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EFFECT OF APPLICATION OF AGRICULTURE ORGANIC WASTES ON PROPERTIES OF A SANDY SOIL, AND THE IMPACT ON MAIZE AND BARLEY GROWN ON THE SOIL.
I- PHYSICAL AND CHEMICAL PROPERTIES OF THE SOIL.

BY

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ABSTRACT

A sandy soil from Meet Kenana, Qalyoubia Governorate was used in the study. Four sources of organic manure were used i.e. chicken manure (CM), charred rice straw (CRS), sugar beet residue compost (SBC) and sugar lime (SL) " a sludgy waste of lime-rich material residual from beet sugar factories". The rates of application were 2 %, 4 % and 8 % w/w in 3 replicates. Organic wastes were added to the soil in plastic pots of 5 kg capacity and watered to about the field capacity and left for one month. Pots were watered weakly to maintain soil moisture to about the field capacity. After that, 20 grains of maze (*Zea mays*, cv. haybrid 2 Taba) were sown for 45 days, followed by 20 barley grains for another 45 days. After barley cutting, soil pots were left to complete one year, after which soil samples were taken for physical and chemical analyses. The obtained results could be summarized as follows:

1- Organic wastes (material) application decreased soil bulk density and increased total porosity. Volume of drainable pores (VDP) was decreased with addition of all the organic wastes and the decrease was more pronounced with sugar lime addition. Water holding pores (WHP) and fine capillary pores (FCP) were increased with addition of organic wastes the increase was more pronounced with adding chicken manure. This reflected on the hydraulic conductivity (HC) of the soil which decreased from 28.1 to 20.6 cm/hr. at R_3 addition.
2 - Soil water contents at field capacity, wilting point as well as available water contents were increased due to the addition of the organic wastes and the increase was more pronounced with the charred rice straw, this reflects the high retentive capacity of the CRS in comparison with the other wastes under study .
3 - Soil salinity increased in the all treatments of added organic wastes, except SL which decreased it; organic matter increased and soil pH decreased due to addition of these organic wastes.
4 - The effect of these materials depended on their kind and rate of the applied material.

INTRODUCTION

Under arid and semi arid conditions much attention has been drawn to applying natural soil conditioners especially to sandy soils to improve their physical and chemical properties. Proper application of appropriate soil conditioners would improve soil structure, pore size distribution, moisture characteristics and many other physical and hydrological properties which would lead to adverse effect of salinity.

Addition and incorporation of organic residues to sandy soils would create a favorable environment for plant growth. Aziz *et al.* (1998) reported that application of farmyard manure to a sandy soil markedly increased the amount of total soluble salts. On the other hand, Abou-Baker and Omar (1996) reported that organic composts lowered soil salinity. Abdel Sabour *et al.* (1997) reported that addition of organic waste composts were effective in reducing bulk density and increasing water holding capacity of a sandy soil in Inshas. Hamoud (1992) and Awad (1998) found that addition of poultry manure or farmyard manure to a sandy soil decreased its pH and the decrease was progressive with increasing the application rate. Aziz *et al.* (1999) reported that bulk density decreased due to sandy soil conditioning with farmyard manure; and the soil moisture content at field capacity increased, while the wilting point was not affected and the hydraulic conductivity decreased. Zebrath *et al.* (1999) reported that soil water retention increased and soil bulk density decreased due to addition of 2 % organic matter. El-Sharawy *et al.* (2003) found that application of composts made of cotton stalks or rice straw to a sandy soil decreased soil bulk density, hydraulic conductivity, and increased soil moisture at field capacity, welting point and available water content; with rice straw compost being of the more effect. Negm *et al.* (2004) found that addition of saw-dust and farmyard manure to a sandy soil increased its total porosity, capillary pores, water holding capacity, field capacity and available water; and decreased its quickly drainable pores and bulk density.

The current investigation was carried out to study the effect of adding some organic materials as natural organic conditioners on some physical and chemical properties of sandy soil.

MATERIAL AND METHODS

A surface sandy soil was taken from the 0 - 15 cm surface of a soil in Meet Kenana, Qalyoubia Governorate, Egypt, to be used in the current experiment.

