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Utilization of some Farm Organic Wastes for Improving Soil Productivity of the Newly Reclaimed Areas at El-Fayoum Governorate Egypt

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THE CURRENT work aims to evaluate the benefit effects of different rates of the local farm organic wastes, *i.e.*, plant residues (composted wheat-rice straw), poultry and cattle wastes for improving the productivity of some newly reclaimed soils have different lithological parent materials (aeolian and Eocene limestone formations) and developed on eastern edge of El-Fayoum Governorate, Egypt. To achieve this target, a field experiment was carried out under wheat-maize cropping sequence grown on aeolian sandy loam and calcareous clayey soils located at Demo and Tamia villages, respectively, during the two agricultural growing seasons of 2001/2002.

The obtained results showed a positive benefits for improving the soil characteristics under study due to the applied amendments, *i.e.*, an increase or decrease in the values of bulk density, hydraulic conductivity, soil strength, available water content, pH value, organic matter content and the released content of available nutrients, *i.e.*, N, P, K, Fe, Mn, Zn and Cu. There was a dual relationship between the applied organic amendments and hydraulic conductivity in both studied soils, where it exhibited a gradual decrease and increase with increasing the applied organic amendment rates in sandy and calcareous soils, respectively.

Application of poultry wastes was very important for enhancing the previous estimated plant nutrients in soil during the first growing season as compared to the other used ones due to the fact that it had a narrow C/N ratio, relatively high contents of active organic compounds and essential nutrients for plant. The positive effects of the applied amendments on soil productivity could be arranged into the descending order of poultry wastes > cattle wastes > composted plant residues. The beneficial effects of these organic amendments were also extended to the next cultivated crop (maize) at the second growing season, but the sequence of their superiority has taken an opposite trend, *i.e.*, composted plant residues > cattle wastes > poultry wastes. This condition is mainly related to the differences in C/N ratios between these organic amendments, and in turn the degree or rate of decaying. That means that the beneficial effect of composted plant residues, which had a wide C/N ratio, was extended to the second growing season.

Concerning the nutrients uptake by plants, data revealed that an increasing trend of nutrient responses for N, P, K, Fe, Mn, Zn and Cu in the plant tissues of the studied two crops with increasing the applied amendment rates, with superiority for poultry and composted plant residues at the first and second seasons, respectively. With exception of N and K in plants grown on the sandy soil, there were positivly close to the corresponding ones of available nutrients in both studied soils, which may lead to a general suggestion that plant nutrients having an accumulative tendency in the plant tissues grown on calcareous soil under the studied conditions of the experiments. This clarified the beneficial effects of the active organic compounds, which have ability to chelate micronutrients as available strategic storehouse, and in turn reflected positively on development of crop yield and its components.

Keywords: Poultry wastes, Cattle wastes, Composted plant residues, Sandy soils, Calcareous soils, Wheat, Maize and plant nutrients.

Conserving the limited agricultural lands in the newly reclaimed areas (sand or calcareous in nature) against desertification is of vital importance. In the last decades, the soil survey data pointed to a considerable decrease in soil productivity for these reclaimed desert ones. Takker & Walker (1993) mentioned that low levels of organic matter in soils are the main factors for widespread occurrence of some micronutrients deficiency in the different regions of the world.

Hassanien (1996) found that successive leaching of calcareous soils resulted in simulaneous lime-crust formation, with a soil strength value of 3.9 bar at the end of leaching, occurred at soil surface through the carbonation process. The addition of farmyard manure with a rate of 2 % caused a sharp decrease in soil strength, where its value reached 0.75 bar. The main mechanical constituents of sandy soils are the sandy fraction, which is not partially capable of retaining neither water nor nutrients for growing plants. Accordingly, these soils are poor not only in the nutrient-bearing minerals, but also in organic matter, which are storehouse for the essential plant nutrients. In addition, the occurrence of inadequate water retention under such severe conditions, in turn the productivity of different crops tends to decrease markedly (Metwally & Khamis, 1998).

Therefore, the scientific researches are necessary to determine the factors affecting soil productivity of the reclaimed desertic areas, and in turn the effective measurements to conserve soils from further desertification. In general, the majority of desertic sandy and calcareous soils having poor hydrophysical and fertility characteristics. So, the addition of organic materials is of vital importance to improve physical, chemical characteristics as well as fertility status of these soils. Wong & Ho (1991) and Logan *et al.* (1996) found that the effect of organic amendment on soil bulk density and porosity had a dual relationship between the applied organic material and their values, where it significantly reduced soil bulk density and increased the total porosity. In addition, Zaid & Asker (1987) bulk density and increased the total porosity. In addition, Zaid & Asker (1987) found that there was a linear relationship between the applied rates, the applied organic manure and hydraulic conductivity, but it was positive in the sandy soil and negative in the calcareous one. Basyouny (2002) found that a dual relationship between the applied organic manure rates and hydraulic conductivity in sandy and calcaroues soils, where it exhibited a gradual decrease and increase with increasing the applied organic manure rates in the sandy and calcareous soils, respectively.

The pH value was the soil property modified to the greatest depth by organic amendments (Tester, 1990 and Park *et al.*,1991) concluded that application of organic wastes from food processing factories increased the contents of organic matter in the soils. Barrow & Whelan (1998) showed that a unit decrease in soil pH increased the concentration of some micronutrient ions required by 10 folds. Abdel-Aziz *et al.* (2000) and Basyouny (2002) reported that increasing the rates of applied organic manure to calcareous and sandy soils, in general, resulted in an increase for soil organic matter content as well as a decrease for soil pH. Application of organic manure from Abo-Rawash sludge to sandy soil at the rate of 1.6 % decreased the soil pH from 7.5 to 6.6 (Abou-Seeda *et al.*, 1984).

Also, Negm *et al.* (2003) found that an organic compost of saw dust with cattle dung application increased slightly ECe and cation exchange capacity, as well as, reduced soil pH just after additions in small range by advancing time. Available N, P and K in soil increased after compost application and reduced gradually by time. Moreover, soil organic matter content also was increased by compost application, where the curve was at its peak after harvest stage of the grown plants and gradually reduced.

Mehana (1998) reported that the concentration and uptake of some micronutrients by maize significantly increased at the different applied rates of chicken manure. Recently, Taha (2000) reported that treating the coarse textures soils with different rates of composted organic residues significantly increased the dry matter yield and micronutrients uptake by maize plants over the respected controls. El-Gizi & Rifaat (2001) and Estefanous & Sawan (2002) amended the calcareous soils with composted saw-dust and composted saw-dust with cattle, and found that applied rates of 2.5 and 5% caused significant increases in tomato cultures, okra and nutrient uptake by them. Mekail (1994) demonstrated that organic amendments application to coarse textured soils had significant direct and residual effect on grains yield of maize. Also, More (1994) found that the yield of wheat was markedly enhanced due to treating the sodic soil with organic manures.

Therefore, this study is an attempt to evaluate the effect of organic amendments having different sources (composted plant residues, poultry and cattle wastes) on some physico-chemical properties of the newly reclaimed sandy and calcareous soils cultivated with wheat-maize cropping sequence.

Material and Methods

Organic amendments

As for the composted plant residues, one ton of wheat straw was mixed with one ton of rice straw and chemical activator mixture (50 kg ammonium sulphate + 50 kg superphosphate). This composting material was prepared as follows: a portion of the wheat straw was scattered over the area of 2x5 m^2, then a portion of the rice straw and the activator mixture was spread over it and moistened with water. The moisture was considered satesfactory when a handful of the composting materials would wet the hand but not drip, (about 70% of water holding capacity). The previous mixture represents a first layer of 20 cm height, then nine layers were built over the first layer in the same manner. After the heap was built to reach 2.0 m height, it was lousily covered with plastic sheet and was moistened with tap water from above if needed. The heap was turned from inside to outside every three weeks for four months. The main properties of composted plant residues, as well as, the other farm organic wastes, *i.e.*, poultry and cattle wastes used in the current study are given in Table 1 .

