight decrease of soil pH may be attributed to the degree of buffering capacity of alluvial soil to resist the changes in soil pH caused by the acid produced from organic matter decomposition. These results are in harmony with Darwich *et al*. (2012).

2. Soil salinity (EC):

Tables (6A, B) show that values of EC slightly increased after cutting the first plants (maize), and there was a gradual EC increase after cutting the second plants (wheat). Moreover, the highest increase in soil salinity was for (G+Ch 2) treatment. Although soil salinity increased as a result of adding soil amendments, it did not reach the hazardous limits to growing crops. This increase in the soil salinity may be attributed to the level of inorganic ions that released from the added amendments. Hamoud (1992) reported that the soil treated with different levels of sewage sludge and farmyard manure additions (10, 15, 20 and 30 ton/fed.) had higher EC values than the untreated one

3. Cation exchange capacity (CEC):

The CEC of the treated soils increased after cutting the first plants (maize), and gradual CEC increase in the CEC values extended in the studied soils after cutting the second plants (wheat) (Tables 6A and B). The (G+Ch 2) treatment gave the highest increase. These results could be attributed to increasing the adsorption or the exchange sites resulting from the applied organic matter and consequently increasing the values of CEC. Similar results were obtained by Clark *et al*. (2007).

4. Soil organic matter (OM):

Soil OM increased after cutting the first plants (maize), and that the gradual increase in OM values extended in the studied soils after cutting the second plants (wheat) (Tables 6A and B). Apparently, (G+Ch 2) treatment resulted in the higher values. It can be concluded that increasing soil organic matter content was a direct result for the application of organic manures. This result was in accordance with Amer *et al.* (1996).

5. Exchangeable sodium percentage (ESP):

Tables (6A, B) show that ESP values decreased after ccuttting the first plants (maize), and gradual decrease in ESP values extended in the studied soils after cutting the second plants (wheat). The application of (G+Ch 2) treatment was more pronounced than the other treatments. These results may be attributed to the effect of organic matter in improving the physical properties of the tested soils as the aggregate stability and hydraulic conductivity increase and bulk density decreases. These effects contribute to improve soil aeration and permit a good leaching out the sodium salts. The same results were reported by Rasouli *et al.* (2013).

6. Soil macronutrients contents:

a. After cutting the first crop (maize):

The application of soil amendments increased the availability of N, P and K in the tested soil and that (G+Ch 2) treatment gave the higher values (Table 6A). This may be due to the effective application role of organic materials which have narrow C/N ratio. So, it is considered a rich source for nutritional elements and also due to the improvement of soil physical and chemical properties such as lowering pH and ESP and in turn increasing the nutrient availability. These results are in agreement with Saeid (2002).

Table (6A): Effect of soil amendments on some chemical properties in the investigated soil samples after cutting of maize plants.

No.	Treatments	pH (1:2.5)	EC (dS/m) (1:5)	CEC (cmol/kg)	ESP (%)	OM (%)	Available nutrients (mg/kg)		
							N	P	K
1	Control	8.52	6.40	37.24	37.89	1.68	32.15	5.56	27.13
2	G	8.52	6.41	37.25	37.61	1.73	33.27	5.63	27.78
3	WC 1	8.51	6.41	37.25	37.26	1.75	35.70	5.70	27.81
4	WC 2	8.50	6.43	37.27	37.03	1.79	36.79	5.78	28.85
5	WS 1	8.50	6.41	37.26	36.85	1.83	37.28	5.78	29.93
6	WS 2	8.50	6.45	37.31	35.62	1.86	39.01	5.85	32.65
7	Ch 1	8.48	6.43	37.33	36.19	1.92	40.65	5.89	34.12
8	Ch 2	8.46	6.48	37.41	31.10	1.98	43.16	5.93	37.78
9	G+WC 1	8.47	6.45	37.30	31.60	1.78	35.78	5.86	28.18
10	G+WC 2	8.45	6.46	37.35	29.80	1.82	36.91	5.92	30.35
11	G+WS 1	8.47	6.47	37.38	27.31	1.89	39.07	6.08	33.10
12	G+WS 2	8.44	6.51	37.43	25.78	1.95	42.12	6.29	35.00
13	G+Ch 1	8.45	6.53	37.51	21.62	1.95	45.13	6.51	37.02
14	G+Ch 2	8.43	6.57	37.65	16.97	1.98	48.32	6.72	40.46

b. After cutting the second crop (wheat):

The results of those found after maize cutting where (G+Ch 2) treatment resulted in more availability of tested nutrients than those of the other treatments. The values of such available nutrients determined after wheat cutting were less than those estimated after maize cutting. These latter results may be due to much more consumption of nutrient contents by wheat plants and consequently the amount of available nutrient contents decreased from crop to crop.

Table (6B): Effect of soil amendments on some chemical properties in the investigated soil samples after cutting wheat plants.