The soil was air-dried, crushed and sieved through a 2 mm sieve, then thoroughly mixed and kept for analysis as well as experimental work. Physical and chemical properties of the studied soil, were determined according to the standard methods outlined by Klute (1986) and Page *et al.* (1982), and are presented in Table 1 .

Table (1): Some physical and chemical properties of the investigated sandy soils.

Soil Properties	
Particle size distribution	
Coarse sand (%)	82.59
Fine sand (%)	10.35
Silt (%)	2.27
Clay (%)	4.79
Texture	Sand
Saturation percentage (%)	22.04
Field capacity(%)	10.73
Wilting point (%)	5.39
Available water (%)	5.34
Bulk density (g cm^{-3})	1.73
Particle density (g. cm^{-3})	2.95
Total porosity (%)	35.04
Hydraulic conductivity (cm h^{-1})	28.28
EC (dSm^{-1})	3.59
pH	8.10
$CaCO_3$ (%)	0.36
Organic matter (%)	0.36
Soluble ions (mmol$_c$/L)	
HCO_3^-	6.40
Cl^-	14.31
CO_3^{2-}	0.00
SO_4^{2-}	16.16
Ca^{2+}	5.28
Mg^{2+}	3.36
Na^+	21.40
K^+	6.83
Exchangeable cations (cmol$_c$ kg^{-1})	
Ca^{2+}	5.16
Mg^{2+}	2.33
Na^+	0.79
K^+	2.33
CEC	10.60
Available macro-nutrient (mg kg^{-1})	
N	24.29
P	14.61
K	195.00
Available micro-nutrient (mg kg^{-1})	
Fe	9.20
Mn	3.60
Zn	4.00

pH: in 1:2.5: soil: water suspension at 25 °C; soluble ions: in paste extract with SO_4^{2-} being calculated by difference between cations and anions.

Available nutrients: Extracted by ammonium bicarbonate - DTPA; available N denotes NO_3-N

Organic materials used in the experiment are:

(1) **Chicken manure (CM):** manure collected from a chicken farm.

(2) **Charred rice straw (CRS):** rice straw burnt anaerobically (with no aeration) till becoming a black material resembling charcoal.

(3) **Sugar beet residue compost (SBC):** leaves and residues of sugar beet roots collected from fields at harvest and the preparation of roots before squeezing them, and composted as described by Abou El- Fadl (1970).

(4) **Sugar lime (S.L):** The sugar lime is a waste by-product of sugar refinery industry resulting from the beet sugar Factory, El-Hamoul, Kafr El-Shaikh Governorate. It was dried made in a form of powder of light brown colour. Upon drying, the lumps break down easily to very fine powder. It is rich in calcium carbonate ($CaCO_3$, 73.1%).

Table (2) shows properties of the organic materials used in the current experiment.

Table (2): Chemical and physical properties of the organic wastes (materials) used in the current study.

Property	CM*	CRS**	SBC***	SL****
PH in (1:5) soil suspension	6.94	8.15	8.58	8.80
EC dSm^{1-} in (1:10) soil suspension	8.73	4.36	8.75	1.90
Organic carbon(%)	11.60	14.60	8.40	3.40
Total nitrogen (%)	3.80	1.80	4.90	0.90
C: N ratio	3.05	8.11	1.71	3.78
Organic matter (%)	23.20	29.20	16.80	6.80
Total P (%)	0.89	0.48	0.52	0.62
Total K (%)	2.43	2.48	6.81	0.25
Ca^{2+} (%)	1.08	0.84	1.80	9.72
Mg^{2+} (%)	0.58	0.29	1.66	0.94
Na^{+} (%)	0.22	0.21	5.90	0.26
Total Fe (mg kg^{1-})	3745	829	6001	1110
Total Mn (mg kg^{1-})	140	85	200	157
Total Zn (mg kg^{1-})	1113	850	1659	1279
Moisture content (%)	9.25	6.84	4.47	3.49
Bulk density g/cm^3	0.69	0.24	0.64	0.74

*: Chicken manure; **: Chard rice straw; ***: Sugar beet compost; ****sugar lime

Greenhouse pot experiment:

A pot experiment was carried out in the greenhouse to study the effect of adding organic materials on the physical and chemical properties of the used sandy soil.