TABLE 1. Some characteristics of the studied organic farm residues (dry weight basis).

Character	Composted plant residues	Poultry wastes	Cattle wastes
Weight of 1 m^3 (kg)	360.00	472.00	680.00
pH (1:10 water suspension)	7.12	6.96	7.38
EC (dS/m, 1:10 water extract)	1.62	3.08	2.74
Moisture %	9.67	7.52	8.91
Organic matter %	59.99	67.89	74.65
Organic carbon %	34.88	39.46	43.40
C/N ratio	30.07	16.65	19.91
Total macro and micronutrients %			
N	1.16	2.37	2.18
P	0.19	0.96	0.47
K	2.06	1.85	1.24
Fe	0.0706	0.7030	0.8608
Mn	0.0257	0.0685	0.0461
Zn	0.0468	0.0767	0.0603
Cu	0.0705	0.1128	0.0987
Available micronutrients (mg/kg)			
Fe	17.5	148.2	132.9
Mn	26.7	59.8	48.6
Zn	13.4	54.8	33.9
Cu	5.8	8.7	7.9

The different characteristics, which carried out on these farm organic wastes, were pH (Jodice *et al.,* 1982), organic matter content (Black, 1965), nitrogen, phosphorus, potassium (Chapman & Pratt, 1961) and micronutrients of Fe, Mn, Zn and Cu (Hesse, 1971).

Field experimental work

Two field experiments were carried out on some newly reclaimed areas having different lithological parent materials (aeolian and Eocene limestone formations) and developed on eastern edge of El Fayoum Governorate, Egypt. In complete randomized block design with 4 replicates, nine treatments of the previous organic amendments were applied in plots 3.0 x 3.5 m^2 for each of the two field experiments. Wheat-maize cropping sequence was grown on the chosen soil types, *i.e.*, siliceous sandy loam and calcareous clayey soils located at Demo and Tamia villages, respectively, during the two agricultural growing seasons of 2001/2002.

According to the N content % in the above mentioned organic amendments, the treatments were applied in the field experiments at Demo and Tamia with rates of 10, 20 and 30 m^3/fed for composted plant residues and 5, 10 and 15 m^3/fed for both poultry and cattle wastes. After organic amendment applications with good turning under in soil, wheat seeds (Sakha 69) were planted on the last November 2001 under furrow irrigation system.

Nitrogen and potassium fertilizers were added to the soils in two equal doses during the growing period (after 15 and 40 days) in the forms of ammonium sulphate (20.5 % N) and potassium sulphate (48 % K_2O) at rates of 120 kg N/fed and 100 kg K_2O /fed, respectively. Also, 30 kg P_2O_5/fed as superphosphate fertilizer (15 % P_2O_5) was added during preparing the soil for cultivation. Samples of wheat plants and soils were collected from each plot at the elongation stage (after 80 days), and at harvest (last of April, 2002), plant samples were separated into grains and straw. In the second agricultural growing season, maize seeds (single cross 10 hybrid) were sown at mid June, 2002 to identify the residual effect of the previously applied organic amendments on both soil and plant characteristics. Similar to wheat, samples of maize plants and soils were taken from each plot at the elongation stage (after 80 days), and at harvest (mid October, 2002), plant samples were separated into grains and shoots.

Plant and soil analysis

The plant samples were dried at 70^o, ground in a Willy mill and digested with H_2SO_4 and H_2O_2 according to Parkinson and Allen (1975) to determine N, P, K (Chapman & Pratt, 1961), Fe, Mn, Zn and Cu (Hesse, 1971). In addition, the collected soil samples, which were taken at the elongation stage of plant growth were analyzed for particle size distribution (Piper, 1950), bulk density (Black & Hartge, 1986), hydraulic conductivity, storage pores, available water content (Klute, 1986), soil strength (Richards, 1954), organic matter content (Walkely and Black method as described by Hesse, 1971), $CaCO_3$ content (Wright, 1939), cation exchange capacity, exchangeable sodium percent, pH, soil paste extract (Jackson, 1973) and available contents of N, P, K, Fe, Mn, Zn and Cu (Sultanpour & Schwab, 1977).

Results and Discussion

General view on soil characteristics of the field experiments

The studied soils were morphologically described and analyzed for identifying the main soil characteristics, as shown in Tables 2 and 3 . Data obtained from the representative soil profiles lead to a good knowledge about the influence of the prevailing environmental conditions. The studied soil sediments of Demo profile are characterized by deep profile, single grain structure, loamy sand in texture and absence of amorphous features.

TABLE 2. The main morphological aspects of the representative soil profiles.

Soil site	Location	Land use	Horizon	Depth (cm)	Soil colour			Texture grade	Soil structure			Calcic formations				
					Hue	Dry	Moist		Grade	Size	Type	Effer.	Feat.	Quan.	Size	Distr.
1	Demo	Maize-wheat cropping sequence	AP	0-25	1OYR	5/4	5/3	sl	1	-	sg	++	lc	m	s	r
			C_1	25-60	1OYR	7/3	7/4	sl	1	-	sg	+	ln	f	s	r
			C_2	60-100	1OYR	5/3	4/2	sl	1	-	sg	+	ln	f	s	r
2	Tamia		AP	0-25	5Y	7/3	6/3	c	2	m	sbk	+++	ln	c	m	h
			C_1	25-60	2.5YR	8/4	7/4	c	2	f	mas	+++	lc	c	m	h
			C_2	60-100	1OYR	7/4	8/3	c	2	f	abk	+++	cg	c	s	r

Texture: sl= Sand loamy c = Clay
Structure: Grade: 1 = Weak 2 = Moderate *Size:* f = Fine m = Medium *Type:* sg = Single grain sbk = Subangular blocky abk = Angular blocky mas = Massive
Calcic formations:Effervescence: + = few ++ = Moderate +++ = Strong *Feature:* ln = Lime nodules lc = Lime concretions cg = Crystals of gypsum *Lime quantity:* c = Common f = Few m = Moderate *Size:* s = Small m = Medium *Distribution:* r = Random h = Horizontal

Whereas, the soils represented by Tamia profile (calcareous in nature) are characterized by different forms of secondary calcic formations in compacted phase, especially in the uppermost layer. These features stood in harmony with the fact that $CaCO_3$ was subjected to intensive goechemical weathering during the humid conditions as a result of continuous applied irrigation water. Also, data in Table 3 represent the main physical, chemical and fertility properties of the studied soil sites, which are largely responsible for performing the high lights on the relationship between soil potentiality for plant nutrients supplying power and the origin or nature of the soil sediments.

TABLE 3. Some physical, chemical and fertility characteristics of the representative soils.

