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Short Term Implications of Organic Additives on Properties of Sandy and Clay Soils and Plants Grown on Them.

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Abstract

Rates of 0 , 10 , 20 and 40 gkg^{-1} of two sources of organic additives i.e. biogas manure and pigeon manure were applied to 3 soils (sand , light clay and heavy clay) in 2 experiments . The first was an incubation one in which the soils were incubated with the organic additive without growing plant and the second was in soils grown with maize (*Zea mays*) . The duration was 60 days. Additives improved soil properties and plant growth. Moisture retained at field capacity (FC and wilting point (WP and available water (AW) increased. Soil organic matter (SOM) and cation exchange capacity (CEC) increased.. Maize growth yield as well as uptake of NPK increased.

Keywords: Biogas manure; pigeon dung; soil physical characteristics; soil chemical characteristics; maize

Introduction

Organic matter in soil consists of a complex mixture of plant and animal remains decomposed to varying extents **(Fageria, 2012 and Kögel-Knabner, 2017)** and plant and animal secretions **(Ondrasek et al., 2019)**. Soil organic matter is a key factor of soil quality in the semiarid regions **(Jordán et al., 2010). E**ffects of applied organic matter are considerable on the characteristics of soil **(Zuber el al., 2015 and Blanco-Canqui, 2017)** and maybe detectable on the short run (< one year) via increasing the aggregate stability, hydraulic conductivity **(Leroy et al., 2008)**, hydraulic conductivity, available water content **(Haghighi et al., 2010)** and water infiltration through soil **(Barzegar et al., 2002)**. Soil organic matter amendments can increase water holding capacity, soil porosity, water infiltration, and percolation and decrease soil crusting and bulk density **(Celik et al., 2004, Herencia et al., 2011 and Li et al., 2018)**. Both bulk (BD) and particle density (PD) are necessary to calculate soil porosity **(Blake and Hartge, 1986)**. Porosity can be derived from BD, knowing or approximating the particle density value **(Rabot et al., 2018)**. Organic matter application is noticeable on increasing soil organic matter content **(Abdelhafez et al., 2018),** soil cation exchange capacity (CEC) and plant nutrients and their uptake by plants **(Elshony et al., 2019)**.This increases plant growth and crop yield such as soy beans **(Bandyopadhyay et al., 2010)**, maize **(Zuber el al., 2015)**, wheat **(Elshony *et al*., 2019),** zucchini **(Tolba *et al*., 2021; Farid et al., 2022) and** faba beans **(Farid *et al*., 2018 and 2021 a and b)**.

The current research represents a trial to follow up the short-term implications of applying two sources of the organic additives i.e. biogas manure and pigeon manure on properties of three soils (a sand , a light clay and a heavy clay). Plant growth and its nutrient in plants grown on the soils are assessed.

Materials and Methods:

1-Soils:

Three soils, a light and a heavy clay (collected from Moshtohor) , a sand (collected from Meet Kenana) were used. Their main properties are presented in Table 1.

Table 1. Main properties of soils used in the experiment.

Property	Sand	Light clay	Heavy Clay
Particle size distribution %			
Coarse sand	91.8	22.28	2.18
Fine sand	1.60	27.72	25.65
Silt	5.16	11.85	23.51
Clay	1.44	38.15	48.66
Texture*	Sand	Light clay	Heavy Clay
Soluble ions (mmol$_c$ L^{-1})			
Ca^{2+}	6.94	21.03	8.65
Mg^{2+}	2.83	12.92	5.89

Na^{+}	2.97	13. 32	11.23
K^{+}	0.15	0.33	0.86
CO_3^{2-}	0.00	0.00	0.00
HCO_3^{-}	3.50	3.07	5.32
SO_4^{2-}	6.42	25.12	12.61
Cl^{-}	2.97	19.41	8.79
pH*	7.46	7.70	8.24
EC* (dSm^{-1})	1.29	4.34	2.56
Field capacity %	9.90	18.66	30.23
Wilting point %	5.51	10.50	14.09
Available water %	4.39	8.16	15.14

*Soil pH in soil: water suspension, 1:2.5 (w:v) ; EC of paste extract.; Texture according to the International Soil Texture Triangle (Moeys 2014)

2-The organic additives:

Two types of the organic additives; biogas manure and pigeon manure were used. The biogas manure was recycled agricultural residues supplied by the of Agricultural Residue Recycling Training Center at Moshtohor, Kalubiya. Main properties of these organic additives are presented in Table 2.