The soil was packed in plastic pots of 5 kg capacity. The experimental design was a randomized complete block, factorial; involving two factors as follows:

1) **The organic wastes:** Chicken manure (CM), Charred rice straw, (CRS), Sugar beet compost (SBC) and sugar lime (SL)

2) **The rate of addition:** 2.0, 4.0, and 8.0 % [rates equivalent to 10, 20, and 40 metric tons / fed., on the basis of 30 cm soil depth]. A no-organic matter treatment (control) was also, carried out. Therefore, there were 13 treatments [i.e. (4 organic waste materials x 3 rates) + 1 control]. Treatments were done in three replicates. Organic materials were added and thoroughly mixed with the soil. All pots were watered to maintain the soil moisture content at about field capacity. Soil pots were left without cultivation for one month to permit a degree of biodegradation of the added materials and mineralization of nutrient elements. Thenafter, 20 seeds of maize (Zea mays, cv. Hybrid 2 Taba) were planted in each pot. Pots were watered to maintain the soil moisture content at about field capacity during the period of the experiment. The experiment continued for 45 days, after which maize seedlings were cut. After that, 20 barley grains were sown in the same pots for another 45 days to study the residual effect of the added organic materials on the soil properties through one year. After cutting barley seedlings, pots were left to complete one year (keeping moisture content at field capacity), at the end of which soil samples were taken for analysis to assess the residual effect on soil.

Soil parameters determined at end of experiment:
Physical determinations
(1) **Bulk density**
(2) **Total porosity,** calculated from particle density and bulk density.
(3) **Pore size distribution,** calculated from the total porosity and the volumetric percentage of water retained in the soil at different applied pressures.
(4) **Soil moisture contents** at field capacity (FC), wilting point (WP) and available water (AW)
(5) **Hydraulic conductivity**

Chemical determinations:
Electrical conductivity (EC); Soil pH and Organic matter content

All data were subjected to statistical analysis according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1 - Effect of added organic wastes (materials) on soil physical properties:
A - Soil bulk density (BD):

Data (Table 3) indicate that addition of organic wastes significantly decreases soil bulk density (BD); this could be attributed to the low specific gravity of the added organic materials and the role of their decomposition products in enhancing aggregation process and production of suitable structure parameters which increase the apparent soil volume and consequently, decrease bulk density (Gouda, 1984 and Aziz *et al.*, 1999). The decreases of BD follow the descending order of: charred rice straw (CRS) > sugar beet compost (SBC) > chicken manure (CM) > sugar lime (SL). These decreases are 16.6 > 13.6 > 11.2 > 3.6 %, respectively as compared with control. Significant differences occurred among the 4 materials. The decrease in soil BD reflects the improvement in the physical conditions of sandy soil; most probably due to increasing the formation of stable aggregates, (Elsharawy *et al.*, 2003).

Results indicate also that increasing the rate of adding organic materials is associated with a progressive decrease in BD. The main effect of the rate of addition showed decreases in BD with a descending order of: $R_3 > R_2 > R_1$ with decreases in BD of 15.4 > 10.7 > 7.7 %, respectively in comparison with the control treatment.

Thus, according to the main effect the most effective material is the charred rice straw (CRS) and the least effective one is sugar lime. The effectiveness is increased by increasing rate of organic material addition.

Soil total porosity and pore size distribution:

Soil total porosity (TP)

Results in Table 3 show that total soil porosity (TP) is significantly increased upon addition of organic materials. These increases in TP follow the descending order of: CRS > SSC > CM > SL; and increases in TP amounting to 28.6 > 24.1 > 19.9 > 5.4 %, respectively. Increasing the rate of addition is associated with a progressive and significant increase in TP. The increases of TP comparing with control are 13.6, 18.5, and 26.4 % due to R_1, R_2 and R_3, respectively. Therefore, the most effective organic material is the CRS and the least effective one is SL; and the effectiveness was highest at the highest rate.

Table (3): Effect of agriculture organic wastes application on soil bulk density ($g\ cm^{-3}$), total porosity (%) of the investigated sandy soil*.

