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Effect of Biochar and Chicken Manure on Soil Properties and Growth Traits of Coriander Plant Irrigated with Saline Water in Sandy Soil

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ABSTRACT

A pot trial was conducted in the nursery of the Faculty of Agriculture, Mansoura University during the 2016/2017 season to study the effect of biochar and chicken manure on sandy soil properties and traits of coriander plant and the possibility of utilizing the seawater diluted (10%) in irrigation. Randomized complete plot design (RCBD) with three replicates was used in this study. The treatments were as follows: Without (Control), Chicken manure, (20 ton fed^{-1}, i.e. 400 g pot^{-1}) and biochar, (5 ton fed^{-1}, i.e. 100 $gpot^{-1}$). Results showed that the organic amendments [chicken manure and biochar] had highly significant effects on all the studied chemical and physical properties of sandy soil such as, total N, P, K, Fe, Zn, Mn, Ca, Mg, Na, pH, EC and bulk density. Adding biochar and chicken manure gave the best values of all the studied chemical and physical properties of sandy soil compared with control. Also, it was noticed surpassed that biochar treatment over chicken manure in some chemical traits of the soil, such as, total N, P, Na and Cl in the soil. On the other side, the chicken manure surpassed over biochar in some chemical traits of the soil, such as, K, Fe, Mn, Ca and Mg. Results indicated that the organic amendments [chicken manure and biochar] had highly significant effects on all the studied chemical, growth and yield traits of coriander plant, i.e. total N, P and K (%); total Fe, Zn and Mn contents ($mgkg^{-1}$); plant fresh weight (g), plant dry weight (g), plant height (cm), leaves number per plant and chlorophyll content. Adding chicken manure and biochar gave the best values of all the studied chemical, growth and yield traits of coriander plant compared with control. In addition, it was noticed surpassed the chicken manure over biochar in improving all the studied chemical, growth and yield traits of coriander plant. Therefore, it could be recommended that adding the organic amendments (chicken manure or biochar) to improve the chemical and physical properties of sandy soil and chemical and growth traits of coriander plant irrigated with saline water (diluted seawater, 10%) in sandy soil.

Keywords: Biochar, chicken manure, sandy soil, Saline water, coriander (*Coriandrum sativum L.*).

INTRODUCTION

Coriander plant is used as thyme like garnish with a new fragrance that is vital in dishes of soups and meat, as these are rich in vitamins A, B_2 (riboflavin), C and dietary fiber. Salads are extremely useful for weight conscious individuals, because of their haughty vitamins and fibers contents. The dried seeds add to agreeably aromatic spice that is considerable used in stews, cuisine, sweet breads, sausages and cakes (Peter, 2004). The Egyptians called this herb as “spice of happiness”, maybe for the cause that it was well thought-out to be an aphrodisiac. It's used for cooking and for children’s digestive sadden and diarrhea. The Romans and Greeks also used coriander to flavor wine and also as a medication. Afterward, it was introduced into Great Britain by the Romans (Livarda and van der Veen, 2008).

Salinity is a major abiotic environmental stress factor by reducing plant growth and productivity throughout the world. Approximately 23% of the cultivated lands are considered as saline and another 37% are sodic. About 20 million hectares of land deteriorates to zero production each year. This problem is more serious in agriculture of south and Southeast Asia (Malcolm, 1993; Francois & Maas, 1999). Research indicated that salinity inhibits plant growth by affecting both water absorption and biochemical processes as N and CO_2 assimilation and biosynthesis of protein (Cusido *et al*., 1987). Under saline situations, plants fail to preserve the vital balance of organic and inorganic constituents leading to repressed growth and yield (Gunes *et al*., 1996). Plant behavior, usually expressed as a fresh yield, biological yield or crop quality (both of vegetative and reproductive organs), may be adversely affected by salinity induced nutritional disorders. These disorders may be due to the effect of salinity on availability of nutrients, competitive uptake of nutrients, transport or partitioning of them within the plant (Ali *et al*., 2006a; Nasim *et al*., 2008).