No.	Treatments	pH(1:2.5)	EC(dS/m) (1:5)	CEC(cmol/kg)	ESP(%)	OM(%)	Available nutrients (mg/kg)		
							N	P	K
1	Control	8.50	6.42	37.95	36.50	1.70	29.11	5.16	27.10
2	G	8.50	6.45	37.96	35.85	1.76	29.65	5.32	27.23
3	WC 1	8.49	6.43	37.98	35.26	1.78	32.13	5.29	28.15
4	WC 2	8.48	6.46	38.05	34.60	1.81	32.78	5.35	28.92
5	WS 1	8.49	6.45	38.17	34.53	1.84	34.79	5.60	30.28
6	WS 2	8.47	6.47	38.18	33.66	1.88	36.21	5.72	33.10
7	Ch 1	8.46	6.46	38.25	33.46	1.93	39.15	5.81	36.18
8	Ch 2	8.45	6.51	38.41	32.31	2.03	40.56	5.83	38.51
9	G+WC 1	8.44	6.43	38.25	30.03	1.82	34.12	5.40	29.56
10	G+WC 2	8.43	6.46	38.41	28.72	1.86	34.79	5.62	32.39
11	G+WS 1	8.46	6.48	38.21	25.70	1.93	37.51	5.61	35.12
12	G+WS 2	8.43	6.49	38.27	21.82	2.07	38.49	6.00	36.10
13	G+Ch 1	8.45	6.48	38.35	19.01	2.03	42.52	6.03	38.15
14	G+Ch 2	8.42	6.51	38.48	15.35	2.08	46.89	6.10	40.52

In general, results approve that the applications of organic amendments individually are the most positive as compared to the application of gypsum individually and that organic amendments become more influential and positive when mixed with gypsum. Also, data reveal that the treatment (gypsum (A or B or C ton/fed.) + Chicken manure (6ton/fed.)) has the most positive effect in improving the properties of the salt affected soils.

Finally, we can say that to improve the properties of salt affected soils and to reduce the spread of this problem as it represents the most harmful to land degradation, so we should expand in the use of soil organic amendments with gypsum because of its positive impact on improving the properties of such soils and by completing this work in actual experiments and study the economic aspects of the use of these amendments.

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الملخص العربـــي

تغيرات فيزيائية كيميائية للتربة أثناء معالجة مشاكل الأراضي المتأثرة بالأملاح بإستخدام المحسنات العضوية

دعاء جمال محمد سليمان [1]،* أحمد أحمد عبدالخالق[2]، محمد ربيع محمود[1]، ريهام أنور محمد[2]

[1] مركز البحوث الزراعية – معهد بحوث الأراضي والمياه والبيئة

[2] كلية العلوم – جامعة بني سويف

أجريت تجربة أصص بمحطة البحوث الزراعية بسدس – محافظة بني سويف خلال الموسمين المتعاقبين (موسم 2013/2014 شتوي – موسم 2014 صيفي). حيث أخذت عينات من الأراضي المتأثرة بالأملاح بمركز ببا وذلك لدراسة استخدام بعض محسنات التربة (الجبس الزراعي و محسنات عضوية مختلفة مثل: بقايا المحاصيل الحقلية و مخلفات مصنع السكر بأبو قرقاص بالمنيا و مخلفات الدواجن، كل منهم بمفرده و مختلطا مع الجبس الزراعي) على بعض خواص التربة الكيميائية و الطبيعية و ايضا على نمو النبات (الذرة و القمح) وامتصاص العناصر الغذائية بواسطة النباتات النامية على هذه التربة. لقد خضعت محسنات التربة العضوية لعملية تحلل لمدة ثلاثة أشهر وذلك قبل إضافتها وخلطها بالتربة تحت الدراسة.

فيما يتعلق بخواص التربة الطبيعية، فقد أوضحت البيانات أن إضافة محسنات التربة أدى إلى نقص في الكثافة الظاهرية للتربة بينما أدى إلى زيادة قيم المسامية الكلية والسعة الحقلية و نقطة الذبول، بالتالي أدى إلى زيادة كمية الماء الميسر خاصة عند إضافة معاملة (10 طن/فدان جبس زراعي + 6 طن/فدان سماد الدواجن)، مقارنة بالمعاملات الأخرى. وأظهرت النتائج أيضا وجود زيادة معنوية في نسبة امتصاص العناصر الغذائية لكل من المحصولين الأول و الثاني (الذرة و القمح) كنتيجة لإضافة محسنات التربة، وقد أعطت معاملة (10 طن/فدان جبس زراعي + 6 طن/فدان سماد الدواجن) أعلى معنوية. بالنسبة لخواص التربة الكيميائية، فقد أظهرت النتائج حدوث نقص تدريجي في قيم الأس الهيدروجيني للتربة و كذلك نسبة الصوديوم المتبادل نتيجة لإضافة المحسنات المختلفة، على العكس فقد أظهرت أيضا وجودة زيادة تدريجية في قيم الأملاح الكلية الذائبة (التوصيل الكهربي) و السعة التبادلية الكاتيونية و نسبة المادة العضوية و محتوى التربة تحت الدراسة من العناصر الغذائية عند المقارنة بمعاملة الكنترول. أفضل نتيجة كانت للمعاملة (10 طن/فدان جبس زراعي + 6 طن/فدان سماد الدواجن) مقارنة بباقي المعاملات.