Treatment (M)	Bulk density (g/cm^3)				Total porosity (%)			
	Rate of addition (R)							
	R_1	R_2	R_3	Mean	R_1	R_2	R_3	Mean
CM	1.66	1.64	1.60	**1.63**	41.64	43.02	46.04	**43.57**
CRS	1.50	1.42	1.31	**1.41**	43.39	46.30	50.57	**46.75**
SBC	1.55	1.53	1.43	**1.50**	42.77	44.78	47.81	**45.12**
SL	1.52	1.46	1.39	**1.46**	37.35	38.24	39.38	**38.32**
Mean	1.56	1.51	1.43		41.29	43.09	45.95	
LSD at 5%	**M = 0.01 R = NS M x R = NS**				**M=1.30 R =1.1 MxR = 2.20**			
Control	**1.69**				**36.35**			

*A sandy soil (from Meet Kenana). NS: non-significant

Control = non- treated soil R_1 = 2 % (w/w) R_2 = 4 % (w/w) R_3 = 8 % (w/w)

CM: chicken manure CRS: Charred rice straw

SBC: Sugar beet compost SL: Sugar lime

There is a significant interaction, since no differences occur between CRS and SBC when the rate of addition is low (R_1), but at the high and highest rates (R_2 and R_3) CRS is superior to SBC. Another interaction occurs: SL is the only material where the progressive increases with the increase in its rate of addition are very little and not statistically significant. Thus increasing SL rates shows no significant effect.

Soil pore size distribution:

Pore size distribution, in general, involves the volume drainable pores (VDP = > 28.8μ); the water holding pores (WHP = 28.8 - 19μ) and the fine capillary pores (FCP = < 0.19μ).

Volume drainable pores (VDP):

Results in Table 4 show that the addition of the organic materials significantly decreases VDP; this decrease is more pronounced with sugar lime addition. This may be due to the breakdown of sugar lime lumps into fine particles and consequently, a movement and precipitation of these fine particles between soil particles to decrease the pore volume and hence the volume of drainable pores. The decreases in VDP follow the descending order of: SL > CM > SBC > CRS and amounts 18.8 > 8.7 > 7.9 > 5.4 %, respectively as compared with control.

Increasing the addition rate of organic wastes is associated with a progressive and significant decrease of VDP. The main effect of the rate of addition shows an order of: $R_3 > R_2 > R_1$ with decreases of 12.8 > 9.9 > 7.9 %, respectively. Differences between the 3 rates are significant. Charred rice straw (CRS) is more effective when added at the low rate R_1.

Therefore, according to the main effect results show that the most effective material is SL and the least effective one is CRS; and the effectiveness is high at the highest rate. Effect of both CM and SBC is similar. The highest decrease in VDP due to the addition of SL may be due to the breakdown of its lumps to a very fine powder on soil surface upon its addition and mixing with the soil as well as its high content of $CaCO_3$ which acts as a cementing agent enhancing aggregation of soil particles and hence decreasing the VDP in the soil.

Fine capillary pores (FCP):

Results in Table 4 show that adding of organic wastes particularly CM and SL increases FCP of the soil,. The main effect of organic wastes additions shows increases in FCP with a descending order of: CM >SL> SBC > CRS and a increases of 12.0 > 6.7 > 5.8 > 0.1, respectively.

Increasing the addition rate is associated with an increase in FCP, although this is significant only at R_3.. The main effect of the rate of addition shows a descending order of $R_3 > R_2 > R_1$ with increases in FCP % of 9.8 > 5.8 > 3.4 %, respectively. Therefore, the most effective material is (CM) and the least effective one is (CRS); and the effectiveness increases by increasing the application rate. The most effective rate was R_3 followed by R_2 and the least effective was R_1.

Water holding pores (WHP):

Results in Table 4 show that the addition of organic wastes significantly increases WHP, with a descending order of CM > SL > SBC > CRS; and increases of 28.4 > 22.7 > 22.4 > 15.4 %, respectively as compared with the control. Although, the charred rice straw (CRS) is the least effective organic materials, its positive effect on WHP is more pronounced when added at a low rate (R_1).

Increasing the rate of addition is associated with a progressive and significant decrease in WHP with an order of: $R_3 > R_2 > R_1$ with increases of 25.8 > 22.1 > 18.8 %, respectively comparing with control. Differences between the 3 rates are significant. Charred rice straw (CRS) is more effective when added at the low rate R_1. Such a pattern of response to organic materials occurs at all rates of addition; and the response to addition rates occurs with each organic material i.e. no significant interaction is found between organic matter sources and rate of addition.