Moisture content, pH, EC, total N, NH_4-N, NO_3-N, organic C , C/N ratio, total P and total K were higher for the pigeon manure than the biogas manure. . Ash content was higher in the biogas manure than the pigeon one.

Table 2. Properties of the investigated additives used in the experiment.

Property	Biogas manure	Pigeon manure
Moisture (gkg^{-1})	80	100
pH (1:10 ratio)	8.30	8.90
EC (1:10) dSm^{-1})	3.22	4.62
Total N (gkg^{-1})	22.2	34.6
NH_4-N (mg kg^{-1})	233	1011
NO_3-N (mg kg^{-1})	356	565
Organic matter (gkg^{-1})	475	839
Organic Carbon %	276	488
Ash (gkg^{-1})	524.1	157.6
C/N ratio	12.4	14.1
Total- P (gkg^{-1})	15.0	20.2
Total- K(gkg^{-1})	1.9	9.4

The experimental work:

The experimental work involved two experiments.

The first experiment "Fallow soil experiment" was conducted in pots in the laboratory at an ambient temperature of 30±5 C^{o} . Each pot (21 cm diameter and 16 cm height) contained 3 kg air dry soil). The design was a randomized complete block, factorial . **Factor 1 Soil (S)** S_1,S_2 and S_3 sand , light clay and heavy clay respectively. **Factor 2 Organic additive (O)** O_1 and O_2 , biogas and pigeon manures respectively. **Factor 3 Dose of manure (D)** ; D_0 , D_1 , D_2 and D_3 , 0, 10 , 20 and 40 gkg^{-1} respectively. Therefore the treatment combinations were 24(3Sx 2Ox4D).Treatments were in 3 replicates making 72 of total treatments. Soil was moistened with tap water to maintain field capacity moisture throughout the incubation period of 60 days. Each treatment was replicated three times. At end of the incubation period soil samples were taken for analysis following standard methods outlined **by Klute (1986)** and **Sparks (1996).**

The second experiment " Planted soil experiment" was conducted in the greenhouse on the same above-mentioned design of the fallow pots but the pots were seeded with maize (*Zea mays* var.Single Hybrid 168) at a rate of five seeds pot^{-1} and left to grow for 40 days.

Results and Discussion

Effect on soil physical characteristics

Bulk density .

Bulk density of the studied was slightly affected by both types of the applied organic additives. However, the pigeon dung was of less obvious effect on bulk density. Increasing rate of the organic additives was associated with decreasing bulk density. Bulk density of the sandy soil remained the highest among the studied soils.

Table 3. Soil bulk density (mean± standard deviation) as influenced by the different rates and types of the organic additives**.**

Soil	Organic additive	Dose (D)				
		D0	**D1**	**D2**	**D3**	**Mean**
Heavy clay	**Biogas manure**	1.27±0.001	1.19±0.02	1.17±0.02	1.13±0.01	1.19
	Pigeon dung	1.27±0.01	1.23±0.03	1.20±0.02	1.18±0.01	1.22
	Mean	1.27	1.21	1.19	1.16	1.21
Light clay	**Biogas manure**	1.41±0.02	1.39±0.02	1.38±0.02	1.33±0.02	1.38
	Pigeon dung	1.41±0.02	1.40±0.02	1.39±0.02	1.36±0.01	1.39
	Mean	1.41	1.40	1.39	1.35	1.38
Sand	**Biogas manure**	1.69±0.01	1.63±0.02	1.59±0.03	1.57±0.02	1.62
	Pigeon manure	1.69±0.01	1.66±0.04	1.61±0.04	1.58±0.01	1.64
	Mean	1.69	1.65	1.60	1.58	1.63

SD

Soil (S)	Manure (M)	Dose (D)	S×M	S×D	M×D	S×M×D
0.01	0.01	0.01	0.02	0.02	0.01	0.01

D_0, D_1, D_2 and D_3 are rates of the applied additives i.e.0.0 ,10.0,20.0 and 40.0 g kg^{-1} .