Soil characteristics	Profile layers (cm) of Demo site			Profile layers (cm) of Tamia site		
	0-25	25-60	60-100	0-25	25-60	60-100
Particle size distribution %, without removing $CaCO_3$						
Coarse sand	26.32	36.54	42.91	6.34	4.68	3.54
Fine sand	53.72	45.06	37.45	26.80	22.02	24.79
Silt	8.61	7.42	8.93	20.46	21.69	24.85
Clay	11.35	10.98	10.71	46.40	51.61	46.82
Texture class*	SL	SL	SL	C	C	C
$CaCO_3$ distribution% in soil mechanical fractions						
Coarse sand	0.97	1.27	1.35	6.87	8.94	8.30
Fine sand	1.40	1.46	0.97	8.93	7.89	7.18
Silt	2.25	1.38	1.02	11.52	9.47	5.96
Clay	3.10	1.34	0.78	13.83	8.09	5.43
Total $CaCO_3$ %	7.72	5.45	4.12	41.15	34.39	25.87
Bulk density (g/cm^3)	1.41	1.44	1.48	1.24	1.31	1.36
Hydraulic cond. (cm/h)	6.97	5.64	3.98	1.24	0.89	0.42
Soil paste extract						
ECe (dS/m)	4.50	3.72	2.95	6.32	5.12	4.70
Soluble ions (meq / l)						
Ca^{++}	14.32	11.17	9.93	12.21	12.43	8.65
Mg^{++}	7.65	5.97	5.30	6.79	6.54	3.32
Na^+	22.36	18.59	15.50	42.10	31.36	17.19
K^+	0.39	0.27	0.21	0.75	0.66	0.41
CO_3^{--}	--	--	--	--	--	--
HCO_3^-	2.92	2.06	1.72	2.65	2.43	2.32
Cl^-	35.14	27.41	24.36	42.54	36.36	21.12
SO_4^{--}	6.66	6.53	4.86	16.66	12.20	26.13
pH (soil paste)	7.40	7.65	7.73	8.34	8.49	8.52
Organic matter %	0.22	0.13	0.08	0.92	0.68	0.44
CEC (meq / 100 g soil)	7.82	6.73	5.97	17.12	21.32	23.91
ESP	9.19	8.74	7.87	10.62	12.46	11.76
Available macronutrients and DTPA extractable micronutrients (ppm)						
N	17.6	9.8	6.4	26.9	14.8	8.5
P	2.6	1.9	0.9	3.8	2.4	1.8
K	63.4	48.8	29.6	189.6	157.8	139.9
Fe	1.9	1.2	0.9	2.7	1.8	1.3
Mn	0.7	0.5	0.4	0.9	0.5	0.5
Zn	0.6	0.4	0.3	0.7	0.4	0.3
Cu	0.4	0.3	0.2	0.5	0.4	0.3

*SL = Sandy loam C = Clay

So, it could be mentioned that the soil of Demo site is, in general, poorer from all aspects, where it is skeletal in texture, weak in structure, attained very low organic matter content and unfavorable from the fertility status. Moreover, it is evident that the secondary surface accumulations of $CaCO_3$ in Tamia profiles is resulting from the upward movement of the saline ground water table by capillary rise (lime carbonation) under the hot and arid climatic conditions. These results are confirmed by the occurrence of a relatively high soil strength value in the surface layer of this soil.

The obtained results show that soil potentiality for total content of the essential plant nutrients not only tended to increase with increasing the clay content, but also with the increment of organic matter content, as compared between the siliceous sandy loam soil with the clayey calcareous one. The studied soils showed relatively low and moderate CEC values extending parallel close to the relatively low and moderate contents of charged silicate clay minerals vs relatively high contents of quartz and $CaCO_3$ particles in the size of clay fraction at Demo and Tamia sites, respectively. Also, these soils are poor in organic matter content and suffering from plant nutrients deficiency, as shown from data illustrated in Tables 3 and 4 , thus, supplying essential elements to them is undoubtedly of great importance, especially for micronutrient deficient sandy soil.

TABLE 4. Critical levels of the studied available nutrients in soil (ppm), after Lindsay & Norvell (1978) and Page *et al.* (1982).

Nutrient level	N	P	K	Fe	Mn	Zn	Cu
Low	< 40.0	< 5.0	< 85.0	< 4.0	< 2.0	< 1.0	< 0.5
Medium	40.0-80.0	5.0-10.0	85.0-170.0	4.0-6.0	2.0-5.0	1.0-2.0	0.5-1.0
High	> 80.0	> 10.0	> 170	> 6.0	> 5.0	> 2.0	> 1.0

Soil properties as affected by the applied organic amendments

Data presented in Tables 5 and 6 showed that the application of composted plant residues (CPR), poultry wastes (PW) and cattle wastes (CW) to the studied soils led to improve their soil properties, *i.e.*, bulk density, soil strength, ECe, pH, $CaCO_3$ and ESP values, since they tended to decrease gradually with increasing the applied rates of these amendments. The best condition, which recorded the lowest values either in the case of sandy soil or calcareous one, occurred at the highest rate of 15 m^3/fed of PW followed by 15 m^3/fed of CW and 30 m^3/fed of CPR. These results are supported by the conclusions of Laila Hussien *et al.* (1998) for the effect of organic manure application on the decrease of soil bulk density.

A comparative study for the positive effect of soil applied organic amendments on improving soil hydraulic conductivity, data in Tables 5 and 6 revealed that PW surpassed CW and CPR additions either in the case of sandy soil or calcareous one. This true hold was observed, since a dual relationship between the applied organic amendments and hydraulic conductivity in both studied soils, where it exhibited a gradual decrease and increase with increasing the applied rates in sandy and calcareous soils, respectively. Concerning the variations in the values of available water range, storage pores, organic matter content and CEC in both the soil sites among the different applied organic resources, data showed that, in general, the soils treated with PW possess relatively high values as compared to those amended with CW and CPR, due to the fact that they attain a pronounced high content of active organic compounds.

TABLE 5. Effect of the applied organic amendments at elongation stage (80 days) on some physical and chemical characteristics of the studied sandy soil.