Therefore, the most effective organic material is CM and the least effective one is CRS; and the effectiveness is high at the highest rate of addition, except CRS.

Table (4): Effect of agriculture organic wastes application on soil pore size distribution of the sandy soil*.

Treat. (M)	Volume drainable pores (%)			
	Rates of addition (R)			
	R_1	R_2	R_3	Mean
CM	55.86	51.91	51.81	**53.19**
CHRS	53.77	55.69	55.86	**55.11**
SBC	54.29	54.41	52.31	**53.67**
SL	50.72	47.99	43.12	**47.28**
Mean	**53.66**	**52.48**	**50.78**	
LSD at 5%	**M=1.2 R= 0.9 MxR=NS**			
Control	**58.25**			
	Fine capillary pores (%)			
CM	22.37	24.54	25.13	**24.01**
CHRS	22.12	21.16	21.08	**21.45**
SBC	22.28	22.41	23.34	**22.68**
SL	21.84	22.59	24.18	**22.87**
Mean	**22.15**	**22.68**	**23.52**	
LSD at 5%	**M=1.4 R=0.7 MxR= NS**			
Control	**21.43**			
	Water holding pores (%)			
CM	24.33	26.53	27.45	**26.10**
CHRS	24.12	23.16	23.06	**23.45**
SBC	24.17	24.99	25.49	**24.88**
SL	23.96	24.59	25.28	**24.94**
Mean	**24.15**	**24.82**	**25.57**	
LSD at 5%	**M=0.6 R=0.4 MxR=NS**			
Control	**20.32**			

2. Effect of organic wastes on soil moisture contents at field capacity, wilting point and available water:

Field capacity (FC):

Results in Table 5 show that organic wastes addition significantly increase soil moisture content at FC with a main effect order of CRS > SBC >

CM > SL where increases are 26.1, 36.8, 32.9 and 17.3 %, respectively as compared with control. This may be due to the formation of large aggregates which increase soil porosity as well as formation of a network of root system. Also, this finding could be attributed to the presence of colloidal materials produced from organic materials which encourage and enhance moisture adsorption and retention, (Singh, 1980a and El-Toukhy, 1982, ElSharawy *et al.*, 2003).

Increasing the rate of addition significantly increases FC with a main effect of $R_3 > R_2 > R_1$ with increases of 46.3 > 25.1 > 13.3, %, respectively. There are significant differences between the 3 rates within each treatment. Therefore, the most effective organic material is CRS and the least effective one is SL.

Wilting point (WP):

Results in Table 5 show that the addition of organic wastes significantly increases soil moisture content at WP with a main effect of: CRS > SBC > CM > SL and increases of 33.2, 28.6, 22.8 and 13.9 %, respectively, (ElSharawy *et al.*, 2003).

Increasing the rate of addition significantly increases WP, i.e. $R_3 > R_2 > R_1$ where increases are 42.3 > 21.3 > 10.4 %, respectively as compared with control. This occurred with all of the added organic materials since there is no significant interaction between the kind of organic material and the rate of addition. Therefore, the most effective organic material is CRS and the least effective is SL; and the effectiveness is highest at the highest rate. Both CM and SL are similar; CRS is superior to SBC and both are superior to CM and SL.

Available water content (AW):

Results in Table 5 show that AW is significantly increased due to the addition of organic materials. The pattern is as follows: CRS > SBC > CM > SL; and amounts 40.5 > 37.1 > 29.2 > 20.6 %, respectively comparing with control.

Increasing the rate of addition is associated with a progressive and significant increase in AW content; with a main effect of: $R_3 > R_2 > R_1$ and increases of 50.6 > 34.1 > 16.2 %, respectively. Such a pattern of response occurred with all organic materials, i.e. no significant interaction occurred between the kind of material and the rate of addition. Therefore, the most effective organic material is (CRS) and the least effective one is (SL); and the effectiveness is high at the highest application rate. Both CM and SL are similar; CRS is superior to SBC and both are superior to CM and SL.