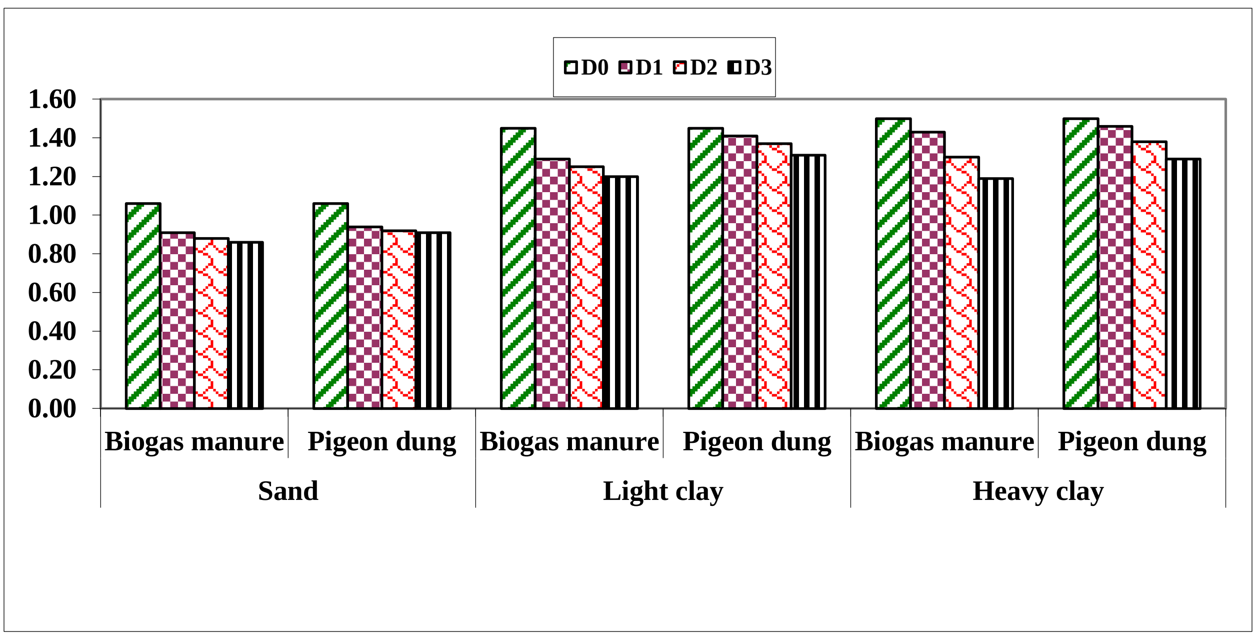

Figure 1. Bulk density (Mg m^{-3}) as influenced by the different rates and types of the organic additives

Soil moisture constants .

Table 4 reveals that application of both types of the manures was of a positive effect on all values of the moisture constants i.e. the maximum saturation percentage (SP),field capacity (FC),witting point percentage (WP) and consequently values of the available water percentage (AW).Application of the biogas manure resulted in higher values of the studied soil moisture . This occurred regardless of the rate of the applied manure or type of soil.

Table 4. Soil moisture constants (mean± standard deviation) as affected by the different rates and types of the organic additives

Soil	organic additive	Rate of additive	Saturation %	Field capacity %	Wilting point %	Available water %
Sand soil	Biogas manure	D0	23.52±0.03	9.92±0.09	4.42±0.03	5.50±0.12
		D1	23.71±0.06	10.16±0.06	4.32±0.03	5.64±0.07
		D2	24.16±0.05	10.62±0.12	4.84±0.06	5.72±0.08
		D3	24.68±0.05	11.80±0.03[aA]	5.23±0.04	6.23±0.09
		Mean	23.98	10.43	4.78	5.65
	Pigeon manure	D0	23.52±0.03	9.92±0.09	4.42±0.03	5.50±0.12
		D1	23.63±0.08	10.29±0.03	4.65±0.04	5.83±0.03
		D2	24.27±0.06	10.64±0.07	4.92±0.05	5.78±0.18
		D3	24.52±0.11	11.31±0.04	5.08±0.05	6.57±0.07
		Mean	24	10.5	4.75	5.75
Light clay	Biogas manure	D0	37.48±0.73	19.65±0.06	7.10±0.05	12.55±0.11
		D1	37.76±0.49	19.87±0.17	7.20±0.05	12.67±0.17
		D2	38.21±0.02	20.34±0.12	7.82±0.08	12.53±0.20
		D3	38.63±0.10	21.16±0.08	8.24±0.09	12.91±0.06
		Mean	38.23	20.23	7.55	12.68
	Pigeon manure	D0	37.48±0.73	19.65±0.06	7.10±0.05	12.55±0.11
		D1	37.38±0.17	19.77±0.04	7.23±0.02	12.54±0.06
		D2	37.94±0.06	20.15±0.17	7.51±0.06	12.49±0.87
		D3	38.42±0.55	20.65±0.06	7.90±0.02	12.75±0.07
		Mean	37.7	20	7.43	12.58
Heavy clay	Biogas manure	D0	59.04±0.22	32.10±0.02	15.21±0.02	16.89±0.01
		D1	59.33±0.43	32.62±0.08	15.31±0.02	17.31±0.10
		D2	59.76±0.14	33.15±0.09	15.93±0.05	17.23±0.05
		D3	61.11±0.01	33.93±0.06	16.28±0.13	17.65±0.08
		Mean	59.05	32.93	15.65	17.28
	Pigeon manure	D0	59.04±0.22	32.10±0.02	15.21±0.02	16.89±0.01
		D1	58.57±0.49	32.46±0.25	15.23±0.10	17.23±0.22
		D2	58.81±0.71	32.91±0.12	15.70±0.03	17.21±0.10
		D3	59.82±0.12	33.48±0.07	16.02±0.07	17.45±0.11
		Mean	58.38	32.68	15.55	17.13
	LSD 0.05	Soil	0.23	0.07	0.04	0.54
		Manure	0.20	0.06	0.03	0.46
		Rate	0.16	0.05	0.03	0.38
		Soil*manure	0.39	0.12	0.07	0.93
		Soil*rate	0.32	0.09	0.05	0.76
		Manure*rate	0.28	0.08	0.05	0.66
		Soil*manure*rate	0.56	0.16	0.09	1.31