Biochar is a fine-grained charcoal great in organic carbon and largely resistant to decomposition. It is produced from pyrolysis of plants and waste feed stocks. Biochar application has received a growing interest as a sustainable technology to recover highly weathered or degraded soils (Lehmann, J. 2007). It can improve plant growth by improving chemical properties of soil (i.e. nutrient retaining and availability) and physical traits of soil (i.e. bulk density, water holding capacity, permeability) and biological properties of soil, all contributing to an improved crop productivity, (Behera *et al.*, 2007) showed that salt and drought stresses negatively affect fertility of soil and growth of plant. Adding of biochar enhances the negative effects of drought and salt stresses on plants. The application of biochar increased the growth of plant, biological yield, and yield under either drought and/or salt stresses and also improved photosynthesis, nutrient uptake, and amended gas exchange characteristics in drought and salt-stressed plants. Under drought stress, biochar amplified the water holding capacity of soil and enhanced the physical and biological soils properties. Under salt stress, biochar reduced Na^+ % uptake, while increased K^+ % uptake by plants. Biochar-mediated increase in salt tolerance of plants is mainly associated with enhancement in soil properties, thus increasing plant water status, decrease of Na^+ % uptake, increasing uptake of minerals, and regulation of stomata conductance and phytohormones. This review highpoints both the potential of biochar in improving water stress and salt stress in plants and future vision of the role of biochar under water stress and salt stress in plants (Ali, *et al.,* 2017). Treatment of organic material always is a positive way for improving physical and chemical properties of soils, where, soil humus content increase. (Böhme and Böhme, 2006 and Sarwar *et al*., 2008). Farmyard –manure, compost and chicken fertilizer known as organic amendments. Chicken fertilizer is rich in both nitrogen and phosphorus compared to other organic manures. Therefore, the main objective of this research was to study the effects of biochar and chicken manure on sandy soil properties and traits of coriander plant irrigated with saline water.

MATERIALS AND METHODS

The trial was conducted in the nursery of the Fac. of Agric. Mansoura Univ. during the 2016/2017 season to study the possibility of reclamation of large areas of sandy land and the possibility of utilizing the seawater diluted with fresh water irrigation. The coriander plant was cultivated in pots, which filled with 20 kg sandy soil. Randomized complete plot design (RCBD) with three replicates was used in this study. The treatments were as follows: 1- Control, 2-Chicken manure, (at a rate of 20 tonfed^{-1}, i.e. 400 g pot^{-1}) The source of Chicken manure was the farm of Kalabsho and 3-Biochar, (5 tonfed^{-1}, i.e. 100 gpot^{-1}) The source of Biochar was from the branches of plants. The source of sandy soil was the farm of Kalabsho. Twenty seeds of coriander were sown on 1st March 2016. The diluted seawater was used for plant irrigation with dilution level of 10% (20 L seawater per 200 L normal water) using drip irrigation method.

Table 1. Chemical analysis of the biochar manures and chicken manure used for the experiments

Analysis	Biochar	Chicken manure
pH value	8.87	7.37
EC, dSm	0.664	14.50
N (%)	35.352	25950.43
Av P mg.kg	9.822	427.06
Av K mg.kg	455.60	1426.32
Total C (%)	29.05	13.82
C:N ratio	24.01	14.55
Fe mgkg^{-1}	3800	1060
Zn mgkg^{-1}	84	480
Mn mgkg^{-1}	103	260

Analysis of Water: To Judge impeccably on the chemical properties of water, these approaches were used conferring to the global standard methods [(pH and EC); Anions ($CO_3^=$, HCO_3^-, $SO_4^=$ and Cl^-) and Cations (Ca^{++}, Mg^{++}, Na^+ and K^+) were determined as defined by Hesse (1971).

Table 2. Chemical properties of irrigation water used for the irrigation of experiments

Irrigation Water used	pH	EC, dSm^{-1}	Anions				Cations			
			$CO_3^=$, meq/l	HCO_3^-, meq/l	$SO_4^=$, meq/l	Cl^-, meq/l	Na^+ meq/l	K^+ meq/l	Ca^{++} meq/l	Mg^{++} meq/l
	6.56	4.38	--	3.5	12.1	22.97	26.7	0.59	3.45	7.85

Analysis of Soil: To get impeccably physical and chemical properties of soil, these approaches were used conferring to the global standard means (Mechanical analysis, EC, pH, Bd, O.M, Ca^{+2}, Mg^{+2}, Na^+, K^+ $CO_3^=$, HCO_3^-, Cl^-, Mg^{++}, N, P, K, Fe, Zn, and Mn), as labelled by Jackson (1967). Table 2 illustrates the some chemical and physical properties of sandy soil.

Table 3. Some chemical and physical properties of sandy soil used before sowing coriander seeds

Properties	value
Chemical properties	
pH	8.56
EC, dSm	3.02
O.M. (organic matter)%	0.41
Soluble Cations and Anions (meq/100g soil)	
Ca	2.1292
Mg	1.703
Na	1.555
K	0.172
CO_3	--
HCO_3	0.261
SO_4	1.208
Cl	4.081
Particle size distribution %	
Sand	95.59
Clay	1.30
Silt	3.35
Textural class	sandy
Available nutrients (mgkg)	
N	22.04
P	4.624
K	86.571
Fe	0.24
Zn	0.1
Mn	0.02