Soil character	Soil depth (cm)	Control	First agricultural growing season (wheat)									Control	Second agricultural growing season (maize)								
			Plant residues (m^3/fed)			Poultry waste (m^3/fed)			Cattle waste (m^3/fed)				Plant residues (m^3/fed)			Poultry waste (m^3/fed)			Cattle waste (m^3/fed)		
			10	20	30	5	10	15	5	10	15		10	20	30	5	10	15	5	10	15
Bulk density (g/cm^3)	0-25	1.43	1.39	1.37	1.36	1.34	1.31	1.29	1.37	1.35	1.32	1.41	1.34	1.33	1.31	1.41	1.39	1.38	1.39	1.36	1.33
	25-60	1.46	1.44	1.42	1.41	1.40	1.37	1.34	1.42	1.39	1.37	1.44	1.38	1.37	1.36	1.43	1.41	1.40	1.41	1.40	1.39
Hyd. Conduct. (cm/h)	0-25	7.12	6.47	6.07	5.63	5.60	4.71	4.29	5.94	5.47	4.92	6.83	5.11	4.69	4.35	6.04	5.67	5.14	5.68	5.25	4.75
	25-60	5.78	5.18	5.53	4.87	4.71	4.45	4.07	5.01	4.82	4.35	5.47	4.96	4.32	3.87	5.26	5.10	4.65	5.03	4.61	4.12
Soil strength (kg/cm^2)	0-25	1.83	1.81	1.79	1.75	1.68	1.57	1.51	1.79	1.68	1.64	1.94	1.86	1.81	1.78	1.93	1.89	1.86	1.85	1.84	1.82
	25-60	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Available water %	0-25	10.54	11.65	12.43	13.76	14.11	15.32	16.13	12.97	14.08	15.73	11.03	13.06	14.18	14.95	11.87	1239	12.98	12.41	13.14	13.65
	25-60	11.86	12..08	12.57	12.75	12.75	13.21	13.78	12.34	12.86	13.07	12.98	14.09	14.57	15.32	13.31	13.70	13.93	13.74	14.20	14.69
Storage pores % (10-6 μ)	0-25	13.45	14.32	16.48	17.60	17.25	18.89	21.63	15.67	17.05	18.53	13.84	16.85	17.76	18.64	14.78	15.42	15.99	15.66	17.09	17.71
	25-60	15.81	16..01	16.37	16..82	16.66	16.98	17.52	16.36	16.79	17.11	1607	17.46	18.13	18.97	16.33	16.58	16.97	16.84	17.27	17.79
ECe (dS/m)	0-25	4.46	4.32	4.18	3.97	3.86	3.35	2.91	4.17	3.85	3.46	4.38	3.94	3.75	3.68	4.21	4.05	3.97	4.08	3.97	3.89
	25-60	2.97	2.83	2.70	2.61	2.53	2.27	2.03	2.71	2.49	2.37	2.89	2.34	2.20	2.11	2.74	2.67	2.62	2.61	2.52	2.40
pH (soil paste)	0-25	7.46	7.32	7.24	7.19	7.12	7.07	7.05	7.18	7.15	7.11	7.44	7.29	7.18	7.13	7.39	7.30	7.26	7.32	7.23	7.19
	25-60	7.69	7.60	7.57	7.54	7.51	7.47	7.44	7.56	7.52	7.49	7.66	7.53	7.49	7.46	7.61	7.58	7.54	7.59	7.55	7.50
$CaCO_3$ %	0-25	7.69	7.08	6.64	6.28	6.27	5.80	5.32	6.71	6.29	5.86	7.67	6.63	6.18	5.74	7.11	6.93	6.70	6.92	6.55	6.17
	25-60	5.48	5.36	5.24	5.15	5.02	4.87	4.74	5.24	5.11	5.03	5.45	5.01	4.62	4.46	5.27	5.14	5.02	5.15	4.97	4.76
Organic matter %	0-25	0.24	0.37	0.56	0.68	0.53	0.82	0.89	0.46	0.59	0.73	0.27	0.39	0.47	0.53	0.28	0.34	0.46	0.32	0.38	0.42
	25-60	0.14	0.14	0.15	0.17	0.16	0.19	0.22	0.16	0.17	0.19	0.15	0.16	0.17	0.19	0.15	0.16	0.16	0.16	0.16	0.17
CEC (meq/100 g soil)	0-25	7.75	7.93	8.22	8.54	8.32	9.04	9.06	8.21	8.44	8.87	7.86	8.51	8.76	9.04	8.07	8.21	8.30	8.24	8.37	8.45
	25-60	6.69	6.81	6.98	7.16	7.15	7.55	7.89	6.99	7.24	7.43	6.75	7.85	8.16	8.50	7.05	7.31	7.55	7.41	7.68	7.93
Exchangeable sodium %	0-25	9.34	8.97	8.56	8.12	8.07	7.74	7.62	8.35	8.10	7.87	9.12	8.01	7.67	7.43	8.76	8.30	8.11	8.34	8.03	7.81
	25-60	8.81	8.56	8.32	8.17	8.06	7.83	7.67	8.31	8.14	7.91	8.57	7.46	7.21	6.88	8.12	8.04	7.92	7.87	7.51	7.33

TABLE 6. Effect of the applied organic amendments at elongation stage (80 days) on some physical and chemical characteristics of the studied calcareous soil.

Soil character	Soil depth (cm)	Control	First agricultural growing season (wheat)									Control	Second agricultural growing season (maize)								
			Plant residues (m^3/fed)			Poultry waste (m^3/fed)			Cattle waste (m^3/fed)				Plant residues (m^3/fed)			Poultry waste (m^3/fed)			Cattle waste (m^3/fed)		
			10	20	30	5	10	15	5	10	15		10	20	30	5	10	15	5	10	15
Bulk density (g/cm^3)	0-25	1.26	1.18	1.15	1.13	1.10	1.06	1.01	1.16	1.12	1.09	1.23	1.16	1.14	1.11	1.21	1.20	1.19	1.18	1.16	1.15
	25-60	1.32	1.29	1.28	1.25	1.21	1.23	1.18	1.26	1.25	1.21	1.31	1.23	1.20	1.18	1.28	1.27	1.26	1.26	1.23	1.22
Hyd. Conduct (cm/h)	0-25	1.32	1.48	1.65	1.76	1.75	1.91	2.29	1.66	1.82	1.95	1.37	1.69	1.81	1.97	1.48	1.69	1.67	1.56	1.73	1.81
	25-60	0.91	1.07	1.16	1.28	1.30	1.47	1.56	1.18	1.2[illegible]	1.34	0.95	1.18	1.24	1.27	1.03	1.08	1.11	1.12	1.17	1.19
Soil strength (kg/cm^2)	0-25	3.89	3.11	2.92	2.76	2.47	2.20	1.85	2.88	2.54	2.32	3.81	2.71	2.38	2.05	3.11	2.87	2.65	2.89	2.52	2.47
	25-60	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Available water %	0-25	18.86	19.31	19.86	20.41	20.62	21.85	22.90	19.88	20.52	21.45	19.03	20.39	21.05	21.61	19.32	19.83	20.01	19.90	20.38	20.87
	25-60	17.46	17.93	18.05	18.22	18.59	18.97	19.07	18.18	18.37	18.63	17.81	18.91	18.22	19.54	18.07	18.24	18.41	18.52	18.69	18.82
Storage pores % (10-6 μ)	0-25	15.07	19.95	21.79	22.85	22.67	24.14	25.16	21.34	22.96	23.93	15.42	18.27	17.45	20.17	16.92	17.23	17.58	17.45	18.36	18.97
	25-60	16.84	17.31	17.76	17.95	19.16	19.73	20.13	18.27	18.61	19.08	16.92	18.13	19.40	20.20	17.32	17.86	18.11	17.71	18.99	19.12
ECe (dS/m)	0-25	6.36	6.23	6.15	6.02	6.09	5.96	5.71	6.16	5.04	5.86	6.18	5.95	5.87	5.78	6.07	6.01	5.96	6.02	5.95	5.89
	25-60	5.18	4.14	5.08	5.03	5.05	4.96	4.90	5.09	5.04	497	5.09	4.89	4.84	4.77	5.01	4.97	4.95	4.93	4.89	4.82
pH (soil paste)	0-25	8.37	8.0.3	7.95	7.87	7.76	7.62	7.51	7.91	7.80	7.73	8.29	8.09	8.04	7.93	8.17	8.11	8.02	8.13	8.08	7.98
	25-60	8.52	8.38	8.30	8.24	8.18	8.11	7.99	8.31	8.23	8.16	8.48	8.27	8.21	8.10	8.47	8.40	8.35	8.38	8.32	8.26
$CaCO_3$ %	0-25	41.23	40.55	39.97	39.14	36.28	35.51	34.96	38.50	37.93	37.01	41.07	38.36	37.75	37.17	40.63	39.24	39.29	39.56	38.81	38.42
	25-60	35.06	34.71	3452	34.47	33.87	33.65	33.18	34.26	33.94	33.79	35.11	33.92	33.67	33.45	34.96	34.67	34.50	34.74	34.31	34.06
Organic matter %	0-25	0.95	1.27	1.36	1.48	1.39	1.47	1.69	1.33	1.42	1.53	0.98	1.25	1.37	1.51	1.15	1.29	1.44	1.19	1.32	1.47
	25-60	0.71	0.76	0.78	0.81	0.79	0.84	0.87	0.77	0.81	0.85	0.74	0.79	0.83	0.88	0.76	0.78	0.79	0.78	0.81	0.84
CEC (meq/100 g soil)	0-25	17.30	17.81	18.12	18.95	18.73	19.54	20.67	18.25	18.91	19.74	17.41	18.36	18.89	19.91	17.91	18.27	19.21	18.05	18.63	19.54
	25-60	21.62	21.79	21.85	21.92	21.97	22.11	22.37	21.86	21.93	22.09	21.68	21.98	22.13	22.47	21.80	21.93	22.05	21.87	22.01	22.23
Exchangeable sodium %	0-25	10.68	9.53	9.07	8.77	8.84	8.35	8.07	9.11	8.71	8.43	10.49	9.19	8.86	8.63	9.59	9.37	9.12	9.35	9.04	8.87
	25-60	12.53	12.18	12.05	11.92	11.78	11.49	11.21	11.94	11.75	11.57	12.46	11.84	11.75	11.61	12.19	11.12	11.98	12.06	11.88	11.84