For D_0, D_1, D_2 and D_3 rates ,see footnotes of Table 3.

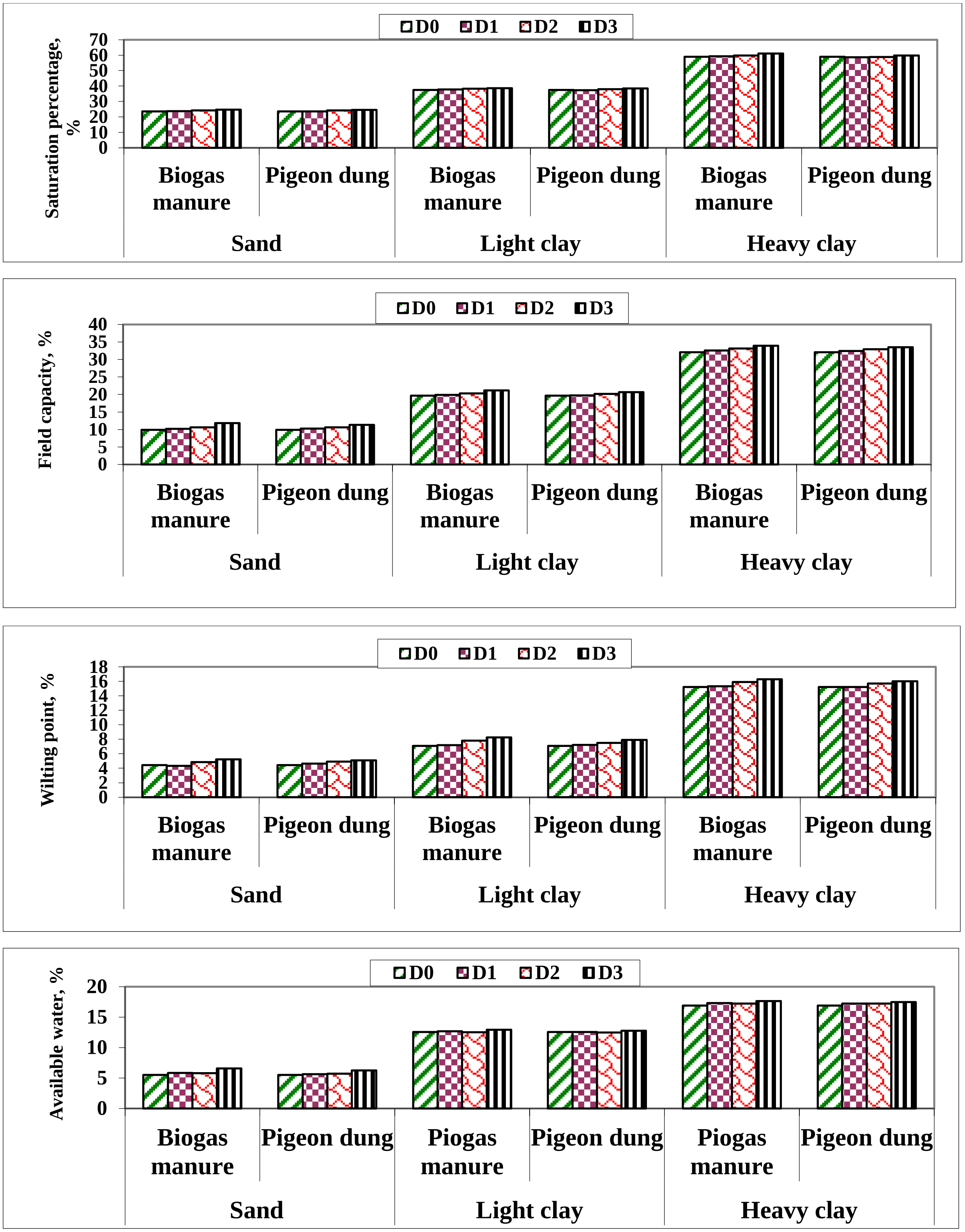

Figure 2. Soil moisture constants as affected by the different rates and types of the organic additives .

The heavier the texture of the soil ,the higher the values of the soil moisture constants and also the corresponding values of available water content (AW) .The increases occurred in the different soil moisture constants due to application of the studied manures were rather little ,probably due to the relatively high temperature at which the experiment was conducted .Such high temperatures would facilitated decomposition of added organic matter and consequently decrease their expected effects on the retention of soil moisture.

Soil organic matter (SOM) .

Data presented in Table 5 reveal that values of the SOM contents increased due to application of the applied manures in all the investigated soils. The SOM values were higher with increasing rate of the applied manure. This was true regardless of type of the applied manure; however , SOM of the biogas manure were higher than those of the pigeon manure . The animal residues are more easily degradable versus the residues of the plants **(Amanullah et al., 2016, Hussein et al., 2022)**. Generally, the values of the SOM contents were higher in heavy textured soils .The organic residues are trapped within the clay fraction forming soil macro- and micro - aggregates **(Elcossy et al., 2020; Mohamed et al., 2021).**