Chemical Analysis of Plant: To estimate N, P and K concentrations in plant tissues, 0.4 g samples of dried plants were wet digested with a mix of concentrated Sulphuric acid (H_2SO_4) and Perchloric acid ($HClO_4$), then heated unit become clear solution. This solution was quantitavely transported into 100 ml flask and kept for determinations, (Gotteni *et al*., 1982). Total nitrogen was estimated using micro-Kjeldahl apparatus, as defined by Jones *et al*., (1991). Total phosphorus was determined spectro-photomitrically by Milten Roy spectronic 120 at wavelength 725 nm using stannous chloride reduced molybdosulphoric blue colour method in sulphoric system as described by Peters *et al*.,(2003). Total potassium was determined using jenway flame photometer, Model-corning 400 according to the modified method of Jackson (1967). For determine heavy metals; Fe, Mn, Zn, and Se, were extracted from the plant samples using the method of micro wave digestion. 0.1 g from each sample was homogenized in a Teflon cups with 5 ml nitric acid (ultrapure), 2 ml H_2O_2 30% and 0.5 ml hidro floric acid. The microwave apparatus at 37 wt/12min. the mixture was frozen at -10 ^{0}C/30 min and set up at 50 ml with redistilled water. The heavy metals concentrations were analyzed by Electro Thermal Atomic Absorption Spectrophotometer, Perkin Elmer Model 5100 as described by Kumpulainen *et al*., (1983).

Plant measurements: Fresh weight (g/pot): as average of 20 plants after harvesting directly but dry weight (g/pot), as an average of 20 plants after harvesting, were air dried, then oven dried at 70 ^{o}C until weight constant, Plant height (cm), as average of 5 plants after harvesting, Number of leaves/plant, as an average of 5 plants after harvesting. Total chlorophyll content: a portable chlorophyll meter (SPAD-502, Soil-Plant Analysis Development (SPAD) Section, Minolta Camera, Osaka, Japan) was used to measure flag leaf greenness in SPAD values conferring to (Castelli *et al*. 1996). These values have been found to be linearly related to chlorophyll concentration in numerous situations (Yadava, 1986). Three readings were made on each of leaf from five plants/ pot.

Statistical analysis: the gotten data were statistically analyzed conferring to the procedure of analysis of variance (ANOVA) for randomized complete plot design (RCBD) as available by Gomez and Gomez (1984) by using means of "MSTAT-C" software package of computer. Least significant of difference (LSD) was used to compare among means of treatments at 5% and 1% probability levels, as labelled by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

A- Soil properties

1-Total N, P and K contents (mgkg^{-1}).

Data in fig1 show that the organic amendments had highly significant effect on total N, P and K contents (mgkg^{-1}) in the sandy soil. The highest value of total N (344.75 mgkg^{-1}) was recorded with adding biochar, obtaining remarked increase compared to chicken manure or control treatments. While, the lowest value of total N (260.88 mgkg^{-1}) was resulted from control treatment (without adding any amendment) in sandy soil. However, the chicken manure treatment resulted the moderate value (336.67 mgkg^{-1}) of total N in the sandy soil with highly significant increase compared to control treatment.

The highest value of total P (110.3 mgkg^{-1}) was recorded with adding chicken manure, recording remarked increase compared with biochar or control treatments. While, the lowest value of total P (37.83 mgkg^{-1}) was resulted from control treatment (without adding any amendment) in sandy soil. However, the biochar treatment resulted the moderate value (44.00 mgkg^{-1}) of total P in the sandy soil with highly significant increase compared with control treatment.

The highest value of total K (879.91 mgkg^{-1}) was recorded with adding chicken manure, giving remarked increase compared to biochar or control treatments. While, the lowest value of total K (817.50 mgkg^{-1}) was resulted from control treatment (without adding any amendments) in sandy soil. However, the biochar treatment recorded the medium value (850.08 mgkg^{-1}) of total K t in the sandy soil with highly significant increase compared to control treatment), as illustrated in Fig 1.

The superiority of both the bio-charcoal and the chicken fertilizer in the increase of potassium in the sandy soil compared to the control treatment may be due to their role in improving soil physical and chemical properties and also the increase of nutrients content in studied soil, especially N, P and K, along with their role in reducing the loss of these nutrients from the soil by increasing the ability of the soil to retain them and minimize the down movement of water in sandy soil due to the increase of these applied organic matter to soil. These results are in agreement with those reported by (Agbna *et al.*, 2017), (Ali, *et al.,* 2017), (Kanwal, *et al.*, 2017) and (Maucieriab, *et al.*, 2017) for studing the effect of biochar, and (Prapagar *et al.*, 2015), (Yu, *et al.*, 2015) and (Ravimycin, 2016) for studing the effect of chicken manure.