The increase of storage pores percent and the reduce of soil strength values are contributed to the suitable air-moisture regime and a wide range of available water, and in turn shows a pronounced positive effect of poor supply conditions in either studied sandy or calcareous soils for nutrients availability and biological activity for the mechanism of their uptake by plant roots. Therefore, the beneficial effect of these organic amendments was also extended to the next agricultural growing season, as shown in Tables 5 and 6 . Whereas, the beneficial residual effect or the increase rate occurred in second season scaled a range of 1/3 to 1/2 fold over the control treatment for the second season as compared to the first one. Of course, the occurred soil changes are associated with different factors; soil physico-chemical properties and plant consumption are of these factors.

Anyhow, the beneficial residual effect of the applied CPR as well as increasing its rates resulted in an increase for each of the studied soil characters, this may be due to its wide C/N ratio that limited or controlled its decaying rate. On the other hand, the poultry wastes exhibited a relative high accelerating for decomposition due to its narrow C/N ratio and followed by cattle wastes. So, the sequence of the superiority for the applied organic amendments has taken an opposite trend, *i.e.*, composted plant residues (CPR) > cattle wastes (CW) > poultry wastes (PW). Thus, the latter conditions, differences between these amendments for C/N ratio as related to the degree or rate of decaying, played an important role for their residual effects in the second season. Therefore, soil improvement degree was extending parallelly close to the increase of organic amendment rates, especially for that possesses narrow and wide C/N ratios in the first and second growing seasons, respectively.

It could be noticed that changes in the percentage of the studied characters (bulk density, hydraulic conductivity, soil strength, available water, storage pores, ECe, pH, $CaCO_3$, organic matter, CEC and ESP) for the surface layer of sandy soil at the highest rate of PW in the first season, as shown in Table 7, ranged between -5.50 and 270.83 % vs -4.17 and 96.30 % at the highest rate of CPR in the second season. The corresponding values for the surface layer of calcareous soil were –10.22 and 87.78 % for PW in the first season vs -4.34 and 54.08 % for CPR in the second one.

As for the subsurface layers, data indicated that they behaved as the same trend of the surface ones, but with a relatively less changes for the studied soil parameters, *i.e.*, -3.25 and 57.14 % for sandy soil treated with PW in the first season vs -2.61 and 29.25 % for CPR among the second one. The corresponding values for the subsurface layer of calcareous soil were 3.47 and 71.44 % for PW in the first season vs -0.98 and 33.68 % for CPR among the second one.

TABLE 7. Relative changes % in the studied soil characters at the highest rates of poultry wastes (PW) and composted plant residues (CPR) in the first and second seasons, respectively.

Soil character	Sandy soil				Calcareous soil			
	Depth of 0-25 cm		Depth of 25-60 cm		Depth of 0-25 cm		Depth of 25-60 cm	
	PW	CPR	PW	CPR	PW	CPR	PW	CPR
Bulk density	-9.79	-7.09	-8.22	-5.56	-19.84	-8.76	-10.61	-9.92
Hyd. Conduc.	-39.75	-36.31	-29.58	29.25	73.48	43.80	71.44	33.68
Soil strength	-17.49	-8.25	--	--	-52.44	-46.19	--	--
Available water	53.04	32.82	16.18	18.03	21.42	13.56	9.22	9.71
Storage pores	60.82	34.68	10.54	18.05	66.95	30.80	19.54	19.39
ECe	-34.75	-15.98	-31.65	-26.99	-10.22	-6.47	-5.41	-6.29
pH	-5.50	-4.17	-3.25	-2.61	-10.27	-4.34	-6.22	-0.98
$CaCO_3$%	-30..82	-25.16	-13.50	-18.17	-15.21	-9.50	-5.36	-4.73
Organic matter%	270.83	96.30	57.14	26.67	87.78	54.08	22.54	18.92
CEC	24.65	15.10	17.94	25.93	19.48	14.36	3.47	3.64
ESP	-18.42	-18.53	-12.94	-19.72	-24.44	-17.73	-10.53	-6.82

The magnitudes of available nutrients in both sandy and calcareous soils as affected by the different treatments are shown in Tables 8 and 9. The obtained results showed a progressive increases in the availability of N, P, K, Fe, Mn, Zn and Cu with increasing the applied rates in the treated soils as compared to the untreated ones. The highest soil content of available nutrients was achieved upon treating the soil with the maximum rate of the studied organic amendments, with superiority to PW, due to its narrow C/N ratio and attains relatively high contents of essential macro and micronutrients. Accordingly, the positive effect of the applied treatments on the available nutrient contents in soil could be arranged, in general, into the descending order of poultry wastes (PW) > cattle wastes (CW) > composted plant residues (CPR).

It is worthy to mention that the application of the studied organic amendments was more effective for improving the different studied soil characters, especially in decreasing soil pH in the calcareous soil, due to the fact that they attained an active organic acids and compounds which have ability to release from these organic amendments. Results obtained revealed that, the residual effect as related to all the studied soil characters was more pronounced for the composted plant residues (CPR) as compared to association of other treatments.

The changes in the percentage of the studied nutrients for the surface layer of sandy soil at the highest rate of PW in the first season surpassed CPR, where their relative increases ranged between 173.08 and 325.00 % for PW vs 165.19 and 218.18 at the highest rate of CPR in the second season. The corresponding values for the surface layer of calcareous soil were 87.74 and 433.33 % for PW vs 74.55 and 287.50 % at the highest rate of CPR in the second season, (Table 10) .

TABLE 8. Available nutrient contents (mg/kg) in the studied soils as affected by the applied rates of the different organic amendments under investigation during the first agricultural growing season (wheat).