Cation exchange capacity (CEC) .

Application of manures increased soil CEC in all the studied soils, especially with increasing the rate of applications. Such increases were more detectable with increasing the clay fraction in soil following the sequence of clayey soils than the sandy soil. This is because the sequestered C by soil **(Swift, 2001)** is rich in the functional groups **(Farid et al., 2018)** which could considerably increase soil CEC **(Zgorelec et al., 2019)**. The highest increases in soil CEC were recorded for biogas manure (versus pigeon manure) in all soils. This is the same trend of residual organic carbon in soil

Table 5. Soil organic matter (SOM) content (mean± standard deviation) as influenced by the different rates of the organic additives

Soil	The organic additive	Dose (D)				
		D0	D1	D2	D3	Mean
Sand	Biogas manure	1.34±0.04	1.49±0.04	1.54±0.05	1.59±0.09	1.49
	Pigpen dung	1.34±0.04[a]	1.40±0.10	1.51±0.04	1.54±0.01	1.45
	Mean	1.34	1.45	1.34	1.57	1.42
Light clay	Biogas manure	1.42±0.02	1.72±0.03	1.81±0.11	1.96±0.06	1.73
	Pigeon dung	1.42±0.02	1.66±0.10	1.75±0.05	1.86±0.06	1.67
	Mean	1.42	1.69	1.34	1.91	1.59
Heavy clay	Biogas manure	1.51±0.09	1.63±0.31	1.84±0.02	2.10±0.01	1.77
	pigeon dung	1.51±0.09	1.69±0.03	1.77±0.22	1.91±0.40	1.72
	Mean	1.51	1.66	1.34	2.01	1.63

LSD

Soil (S)	Manure (M)	Dose (D)	S×M	S×D	M×D	S×M×D
0.08	**0.07**	**0.06**	**0.15**	**0.12**	**0.10**	**0.21**

See footnotes of Table (3)