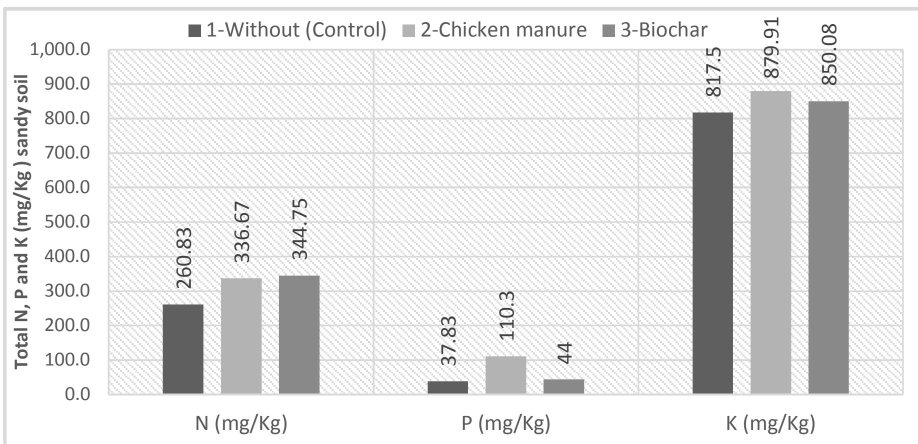

Fig. 1. An average of total N, P and K (mgkg^{-1}) soil as affected by the organic amendments types under sandy soil conditions.

2-Total Fe, Zn and Mn contents (mgkg^{-1}).

Data in fig2 show that the organic amendments [chicken manure and biochar] had highly significant effect on total Fe (mgkg^{-1}) soil and only significant effect (at 0.05 probability level) on total Zn and Mn contents (mgkg^{-1}) sandy soil.

The highest value of total Fe (227.75 mgkg^{-1}) was recorded with adding chicken manure, obtaining remarked increase compared to biochar or control treatment. While, the lowest value of total Fe (131.66 mgkg^{-1}) was resulted from control treatment (without adding any amendments) in sandy soil. However, the biochar treatment recoding the medium value (163.33 mgkg^{-1}) of total Fe in the sandy soil with highly significant increase compared to control treatment.

The highest value of total Zn content (7.99 mgkg^{-1}) was recorded in control (without adding any organic amendments), followed by adding biochar (7.02 mgkg^{-1}). While, the lowest value of total Zn (6.92 mgkg^{-1}) was resulted from adding chicken manure to sandy soil.

The highest value of total Mn (136.16 mgkg^{-1}) was resulted from adding chicken manure in the sandy soil with significant increase compared to other treatments, followed by adding biochar (111.91 mgkg^{-1}). While, the lowest value of total Mn (107.08 mgkg^{-1}) was recorded from control treatment (without adding any organic amendments), as graphically illustrated in Fig 2.

3-Total Ca, Mg and Na contents (mgkg^{-1}).

Data in fig 3 show that the organic amendments [chicken manure and biochar] had highly significant effect on total Ca, Mg and Na contents (mgkg^{-1}) in the sandy soil.

The highest value of total Ca (251.1 mgkg^{-1}) was resulted from adding chicken manure to the studied sandy soil with significant increase (90.2%) compared to control, followed by adding biochar (172.2 mgkg^{-1}) with significant increase (30.5 %) compared to control. While, the lowest value of total Ca (132.0 mgkg^{-1}) was recorded from control treatment (without adding any organic amendment).

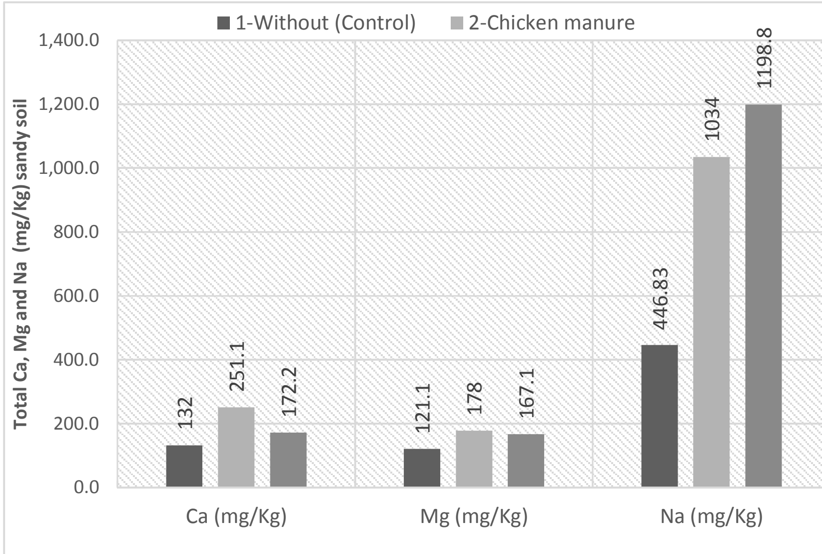

Fig. 2. An average of total Fe, Zn and Mn (mgkg^{-1}) soil as affected by the organic amendments types under sandy soil conditions.

The highest value of total Mg t (178.0 mgkg^{-1}) was resulted from adding chicken manure in the sandy soil with highly significant increase (47.0 %) compared with control, followed by adding biochar treatment (167.1 mgkg^{-1}) to highly significant increasing (38.0 %) compared to control. While, the lowest value of total Mg (121.1 mgkg^{-1}) was recorded from control treatment (without adding any organic amendment).