3 - Soil hydraulic conductivity (HC):

Results in Table 6 show that HC significantly decreased upon addition of the organic materials as compared with control. The main effect shows an order of CRS > CM = SBC > SL; with a decreases of 34.5 > 27.8 = 27.8 > 6.4 %, respectively. Decreasing of HC may be due to (a) increased organic matter content from decomposition of roots of maize and barley previously grown on the soil and (b) formation of a network of root system; which forms more aggregates and more micro-pores on the expense of macro-pores and hence reducing water percolation through the soil. The highest decrease in HC due to addition of CRS could be attributed to a movement of the charred particles of the material downward and consequently filling the macro pores and decreasing the movement of water through the soil matrix. ElSharawy *et al.* (2003) applied rice straw compost to a sandy soil and observed a decrease in soil hydraulic conductivity.

Table (5): Effect of agriculture organic wastes application on soil moisture contents at field capacity, wilting point and available water (on mass basis, %) of a sandy soil*.

Treat. (M)	Field capacity(%)			
	Rates of addition (R)			
	R_1	R_2	R_3	Mean
CM	9.71	11.30	12.94	11.32
CRS	11.06	11.84	13.95	12.28
SBC	10.61	11.53	13.65	11.93
SL	9.29	10.26	12.03	10.53
Mean	10.17	11.23	13.14	
LSD at 5%	M=0.7 R=0.4 M x R =0.1			
Control	8.98			
Wilting point (%)				
CM	4.86	5.65	6.47	5.66
CRS	5.53	5.92	6.98	6.14
SBC	5.32	5.68	6.80	5.93
SL	4.63	5.13	6.00	5.25
Mean	5.09	5.59	6.56	
LSD at 5%	M=0.09 R=0.06 MxR=NS			
Control	4.61			
Available water (%)				
CM	4.85	5.62	6.46	5.65
CRS	5.53	5.92	6.97	6.14
SBC	5.29	5.85	6.85	5.99
SL	4.66	5.13	6.03	5.27
Mean	5.08	5.86	6.58	
LSD at 5%	M=0.09 R= 0.06 MxR=NS			
Control	4.37			

Increasing the rate of addition decreases HC progressively and significantly. The main effect of the rate shows an order of $R_3 > R_2 > R_1$ and decreases of 26.69 > 22.06 > 16.34, %, respectively. This occurred with all of the added organic materials since there is no significant interaction between the kind of material and the rate of addition.

Table (6): Effect of agriculture organic wastes application on hydraulic conductivity (cm. h^{-1}) of the investigated sandy soil*.

Treatment (M)	Rate of addition (R)			
	R_1	R_2	R_3	Mean
CM	22.4	20.3	18.3	**20.3**
CRS	19.8	18.2	17.2	**18.4**
SBC	22.4	20.3	18.3	**20.3**
SL	27.3	26.1	25.5	**26.3**
Mean	**23.5**	**21.9**	**20.6**	
LSD at 5%	**M = 1.9 R = 1.1 M x R= NS**			
Control	**28.1**			

4. Effect of organic materials addition on some soil chemical properties:

A - Soil salinity (EC):

Results of Table 7 show that soil salinity (EC in dS m^{-1} of the soil past extract) significantly increases due to CM, CRS and SBC additions but significantly decreases due to SL addition with average increase of 2.8, 8.4 and 19.6 % for the former 3 materials and a decrease of 8.9 % for the latter material. The increase in salinity due to CM, CRS and SBC additions reflects the saline nature of these materials (see Table, 2). These results agree with those obtained by Abou Gabal (1990), Aziz *et al.* (1998), El-Kamar (2003) and ElSharawy *et al.* (2003).

The decrease in soil salinity due to SL addition, on the other hand, and despite the high salinity of this material may be due to the very high HC of the soil treated with this material in comparison with the other materials. The high soil HC facilitates the movement of water through soil and hence leaching out the salt from the soil.

Increasing the addition rate is associated with a progressive and significant increase in soil salinity, with a main effect of: $R_3 > R_2 > R_1$; and increases of 7.6 > 5.6 > 3.8 % comparing with control, respectively, and the differences between the rates are significant.