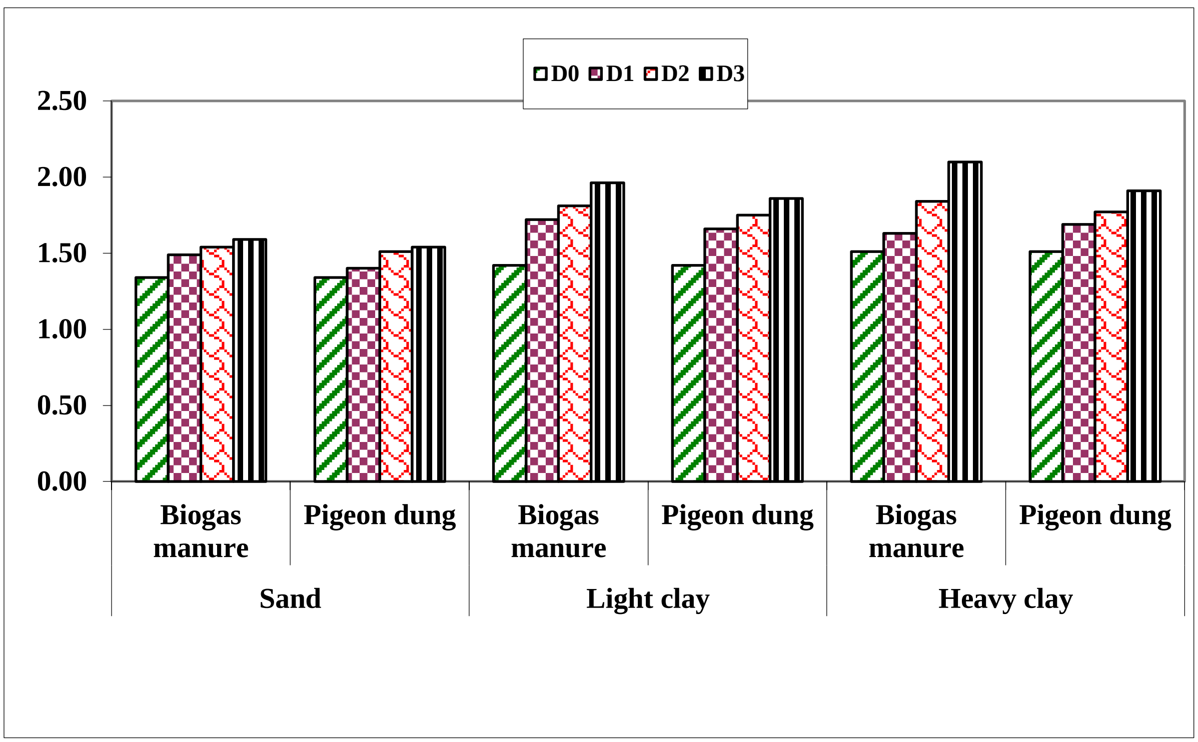

Figure 3. Soil organic matter (SOM) content % as influenced by the different rates and types of the organic additives.

Table 6. Cation exchange capacity (CEC) (mean± standard deviation)as influenced by the different rates and types of the organic additives.

Soil	The organic additive	D0	D1	D2	D3	Mean
Sand	Biogas manure	10.26±0.09	11.30±0.20	11.48±0.26	11.66±0.54	11.18
	pigeon dung	10.26±0.09	10.96±0.76	10.65±0.01	10.87±0.09	10.69
	Mean	10.26	11.13	11.07	11.27	10.93
Light clay	Biogas manure	30.48±0.02	31.18±0.02	38.92±0.12	31.88±0.08	33.12
	Pigeon dung	30.48±0.02	26.26±0.06	39.62±0.12	29.06±0.04	31.36
	Mean	30.48	28.72	39.27	30.47	32.24
Heavy clay	Biogas manure	34.70±0.20[aC]	36.82±0.01[bB]	31.54±0.04[aC]	38.22±0.02	35.32
	Pigeon dung	34.70±0.20[aC]	37.52±0.02[aB]	27.66±0.16[bD]	41.74±0.04	35.41
	Mean	34.70	37.17	29.60	39.98	35.36

LSD

Soil (S)	Manure (M)	Rate (R)	S×M	S×R	M×R	S×M×R
0.15	**0.13**	**0.10**	**0.25**	**0.21**	**0.18**	**0.36**

D_0, D_1, D_2 and D_3 :see footnotes of Table (3)