Soil depth (cm)	nutrient	Control	Plant residues (m^3/fed)			Poultry wastes (m^3/fed)			Cattle wastes (m^3/fed)		
			10	20	30	5	10	15	5	10	15
Sandy soil											
0-25	N	17.6	18.1	25.2	33.4	20.3	42.4	63.8	19.6	30.2	48.6
25-60		9.8	10.4	11.8	13.5	11.5	16.1	21.4	10.69	13.6	17.4
0-25	P	2.6	2.9	4.5	5.9	3.6	5.4	7.1	3.1	5.2	6.3
25-60		1.7	2.0	2.1	2.2	2.2	2.4	2.8	2.1	2.3	2.5
0-25	K	63.4	76.5	88.9	103.7	84.5	129.8	184.6	79.3	108.1	144.3
25-60		44.8	50.3	52.6	55.1	51.7	58.5	67.9	50.8	55.7	61.5
0-25	Fe	2.4	3.7	4.4	5.1	4.1	6.6	9.7	3.9	5.3	7.4
25-60		1.7	1.9	2.0	2.2	2.1	2.8	3.6	2.0	2.4	2.9
0-25	Mn	0.55	0.80	0.90	1.10	1.00	1.60	2.30	0.90	1.20	1.70
25-60		0.35	0.50	0.60	0.70	0.60	0.80	1.10	0.60	0.70	0.90
0-25	Zn	0.45	0.70	0.80	1.00	0.90	1.30	1.60	0.80	1.10	1.40
25-60		0.35	0.50	0.50	0.50	0.60	0.70	0.90	0.50	0.60	0.70
0-25	Cu	0.40	0.50	0.60	0.70	0.70	1.10	1.70	0.60	0.80	1.20
25-60		0.30	0.40	0.40	0.40	0.50	0.60	0.70	0.40	0.50	0.50
Calcareous soil											
0-25	N	26.9	28.7	36.3	45.5	30.4	54.7	82.9	29.5	45.4	64.2
25-60		14.8	15.6	20.3	26.0	17.1	30.3	45.6	16.3	25.6	35.3
0-25	P	3.1	4.2	4.9	5.7	4.9	7.2	9.7	4.8	6.2	7.7
25-60		2.4	2.7	3.0	3.3	3.0	4.1	5.3	2.8	3.4	4.3
0-25	K	169.6	196.4	211.7	232.4	199.8	256.2	318.4	198.3	234.7	275.4
25-60		147.8	168.6	173.9	180.1	177.3	198.6	224.9	174.2	186.9	202.5
0-25	Fe	2.1	2.9	3.9	5.0	3.3	7.5	11.2	3.2	5.6	8.1
25-60		1.4	1.8	2.0	2.3	2.0	3.2	4.1	1.9	2.5	3.2
0-25	Mn	0.70	1.10	1.40	1.70	1.30	2.40	3.50	1.20	1.80	2.60
25-60		0.50	0.60	0.60	0.70	0.80	1.00	1.30	0.70	0.80	1.00
0-25	Zn	0.60	0.80	1.00	1.20	1.10	1.60	2.20	0.90	1.20	1.70
25-60		0.40	0.50	0.50	0.50	0.70	0.90	1.10	0.60	0.70	0.80
0-25	Cu	0.45	0.60	0.70	0.90	0.80	1.30	2.00	0.70	1.00	1.40
25-60		0.40	0.50	0.50	0.50	0.70	0.80	0.90	0.60	0.60	0.70

TABLE 9. Available nutrient contents (mg/kg) in the studied soils as affected by the residual effect of the applied rates of the organic amendments under investigation during the second agricultural growing season (maize).

Soil depth (cm)	Nutrient	Control	Plant residues (m^3/fed)			Poultry wastes (m^3/fed)			Cattle wastes (m^3/fed)		
			10	20	30	5	10	15	5	10	15
Sandy soil											
0-25	N	18.1	33.5	40.8	48.0	20.1	24.7	29.0	26.4	33.3	41.0
25-60		10.2	13.2	15.1	17.0	10.6	11.0	12.0	11.5	13.1	15.0
0-25	P	2.8	5.1	6.3	7.0	3.1	4.5	5.7	4.2	5.6	6.1
25-60		1.9	2.4	2.5	2.8	2.0	2.1	2.3	2.2	2.4	2.6
0-25	K	65.9	109.8	131.9	153.0	73.7	90.3	107.0	89.5	106.6	124.0
25-60		46.3	54.9	59.1	63.0	48.4	50.8	53.0	51.2	54.7	54.5
0-25	Fe	2.8	5.3	6.7	7.9	3.3	4.3	5.2	4.2	5.5	6.8
25-60		1.8	2.4	2.9	3.4	1.9	2.3	2.7	2.2	2.6	3.1
0-25	Mn	0.60	1.10	1.40	1.80	0.70	0.90	1.10	0.80	1.00	1.30
25-60		0.40	0.70	0.80	1.00	0.50	0.60	0.70	0.60	0.70	0.90
0-25	Zn	0.50	0.90	1.20	1.30	0.60	0.70	0.90	0.70	0.90	1.10
25-60		0.40	0.70	0.80	0.80	0.50	0.60	0.60	0.60	0.70	0.70
0-25	Cu	0.50	0.90	1.20	1.40	0.60	0.70	0.90	0.70	0.90	1.10
25-60		0.30	0.70	0.80	0.80	0.40	0.50	0.50	0.50	0.60	0.60
Calcareous soil											
0-25	N	28.7	49.2	58.1	67.0	31.8	39.7	48.1	40.6	50.3	59.7
25-60		15.1	29.9	35.4	41.0	18.2	23.5	29.0	24.6	31.1	37.6
0-25	P	3.3	6.4	7.6	8.9	4.4	5.2	6.1	4.5	6.5	7.3
25-60		2.5	3.5	4.1	4.8	2.6	3.1	3.6	3.1	3.6	4.3
0-25	K	171.3	224.8	260.6	299.0	176.6	182.0	187.6	188.3	200.9	215.1
25-60		149.5	183.8	196.9	212.0	156.8	164.7	173.2	170.1	182.8	197.9
0-25	Fe	2.4	6.0	7.6	9.3	3.2	4.6	6.1	4.5	6.0	7.5
25-60		1.5	2.5	3.2	3.8	1.7	2.1	2.6	2.1	2.6	3.3
0-25	Mn	0.80	1.80	2.30	2.90	1.00	1.30	1.60	1.30	1.70	2.10
25-60		0.60	0.90	1.00	1.10	0.70	0.80	0.80	0.80	0.90	0.90
0-25	Zn	0.70	1.20	1.50	1.90	0.70	0.80	1.10	0.90	1.30	1.60
25-60		0.50	0.80	0.90	0.90	0.60	0.70	0.70	0.70	0.80	0.80
0-25	Cu	0.50	0.90	1.20	1.60	0.50	0.70	0.90	0.70	0.90	1.20
25-60		0.45	0.60	0.70	0.80	0.47	0.50	0.60	0.50	0.60	0.70

TABLE 10. Relative changes % in the studied available nutrients at the highest rates of poultry wastes (PW) and composted plant residues (CPR) in the first and second seasons, respectively.

Available nutrients (mg/kg)	Sandy soil				Calcareous soil			
	Depth of 0-25 cm		Depth of 25-60 cm		Depth of 0-25 cm		Depth of 25-60 cm	
	PW	CPR	PW	CPR	PW	CPR	PW	CPR
N	262.50	165.19	118.37	66.67	208.18	133.45	208.11	171.52
P	173.08	218.18	64.71	100.00	212.90	169.70	120.83	92.00
K	191.01	132.17	51.56	150.00	87.74	74.55	52.17	41.81
Fe	304.17	182.14	111.76	88.89	433.33	287.50	192.86	153.33
Mn	318.18	200.00	214.29	36.07	400.00	262.50	160.00	83.33
Zn	255.56	160.00	157.14	47.37	266.67	171.43	175.00	80.00
Cu	325.00	180.00	133.33	66.67	344.44	220.00	125.00	77.78

As for the subsurface layers, data indicated that they behaved as the same trend of the surface ones, but with relative slight increases for these studied plant nutrients, *i.e.*, 51.56 and 214.29 % for PW in the sandy soil during the first season vs 36.07 and 166.67 % for CPR among the second one. The corresponding values for the subsurface layer of calcareous soil were 52.17 and 208.11 % for PW in the first season vs 41.81 and 171.52 for CPR among the second one

Nutrient contents in plant at elongation stage as affected by the applied amendments

Studying the effect of applied composted plant residues, poultry wastes and cattle wastes to both sandy and calcareous soils (Table 11), it could be noticed that the PW caused a markedly positive effect on the wheat contents of N, P, K, Fe, Mn, Zn and Cu in the whole plant as compared to CPR and CW among the different applied rates in the first growing season. While, it exhibits an opposite trend for the nutrients content in the next crop of maize plants during the second growing season, since the CPR gave the highest values.