The highest value of total Na (1198.8 mgkg^{-1}) was resulted from adding biochar to the sandy soil with highly significant increase (168.3 %) compared to control, followed by adding chicken manure (1034.0 mgkg^{-1}) with highly significant increase (131.4 %) compared to control. While, the lowest value of total Na (446.83 mgkg^{-1}) was recorded from control treatment (without adding any organic amendment), as graphically illustrated in Fig 3.

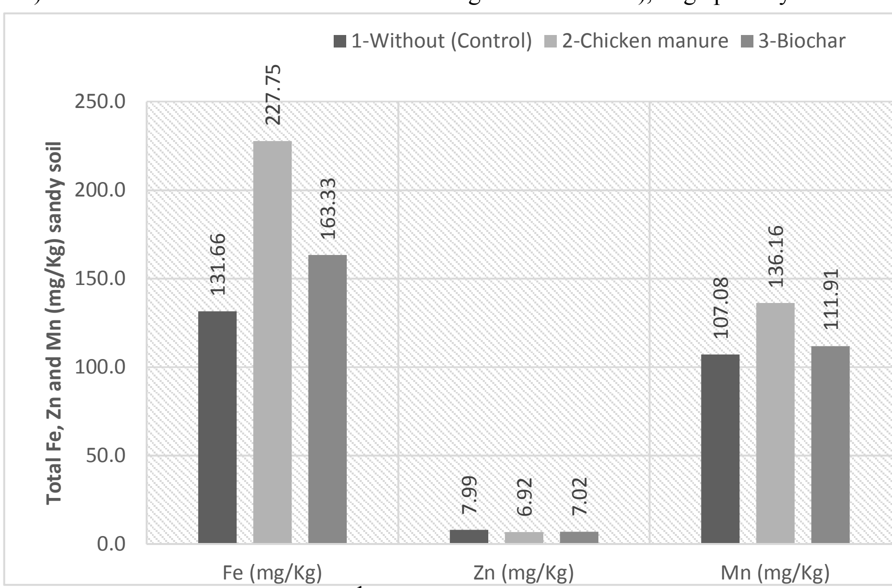

Fig. 3. An average of total Ca, Mg and Na (mgkg^{-1}) soil as affected by the organic amendments types under sandy soil conditions.

4-Mean value of pH, EC and bulk density.

Obtained data in fig 4 show that the organic amendments [chicken manure and biochar] had highly significant effect on pH, EC and bulk density in the sandy soil.

The highest value of pH (7.99) was resulted from control treatment (without adding any organic amendment) with highly significant increase compared to other treatments, followed by adding biochar (7.46). While, the lowest value of pH (7.07) was recorded when chicken manure was added.

The lowest value of Ec (0.58 dSm^{-1}) was recorded with adding chicken manure, with highly significant decrease percentage (59.2 %) compared to control. While, the highest value of Ec (1.42 dSm^{-1}) was resulted from control treatment (without adding any organic amendment). However, adding biochar recorded moderate value of Ec (1.16 dSm^{-1}) with highly significant decrease percentage (18.3 %) compared to control treatment (without adding any organic amendment).

The highest value of bulk density (1.46 g/cm^3) was recorded in control treatment, with highly significant increase compared to other treatments. While, the lowest value (1.38 g/cm^3) was resulted from adding chicken manure treatment, with remarked decrease percentage (5.8 %) compared to control. However, the adding of biochar recorded moderate value (1.40 g/cm^3) with highly significant decrease percentage (4.1 %) compared to control treatment (without adding any organic amendment), as graphically illustrated in Fig 4.

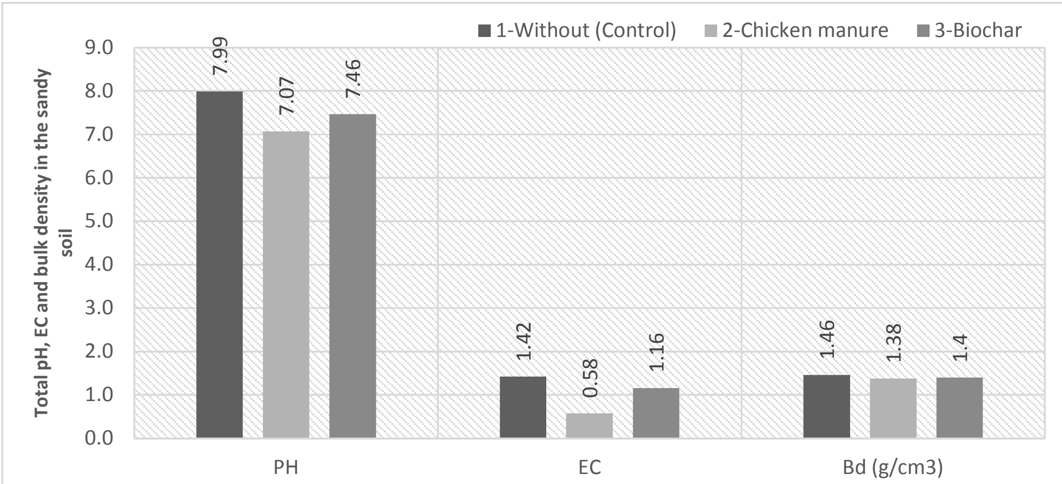

Fig. 4. An average of pH value, EC (dSm^{-1}) and bulk density (g/cm^3) in the studied sandy soil as affected by the organic amendments under sandy soil conditions.