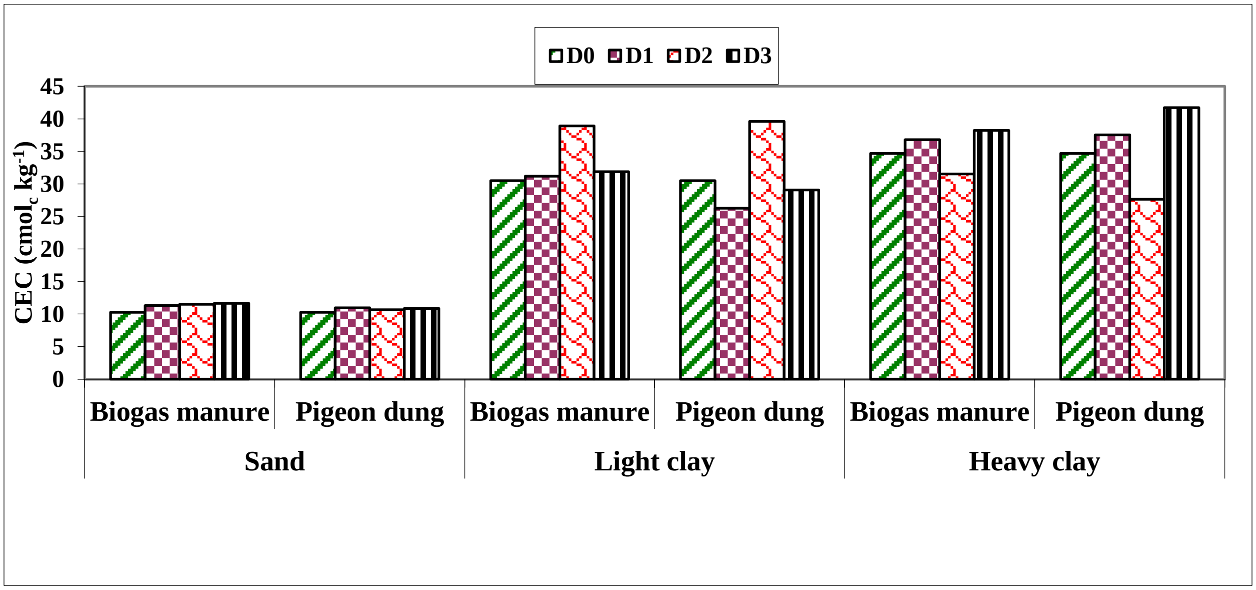

Figure 4. Cation exchange capacity (C E C) as influenced by the different rates and types of the organic additives

II-Effect of rate and type of the organic additives on maize plants

Dry matter yield of the maize plants

Amending all soils with the investigated organic additives or amendments significantly boosted the plant biomass. These organics supply plants with nutrients and manage soil health **(Quilty and Cattle, 2011)**. Organic acids released upon decomposition of the applied organic manures can decrease soil pH and hence increase availability of the macro and micro nutrients. The carbonic acid formed due to reaction between CO_2 (released by organic matter decomposers) with the soil moisture may account for further acidic reaction of soils **(El Shwarby et al.,2022).** The decreased organic matter content of soil is an indicator of soil degradation **(Diacono and Montemurro, 2011)**. The increase in plant growth was noticeable with application of biogas manure than the pigeon manure, particularly with the high application doses. The effects of these organic applications were more substantial in the clay soils, This is because the organic matter bounds mainly with the clay fraction in soil **(Lagaly et al., 2013)**; besides the clayey soil is more fertile than the sandy one **(Huang and Hartemink, 2020)**

Table 7. Dry matter yield (mean± standard deviation) of the maize plants (in gram) as influenced by the different types and rates of the applied organic additive

Soil	Type of the organic additive	D0	D1	D2	D3	Mean
Sand soil	Biogas manure	4.30±0.20	5.33±0.33	5.50±0.10	5.70±0.40	5.21
	Pigeon dung	4.30±0.20	4.26±0.04	5.30±0.30	5.63±0.33	4.87
	Mean	4.30	4.80	5.40	5.70	5.04
Light clay	Biogas manure	4.26±0.24	5.86±0.36	6.40±0.20	6.46±0.15	5.75
	Pigeon dung	4.26±0.24	4.36±0.14	4.66±0.36	5.40±0.23	4.67
	Mean	4.26	5.11	5.53	5.93	5.21
Heavy clay	Biogas manure	4.43±0.23	4.33±0.13	5.61±0.57	5.86±0.56	5.06
	Pigeon dung	4.43±0.23	4.80±0.30	4.83±0.33	4.90±0.80	4.74
	Mean	4.43	4.57	5.22	5.38	4.90

LSD 0.05

Soil (S)	Manure (M)	Dose (D)	S×M	S×D	M×D	S×M×D
0.22	0.19	0.16	0.39	0.32	0.27	0.55

D_0, D_1, D_2 and D_3 :see footnotes of Table 3.