As mentioned before, such effect being dependent on the nature of concerned organic amendment, especially its chemical composition and C/N ratio, along with its applied rate or the initial state in soil, in organo-metalic forms, as a storehouse, and increase their mobility or availability for uptake by plants

Generally, it could be concluded that the nutrient contents in plants were extending parallelly close to the corresponding available nutrient contents in soils, as shown in Tables 8, 9, 11 and 12.

TABLE 11. Nutrient contents (mg/kg) in wheat and maize plants grown on the studied sandy and calcareous soils as affected by the applied rates of the organic amendments under investigation.

Soil type	Nutrient	Control	Plant residues (m^3/fed)			Poultry wastes (m^3/fed)			Cattle wastes (m^3/fed)		
			10	20	30	5	10	15	5	10	15
Wheat											
Sandy soil	N	2.37	2.55	2.71	2.89	3.35	3.69	3.98	2.93	3.30	3.51
	P	0.28	0.30	0.33	0.36	0.38	0.42	0.48	0.34	0.37	0.42
	K	2.79	2.89	3.01	3.14	3.24	3.73	4.38	3.04	3.37	3.80
	Fe	42.55	49.38	58.62	69.03	64.67	79.52	103.61	56.74	70.49	88.07
	Mn	36.29	41.52	47.67	56.16	54.82	65.54	79.68	47.91	55.73	67.04
	Zn	27.18	30.48	34.65	39.32	39.37	46.64	55.78	34.75	39.82	46.03
	Cu	6.96	7.19	7.53	7.92	7.89	9.14	11.95	7.49	8.17	9.09
Calcareous soil	N	2.82	2.94	3.09	3.26	2.47	3.36	4.52	2.15	2.95	3.91
	P	0.34	0.35	0.36	0.38	0.43	0.48	0.54	0.38	0.42	0.46
	K	3.41	3.53	3.69	3.87	3.97	4.38	4.95	3.61	3.82	4.13
	Fe	58.73	64.81	71.34	79.89	82.46	99.57	117.19	72.24	81.17	93.30
	Mn	52.57	56.73	61.49	67.18	67.86	77.63	90.07	61.45	68.29	76.86
	Zn	31.38	35.67	40.81	46.53	49.43	55.85	63.05	41.67	47.29	54.51
	Cu	9.82	9.87	9.95	10.03	10.03	11.74	13.51	9.94	10.46	11.18
Maize											
Sandy soil	N	2.51	2.74	2.98	3.29	2.58	2.69	2.83	2.65	2.77	2.98
	P	0.25	0.29	0.33	0.39	0.26	0.29	0.32	0.27	0.30	0.35
	K	2.87	3.53	3.61	3.69	3.49	3.52	3.56	3.51	3.55	3.62
	Fe	49.71	59.46	71.57	84.92	51.83	55.76	61.15	54.62	60.58	67.49
	Mn	42.53	48.53	56.88	65.93	43.67	49.35	57.78	45.35	53.49	62.13
	Zn	27.24	32.54	38.97	46.37	28.65	31.88	36.53	30.14	35.36	41.87
	Cu	6.15	6.97	8.53	9.87	6.38	7.04	7.91	6.59	7.43	8.76
Calcareous soil	N	2.94	3.15	3.37	3.69	2.99	3.08	3.17	3.06	3.21	3.39
	P	0.35	0.38	0.39	0.43	0.36	0.37	0.38	0.37	0.39	0.40
	K	3.45	3.56	3.68	3.85	3.48	3.52	3.57	3.51	3.59	3.69
	Fe	62.73	72.91	83.85	96.17	65.62	68.41	72.95	68.94	76.86	88.46
	Mn	49.68	55.75	63.46	72.05	51.35	55.87	61.76	53.17	59.42	66.38
	Zn	34.42	38.76	43.46	49.89	35.65	37.15	39.91	36.84	40.62	45.12
	Cu	8.17	9.07	10.00	11.07	8.46	8.97	9.72	8.73	9.63	10.47

TABLE 12. Relative changes % in the studied nutrients at the highest rates of poultry wastes (PW), cattle wastes (CW) and composted plant residues (CPR) in the first and second seasons.

Nutrient (mg/kg)	First season						Second season					
	Sandy soil			Calcareous soil			Sandy soil			Calcareous soil		
	PW	CW	CPR	PW	CW	CPR	CPR	CW	PW	CPR	CW	PW
N	67.9	26.09	21.94	60.3	38.7	15.6	31.8	18.7	12.8	25.5	15.3	7.8
P	71.4	50.00	28.57	58.8	35.3	11.8	56.0	40.0	28.0	22.9	14.3	8.6
K	57.0	36.20	12.54	45.2	21.1	13.5	78.3	26.1	24.0	11.6	7.0	3.5
Fe	143.5	107.0	62.5	99.5	58.9	36.0	70.8	35.8	23.0	53.3	41.0	16.3
Mn	119.6	84.7	54.8	71.3	46.2	27.8	55.0	46.1	35.9	45.0	33.6	24.3
Zn	105.2	69.4	44.7	100.9	73.7	48.3	69.9	53.7	34.1	44.9	31.1	16.0
Cu	71.2	30.6	13.8	37.6	13.9	2.1	60.5	42.4	28.6	35.5	28.2	19.0

Dry weight of straw or shoot and grain yields as affected by the applied organic amendments

Data presented in Table 12 , indicated that application of the studied organic amendments to both soils under investigation had a beneficial effect on plant dry weights , the straw and shoots yields of wheat and maize plants, as well as, their grain yields at the first and second growing seasons, respectively. Also, the results obtained showed the superiority of poultry wastes and composted plant residues for increasing the studied plant parameters at the first and second growing seasons, respectively, with more respondence to the calcareous soil than the sandy one. These findings are good in agreement with those obtained by Abdel-Aziz *et al.* (2000).

The relative increases of wheat dry weight (per plant) as a result of applied the highest rates of CPR, PW and CW were 265.05, 530.10 and 374.76 % for the sandy soil vs 211.30, 384.52 and 294.05 %, respectively, for the calcareous soil. Similar trends were found for wheat straw, where the corresponding values were 80.49, 112.20 and 92.68 % for the sandy soil vs 20.29, 37.68 and 33.33 %, respectively, for the calcareous soil.

Whereas, the relative increases of wheat grains were 119.94, 151.82 and 135.50 % for the sandy soil vs 18.87, 34.41 and 28.85 %, respectively, for the calcareous soil.

In addition, opposite trends held true for maize dry weight, shoots and grains in the second growing season, where the relative increases in plant dry weight were 25.63, 9.65 and 18.36 % for the sandy soil vs 22.96, 11.49 and 18.15 %, respectively, for the calcareous soil. Similar trends were found for maize shoots, where the corresponding values were 152.63, 124.56 and 140.35 % for the sandy soil vs 96.10, 80.52 and 84.42 %, respectively, for the calcareous soil. Whereas, The relative increases of maize grains were 103.41, 80.48 and 95.79 % for the sandy soil vs 43.79, 28.77 and 37.08 %, respectively, for the calcareous soil (Table 13).

TABLE 13. Effect of the applied organic amendments on shoot dry weight, straw and grains yields of wheat and maize crops grown on the sandy and calcareous soils under investigation.