B- Coriander plant characters:

1- N, P and K (%).

Data in Table 4 show that the organic amendments [chicken manure and biochar] had highly significant effects on N, P and K percentages in the coriander plant tissue.

The highest percentage of nitrogen (3.23 %) was recorded when adding chicken manure added to soil with remarked increase (360.1%) compared to control treatment. While, the lowest percentage of N (0.702 %) was resulted from control treatment (without adding any organic amendment to sandy soil). However, the biochar treatment recorded the moderate percentage of N (2.175 %) with highly significant increase percentage (209.8 %) compared to control treatment.

Table 4. Average of N, P and K percentages in the coriander plant tissue as affected by organic amendments types, as well as their interaction under sandy soil conditions.

Characters Treatments	N (%)	P (%)	K (%)
1-Without addition(Control)	0.702	0.392	2.88
2-Chicken manure	3.230	0.696	5.38
3-Biochar	2.175	0.505	3.85
F. test	**	**	**
LSD at 5 %	0.105	0.040	0.130
LSD at 1 %	0.174	0.066	0.216

The highest percentage of phosphorus (0.696 %) was recorded with adding chicken manure, with remarked increase (77.6 %) compared to control treatment. While, the lowest percentage of P (0.392 %) was resulted from control treatment (without adding any organic amendment to sandy soil). However, the biochar treatment gave the moderate percentage of P (0.505 %) with highly significant increase percent (28.8 %) compared to control treatment (without adding any organic amendment).

The highest percentage of potassium (5.38 %) was recorded with adding chicken manure, with remarked increase (86.8 %) compared to control treatment. While, the lowest percentage of K (2.88 %) was resulted from control treatment (without adding any organic amendment to sandy soil). However, the biochar treatment gave the moderate percentage of K (3.85 %) with highly significant increase percentage (33.7 %) compared to control treatment (without adding any organic amendment), as graphically illustrated in Table 4.

2- Fe, Zn and Mn contents (mgkg^{-1}).

Data in Table 5 show that the organic amendments [chicken manure and biochar] had highly significant effect on total Zn and Mn (mgkg^{-1}) in the coriander plant tissue.

The highest value of Fe content (1458.4 mgkg^{-1}) was recorded by adding chicken manure, with remarked increase (25.92 % and 10.24 %) compared to control and biochar treatments, respectively. While, the lowest value of Fe (1158.2 mgkg^{-1}) was resulted from control treatment (without adding any organic amendment) to the sandy soil. However, the biochar treatment recorded the moderate value (1322.9 mgkg^{-1}) of Fe content in the coriander plant tissue with highly significant increase (14.22 %) compared with control treatment.

The highest value of Zn content (44.57 mgkg^{-1}) was recorded by adding chicken manure, with remarked increase percentages (195.9 % and 101.7 %) compared to control and biochar treatments, respectively. While, the lowest value of Zn (15.06 mgkg^{-1}) was resulted from control treatment (without adding any organic amendment) to the sandy soil. However, the biochar treatment recorded d the moderate value (22.10 mgkg^{-1}) of Zn content in the coriander plant tissue with highly significant increase (46.7 %) compared with control treatment.

The highest value of Mn content (132.1 mgkg^{-1}) was recorded by adding chicken manure, to remarked increase percentages (96.6 % and 47.4 %) compared to control and biochar treatments, respectively. While, the lowest value of Mn (67.18 mgkg^{-1}) was resulted from control treatment (without adding any organic amendment) to the sandy soil. However, the biochar treatment recorded the moderate value (89.59 mgkg^{-1}) of total Mn content in the coriander plant tissue with highly significant increase (33.3 %) compared to control treatment, as graphically illustrated in Table 5.

Table 5. Average of Fe, Zn and Mn contents (mgkg^{-1}) in the coriander plant tissue as affected by organic amendments types, as well as their interaction under sandy soil conditions.

Characters Treatments	Fe (mgkg-1)	Zn (mgkg-1)	Mn (mgkg-1)
1-Without addition(Control)	1158.2	15.06	67.18
2-Chicken manure	1458.4	44.57	132.1
3-Biochar	1322.9	22.10	89.59
F. test	**	**	**
LSD at 5 %	43.698	0.874	3.159
LSD at 1 %	72.471	1.449	5.239

3- Fresh weight (g), dry weight (g) and plant height (cm):

Data in Table 6 show that the organic amendments [chicken manure and biochar] had highly significant effect on fresh weight (g), dry weight (g) and plant height (cm) of the coriander plant.