A significant interaction between the source of organic material and the rate of addition is found. In the case of CM, a significant difference occurs between R_1 and R_3 but no significant differences occurs between R_2 and each of R_1 and R_3. In the case of CRS, no significant differences occurs among all of the three rates. With SBC significant differences occurs among the three rates of addition. With SL there is a significant difference only between R_3 and R_1.

B - Soil (pH):

Results in Table 7 show that the addition of organic materials decreases soil pH, particularly by adding SL. pH decreases take the following order: SL > CRS > CM > SBC. Also, soil pH decreases with increasing the addition rate. The decrease of soil pH is progressive but not significant with the rate; also the response to rates occurs with each organic substances i.e. no significant interaction is found between organic matter sources and the rate of addition.

The decrease in soil pH can be attributed to the decomposition of organic matter and formation of organic acids which would decrease the soil pH. Also, organic matter decomposition would result in carbon dioxide formation which dissolves in soil moisture forming carbonic acid (H_2CO_3) that leads to a decrease in soil pH, (ElSharawy *et al.*, 2003).

C - Soil organic matter content (OM):

Results in Table 7 show that organic matter content in the soil significantly increases upon addition of organic materials with a main effect of: CRS > SBC > CM > SL and increases of 466.7 > 133.3 > 80.0 > 26.7 %, respectively, (El-Kamar, 2003) and ElSharawy *et al.*, 2003).

Table (7): Effect of agriculture organic wastes application on soil salinity (in saturated paste extract, dSm^{-1}); pH (in 1:2.5 suspension at 25°C) and soil organic matter content (%) of the investigated soil*.

Treat. (M)	EC (dSm^{-1})			
	Rates of addition (R)			
	R_1	R_2	R_3	Mean
CM	3.97	4.04	4.12	**4.04**
CRS	4.21	4.26	4.30	**4.26**
SBC	4.47	4.71	4.91	**4.70**
SL	3.67	3.57	3.51	**3.58**
Mean	**4.08**	**4.15**	**4.23**	
LSD at 5%	M = 0.08 R = 0.06 MxR = 0.13			
Control	3.93			
pH				
CM	8.15	8.13	8.11	**8.13**
CRS	8.14	8.10	7.99	**8.08**
SBC	8.18	8.14	-8.12	**8.15**
SL	8.16	8.04	8.01	**8.04**
Mean	**8.13**	**8.09**	**8.06**	
LSD at 5%	M= 0.06 R = NS MxR = NS			
Control	8.17			
Organic matter content (%)				
CM	0.24	0.27	0.31	**0.27**
CRS	0.42	0.91	1.22	**0.85**
SBC	0.23	0.35	0.48	**0.35**
SL	0.18	0.19	0.21	**0.19**
Mean	**0.27**	**0.43**	**0.56**	
LSD at 5%	M = 0.04 R=0.03 MxR=0.06			
Control	0.15			

Increasing the addition rate of organic material is associated with progressive and significant increase in organic matter content with a main effect as follows: $R_3 > R_2 > R_1$ and increases of 273.3, 186.7, and 80.0 %, respectively.

Results show also, that there is an interaction between the source of organic material and its addition rate. Significant differences among R_1, R_2 and R_3 occur in the case of CRS and SBC whereas no significant differences occur with CM or SL.

CONCLUSION

In general, addition of agriculture organic wastes (materials) to the sandy soil as a natural organic conditioners leads to a decrease in macro pores and an increase in micro pores. This raises the retaining capacity of soil and consequently, reduces the velocity of water movement within the soil, decreases soil hydraulic conductivity. The effect of organic materials on the studied parameters varies and depends on the type of material and the rate of addition. The increase in soil total porosity, soil moisture and organic matter contents; and the reduction in soil bulk density and hydraulic conductivity are more pronounced in CRS treatment. Thus CRS was the beast organic waste material in these particular respects. Also, addition of these materials increase soil organic matter content, which will reflect on increasing soil contents of nutrient elements; and decreased soil pH but slightly increased soil salinity.

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تأثير إضافة المخلفات الزراعية العضوية على خواص الأراضى الرملية وعلى نمو نبات الذرة والشعير فيها.