Soil type	Control	Plant residues (m^3/fed)			Poultry waste (m^3/fed)			Cattle waste (m^3/fed)		
		10	20	30	5	10	15	5	10	15
First agricultural growing season (wheat)										
Sandy soil	Dry weight (g/plant) at the elongation stage									
	1.03	1.87	2.62	3.76	3.04	4.67	6.49	2.64	3.52	4.89
	Straw or shoot yield (ton/fed)									
	2.05	3.1	3.45	3.70	3.65	4.10	4.35	3.20	3.55	3.95
	Grain yield (kg/fed)									
	907	1687	1789	1993	1987	2115	2284	1806	1998	2136
Calcareous soil	Dry weight (g/plant) at the elongation stage									
	1.68	2.30	3.62	5.23	3.36	5.23	8.14	2.95	4.18	6.62
	Straw or shoot yield (ton/fed)									
	3.45	3.65	4.05	4.15	4.10	4.40	4.75	3.90	4.20	4.60
	Grain yield (kg/fed)									
	1924	2079	2118	2287	2307	2423	2586	2136	2314	2479
Second agricultural.growing season (maize)										
Sandy soil	Dry weight (g/plant) at the elongation stage									
	111.97	119.32	124.51	140.67	114.54	117.27	122.78	117.46	121.27	132.53
	Straw or shoot yield (ton/fed)									
	2.85	6.55	6.90	7.20	6.1	6.25	6.40	6.30	6.70	6.85
	Grain yield (kg/fed)									
	1378	2504	2716	2803	2106	2290	2487	2359	2517	2698
Calcareous soil	Dry weight (g/plant) at the elongation stage									
	128.90	136.29	146.62	158.50	130.92	137.43	143.71	133.83	141.71	152.30
	Straw or shoot yield (ton/fed)									
	3.85	6.90	7.25	7.55	6.35	6.70	6.95	6.50	6.85	7.10
	Grain yield (kg/fed)									
	2489	3284	3402	3579	2887	3096	3205	2976	3292	3412

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الانتفاع ببعض مخلفات المزارع العضوية في تحسين إنتاجية الأراضي حديثة الاستصلاح في محافظة الفيوم – مصر

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تهدف هذه الدراسة إلى إستبيان التأثير الإيجابى لإضافة معدلات مختلفة من بعض مخلفات المزارع العضوية ممثلة فى مكمورة المخلفات النباتية ، مخلفات مزارع الدواجن والماشية على إنتاجية بعض أراضى المناطق حديثة الإستصلاح تكونت من رسوبيات رملية سافية ، جيرية طينية أيوسينية على الحافة الشرقية لمحافظة الفيوم – مصر . ولتحقيق هذا الهدف أجريت تجربة حقلية فى قطعتين من الأراضى حديثة الإستصلاح يقعا بزمام ناحيتى دمو (ذات طبيعة طميية رملية) ، وطامية (ذات طبيعة جيرية طينية) التابعتين لمركزى الفيوم وطامية ، محافظة الفيوم – مصر . وقد إشتملت التجربة على تسعة معاملات من مخلفات المزارع العضوية المشار إليها سابقا – بإستخدام ثلاث مكررات – وزعت فى تصميم قطاعات كاملة العشوائية ، بمعدلات 10 ، 20 ، 30 م^3 / فدان من مكمورة المخلفات النباتية ، 5 ، 10 ، 15 م^3 / فدان من كلا مخلفات مزارع الدواجن والماشية ، ثم تم زراعة محصولين متعاقبين (قمح –ذرة) خلال الموسمين الزراعيين لعام 2001 / 2002.

وتشير النتائج المتحصل عليها إلى حدوث إستفادة ايجابية محققة نابعة من تحسين فى خواص الأراضى تحت الدراسة كنتيجة لإضافة تلك المحسنات العضوية ، تدل عليها قيم الكثافة الظاهرية ، التوصيل الهيدروليكى ، مقاومة الطبقة السطحية من التربة ، مدى الماء الميسر ، Soil pH ، محتوى التربة من المادة العضوية وكذا المحتوى من المغذيات الميسرة للنبات فى التربة تحت الدراسة (N, P, K, Fe, Mn, Zn and Cu) ، كما تشير قيم التوصيل الهيدروليكى إلى وجود علاقة إيجابية حيث أظهرت تناقص تدريجى مع زيادة معدلات الإضافة من تلك المحسنات العضوية فى الأرض الرملية مقابل زيادة تدريجية فى الأرض ذات الطبيعة الجيرية .

كما اظهرت النتائج الأهمية الكبيرة لإضافة تلك المحسنات العضوية لدورها الإيجابى فى تيسر المغذيات النباتية فى مثل هذه الأراضى ، خاصة فى حالة إضافة مخلفات الدواجن خلال الموسم الزراعى الأول (القمح) ، ويرجع ذلك أساسا إلى ارتفاع محتواها من المركبات العضوية الفعالة والمغذيات الضرورية للنبات وكذا ضيق فى مدى نسبة C/N مما يزيد من سرعة ومعدل تحللها . ويمكن ترتيب مخلفات المزارع العضوية تحت الدراسة تنازليا تبعا لتاثيرها

الإيجابى على تحسين خواص التربة ومحتواها من المغذيات النباتية خلال الموسم الزراعى الأول كالآتى : مخلفات الدواجن > مخلفات الماشية > مكمورة المخلفات النباتية .

ولقد امتدت تلك التأثيرات الإيجابية والمفيدة إلى المحصول المنزرع فى الموسم الزراعى الثانى (الأذرة) ، ولكن هنا أخذت المحسنات العضوية ترتيبا معاكسا لما هو مشار إليه فى الموسم الزراعى الأول تبعا لدرجة تفوقها ، حيث أصبح كالتالى: مكمورة المخلفات النباتية > مخلفات الماشية > مخلفات الدواجن . وتلك الظروف ترتبط أساسا بالإختلافات فى قيم نسبة C/N بين المحسنات العضوية تحت الدراسة ، ومن ثم درجة ومعدل تحللها والتى لعبت دورا هاما فى تحقيق الأثر المتبقى فى الموسم الزراعى الثانى . هذا يعنى أن مكمورة المخلفات النباتية - ذات المدى الواسع فى نسبة C/N - أظهرت معدل تحلل بطىء خلال الموسم الزراعى الأول مما أدى إلى إمتداد أثرها المفيد إلى الموسم الزراعى الثانى .

وبالنسبة إلى الظروف الخاصة بإمتصاص المغذيات بواسطة النبات ، أظهرت النتائج أن هناك إتجاه متزايد لمعدل الإستجابة للعناصر تحت الدراسة (N, P, K, Fe, Mn, Zn and Cu) فى انسجة نباتات كلا المحصولين مع زيادة معدلات الإضافة ، مع وجود أفضلية لمخلفات الدواجن ومكمورة المخلفات النباتية خلال الموسمين الزراعيين الأول والثانى على التوالى . كما إتضح أن قيم تلك المغذيات كانت أكثر إرتباطا بالمحتوى الميسر فى التربة - فيما عدا عنصرى N & K ، فى تلك النباتات النامية فى الأرض الرملية - مما أدى الى زيادة تجمعها فى أنسجة النباتات النامية فى الأرض الجيرية تحت ظروف التجربة .

وهذه النتائج توضح التأثيرات المفيدة لتلك المحسنات العضوية . والتى تشجع على إنطلاق وتيسر الفوسفور وكذا المركبات العضوية النشطة التى لها القدرة على خلب المغذيات الصغرى وتكوين معقدات معدنية-عضوية تعتبر مخزون إستيراتيجى ميسرله القدرة على الحركة والإمتصاص بواسطة النباتات ، مما إنعكس إيجابيا على تطور وزيادة إنتاجية المحصول ومكوناته لنباتات القمح والذرة .