The highest value of fresh weight (71.11 g) was recorded by adding chicken manure, with remarked increase percentages (131.3 % and 90.7 %) compared to control and biochar treatments, respectively. While, the lowest value of fresh weight (30.74 g) was resulted from control treatment (without adding any organic amendment). However, the biochar treatment recorded the moderate value (37.29 g) of fresh weight of the coriander plant with significant (at 0.05 level of probability) increase percentage (21.3 %) compared to control treatment.

Table 6. Average of fresh weight (g), dry weight (g) and plant height (cm) of the coriander plant as affected by organic amendments types, as well as their interaction under sandy soil conditions.

Characters Treatments	Fresh weight (g)	Dry weight (g)	Plant height (cm)
1-Without addition(Control)	30.74	4.019	35.25
2-Chicken manure	71.11	9.088	45.75
3-Biochar	37.29	5.925	40.16
F. test	**	**	**
LSD at 5 %	4.588	0.985	0.855
LSD at 1 %	7.609	1.634	1.418

The highest value of dry weight (9.088 g) was recorded by adding chicken manure, with remarked increase percentages (126.1 % and 53.4 %) compared to control and biochar treatments, respectively. While, the lowest value of dry weight (4.019 g) was resulted from control treatment (without adding any organic amendments). However, the biochar treatment recorded the moderate value (5.925 g) of dry weight of the coriander plant with highly significant (at 0.01 level of probability) increase percentage (47.4 %) compared to control treatment.

The highest value of plant height (45.75 cm) was recorded by adding chicken manure, with remarked increase percentages (29.8 % and 13.9 %) compared to control and biochar treatments, respectively. While, the lowest value (35.25 cm) was recorded from control treatment (without adding any organic amendment). However, the biochar treatment resulted the moderate value (40.16 cm) of plant height of the coriander with highly significant (at 0.01 level of probability) increase percentage (13.9 %) compared to control treatment, as graphically illustrated in Table 6.

4-Number of leaves/ plant and chlorophyll content

Data in Table 7 show that the organic amendments [chicken manure and biochar] had highly significant effect on number of leaves/ plant and chlorophyll content of the coriander plant.

The highest value of number of leaves/ plant (20.1) was recorded by adding chicken manure, with remarked increase percentages (289.5 % and 154.1 %) compared to control and biochar treatments, respectively. While, the lowest value (5.16) was resulted from control treatment (without adding any organic amendment). However, the biochar treatment recorded the moderate value (7.91) of number of leaves/ plant of the coriander with highly significant (at 0.01 level of probability) increase percentage (53.3 %) compared to control treatment.

The highest value of chlorophyll content (12.3 SPAD) was recorded by adding chicken manure, with remarked increase percentages (93.1 % and 65.5 %) compared to control and biochar treatments, respectively. While, the lowest value (6.37 SPAD) was resulted from control treatment (without adding any organic amendment). However, the biochar treatment recorded the moderate value (7.43 SPAD) of chlorophyll content in the coriander with significant (at 0.05 level of probability) increase percentage (16.6 %) compared to control treatment, as graphically illustrated in Table 7.

Table 7. Average of number of leaves/ plant and chlorophyll content of the coriander plant as affected by organic amendments types, as well as their interaction under sandy soil conditions.

Characters Treatments	Number of leaves/ plant	Chlorophyll content, SPAD
1-Without addition(Control)	5.16	6.37
2-Chicken manure	20.1	12.3
3-Biochar	7.91	7.43
F. test	**	**
LSD at 5 %	1.309	0.826
LSD at 1 %	2.170	1.370

Improving chemical, physical, and biological properties of soil through the use of biochar have been reported (Glaser *et al*., 2002). Biochar integration into soil have many benefits, as C sequestration (Woolf *et al*., 2010); soil fertility alterations (Atkinson *et al*., 2010) through suggested improvements in crop water and use efficiency of nutrient (Chan *et al*., 2007), nutrient retention and increased bioavailability to plants (Glaser *et al*., 2002; McCormack *et al*., 2013); and consequent yield increases (Jeffery *et al*., 2011). The use of biochar can increase soil pH (Chan *et al*., 2007), amend electrical conductivity (EC) and cations exchange capacity (CEC) (DeLuca *et al*., 2009) and add nutrients as N, P and S (Atkinson *et al*., 2010; Sohi *et al*., 2010). Organic wastes hold varying amounts of water, mineral nutrients, organic matter (Edwards and Daniel, 1992; Brady and Weil, 1996). While the use of organic wastes as manure has been in practice for centuries world-wide (Straub, 1977) and in the recent times (López-Masquera *et al*., 2008), there still exists a need to assess the potential impacts of chicken manure on soil chemical properties and crop yield and in particular evaluating the critical application levels. Ali, *et al.* (2017) showed that adding biochar improved the growth of plant, biological yield and fresh yield under either salt and/or drought stresses, and also improved photosynthesis, nutrient uptake, and amended gas exchange characteristics in water stress and salt-stressed plants. Under salt stress, biochar reduced Na^+ uptake, while enlarged K^+ uptake by plants. Biochar-mediated intensification in salt tolerance of plants is mainly associated with enhancement in properties of soil, thus increasing plant water status, decrease of Na^+ uptake, increasing uptake of minerals, and regulation of stomata conductance and phytohormones. This review highpoints both the potential of biochar in improving water and salt stresses in plants and future vision of the role of biochar under salt and drought stresses in media of plant growth.