١ – الخواص الطبيعية والكيميائية للتربة

عصمت حسن عطية نوفل

قسم الأراضى – كلية الزراعة بمشتهر –جامعة بنها

يهدف البحث إلى دراسة تأثير إضافة بعض مخلفات المزرعة العضوية كمحسنات عضوية ، على تحسين بعض الخواص الطبيعية والكيميائية للأراضى الرملية. حيث إستخدمت عينة من الطبقة السطحية (صفر – ١٥ سم) لأرض رملية من قرية ميت كنانة محافظة القليوبية ، وإستخدم كل من سماد الدواجن وقش الأرز المتفحم (قش الأرز المحروق بمعزل عن الهواء) وكمبوست مخلفات بنجر السكر (أوراق + جذور) ومخلفات تصنيع بنجر السكر)(Sugar mud; sugar lime) كمحسنات عضوية طبيعية تم إضافتها بمعدل نسب وزنية هى ٢ ، ٤ ، ٨ %. والتى تكافئ ١٠ ، ٢٠ ، ٤٠ طن للفدان لعمق ٣٠ سم وقد تم إجراء تجربة تحضين تحت ظروف الصوبة

إستخدم فيها أصص سعة ٥ كجم ثم أضيفت المواد العضوية تحت الدراسة إلى التربة بكل أصيص ثم رويت الأرض إلى السعة الحقلية وتركت فى فترة تحضين لمدة ٣٠ يوم للسماح بالتحلل الميكروبى للمواد المضافة وتفاعلها مع التربة مع المحافظة على ثبات نسبة الرطوبة قرب السعة الحقلية. بعد ذلك تم زراعة ٢٠ حبة ذرة صنف (هجين ثنائى طابا ٢) بكل أصيص لمدة ٤٥ يوم ، ثم أعقبها زراعة ٢٠ حبة شعير صنف (جيزة ١٢٣) فى نفس الأصص لمدة ٤٥ يوم أخرى. بعد قطع براعم الشعير تركت الأرض لتكمل مدة عام وذلك لإعطاء فرصة لتحلل هذه المواد فى التربة وتفاعلها معها مع المحافظة على نسبة الرطوبة عند السعة الحقلية طوال هذه المدة. بعد مرور عام من إضافة المواد العضوية للتربة أخذت عينة من كل أصيص بواسطة إسطوانة التربة لتقدير الخواص الطبيعية المدروسة. بعد ذلك خلطت التربة المتبقية بالأصيص خلطا تاما وأخذت منها عينة ممثلة لتقدير بعض الخواص الطبيعية والكيميائية لها. ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:

١ – أدت إضافة المخلفات العضوية المستخدمة إلى تحسين الخواص الطبيعية للتربة حيث انخفضت الكثافة الظاهرية وازدادت المسامية الكلية وقد إزداد معدل التحسين فى هذه الخواص بزيادة معدل الإضافة.

٢ – انخفضت نسبة مسام الصرف نتيجة إضافة المخلفات تحت الدراسة وكان الإنخفاض ملحوظا أكثر عند إضافة جير السكر (Sugar lime) .

٣ – ازدادت نسبة المسام الماسكة للماء والمسام الشعرية الدقيقة وكانت الزيادة ملحوظة أكثر عند إضافة سماد الدواجن وقد إنعكس ذلك على التوصيل الهيدروليكى للتربة والذى إنخفض من ٢٨,١ إلى ٢٠,٦ سم / ساعة عند المعدل الثالث من الإضافة .

٤ – ازداد محتوى التربة من الرطوبة عند كل من السعة الحقلية ومعامل الذبول وكذلك الماء الميسر وقد كانت الزيادة ملحوظة أكثر عند إضافة قش الأرز المتفحم وهذا يعكس السعة الحفظية العاليةhigh retentive capacity له مقارنة بالمواد الأخرى

٥ – ازدادت ملوحة التربة زيادة طفيفة نتيجة إضافة المواد تحت الدراسة فيما عدا جير السكر والذى أدت إضافته إلى خفض ملوحة التربة.

٦ – ازداد محتوى التربة من المادة العضوية بينما إنخفض رقم حموضة التربة نتيجة إضافة المواد تحت الدراسة .

وعلى ذلك يمكن التوصية بإستخدام هذه المخلفات العضوية كمحسنات للتربة فى الأراضى حديثة الإستصلاح أو الأراضى تحت الإستصلاح.