CONCLUSION

It can be concluded that adding chicken manure and biochar had highly significant effects on all the studied chemical and physical properties of sandy soil and on all the studied chemical, growth and yield traits of coriander plant. Therefore, it could be recommended that adding the organic amendments (chicken manure or biochar) to improve the chemical and physical properties of sandy soil and chemical and growth traits of coriander plant irrigated with saline water (diluted seawater, 10%) in sandy soil.

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تأثير الفحم الحيوي وسماد الدواجن على خواص التربة وعلى نمو نباتات الكزبرة المروية بمياه ملحية في الأراضي الرملية

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أجريت تجربة الأصص بمشتل كلية الزراعة بجامعة المنصورة أثناء الموسم 2017/2016 لدراسة تأثير الفحم الحيوي وسماد الدواجن على الخواص الكيميائية والفيزيائية للتربة الرملية وعلى صفات النمو لنباتات الكزبرة المروية بمياه البحر المخففة بمياه عذبة (نسبة تخفيف 10%). واستخدم تصميم القطاعات كاملة العشوائية في ثلاث مكررات ، وكانت المعاملات هي ثلاث معاملات كالتالي : 1- معاملة الكنترول (بدون إضافة أي مواد عضوية) ، 2- معاملة إضافة سماد الدواجن (بمعدل 20 طن/فدان ، أي 400 جرام لكل أصيص) و 3- معاملة إضافة الفحم الحيوي (بمعدل 5 طن/فدان ، أي 100 جرام لكل أصيص). أظهرت النتائج أن المحسنات العضوية (سماد الدواجن و الفحم الحيوي) كان لها تأثير عالي المعنوية على كل الخواص الكيميائية والفيزيائية المدروسة للتربة الرملية مثل محتوى كل من النيتروجين ، الفوسفور ، البوتاسيوم ، الحديد ، الزنك ، المنجنيز ، الماغنسيوم ، الكالسيوم ، الصوديوم ، رقم حموضة التربة ودرجة التوصيل الكهربي و الكثافة الظاهرية للتربة. وجد إن إضافة المحسنات العضوية (الفحم الحيوي وسماد الدواجن) أعطت أفضل القيم لكل صفات التربة المدروسة مقارنة بمعاملة الكنترول (عدم إضافة أي محسنات عضوية). لوحظ إيضاً تفوق الفحم الحيوي على سماد الدواجن في بعض الصفات الكيميائية مثل محتوى كل من النيتروجين ، والفوسفور ، والصوديوم و الكلور في التربة. وعلى الجانب الآخر تفوق سماد الدواجن على الفحم الحيوي في بقية الصفات المدروسة للتربة وهى: المحتوى الكلي للبوتاسيوم ، والحديد ، والمنجنيز ، والكالسيوم والماغنسيوم في التربة. أظهرت النتائج أن المحسنات العضوية (سماد الدواجن و الفحم الحيوي) كان لها تأثير عالي المعنوية على كل من الصفات الكيميائية وصفات النمو والمحصول لنبات الكزبرة مثل النسبة المئوية للنيتروجين والفوسفور والبوتاسيوم ، والمحتوى الكلي من الحديد والزنك والمنجنيز ، والوزن الغض والوزن الجاف للنبات ، وطول النبات وعدد الأوراق بالنبات ومحتوى الكلوروفيل بأوراق النبات. وجد إن إضافة سماد الدواجن والفحم الحيوي أعطت أفضل القيم لكل الصفات المدروسة الكيميائية وصفات النمو والمحصول لنبات الكزبرة مقارنة بمعاملة الكنترول (عدم إضافة أي محسنات)، كذلك لوحظ تفوق سماد الدواجن على الفحم الحيوي في تحسين كل الصفات المدروسة الكيميائية وصفات النمو والمحصول لنبات الكزبرة. لذلك نستنتج انه يمكن إضافة المحسنات العضوية (سماد الدواجن أو الفحم الحيوي) لتحسين الصفات الكيميائية والفيزيائية للتربة الرملية وكذلك تحسين الصفات الكيميائية وصفات النمو والمحصول لنباتات الكزبرة المروية بمياه مالحة (مياه بحر مخففة بمياه عذبة بنسبة 10%) في الأراضي الرملية.