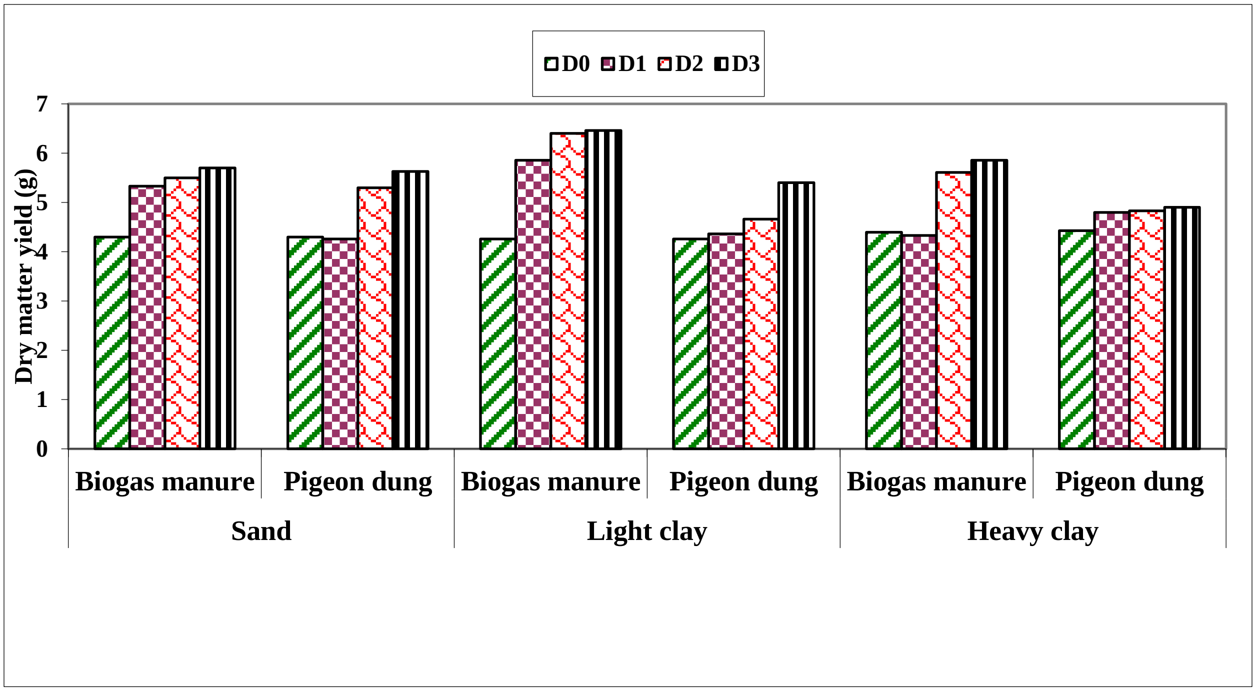

Figure 5. Dry matter yield of the maize plants (g pot^{-1}) as affected by organic additives

NPK uptake by maize plants

The uptake of NPK by the maize plants increased owing to application of organic amendments and such increases were more noticeable with increasing their rate of application. Results reported by **Farid et al., 2018 and Elshony et al., 2019** indicate that organic matter application increased NPK in soils and plants **(Shen et al., 2011)** . .The highest increases in NPK were attained by the plants grown on the clay soils. The least uptake values were recorded by the maize plants grown on the sandy soil. The clay fraction increases soil fertility via reducing nutrient losses from the surface soil layer **(Zingore et al., 2007)**, increasing soil CEC **(Riaz and Marschner, 2020)** and improving the efficiency of water use by plants **(Ismail and Ozawa, 2007)**

Available NPK in soil.

Available NPK in soil increased owing to organic applications, especially with the increases in the dose of application. These increases are mostly the consequence of organic nutrients mineralization in soil **(Abdelhafez et al., 2018)**. Organic amendments release acids and organic chelates that increase the solubility and availability of P **(Chun et al., 2011; Shen et al., 2011)**. Organic matter increase the efficiency of nutrient utilization by plants **(Abedi et al., 2010)**. Pigeon manure recorded higher increases than the biogas manure. This is an indication of the higher nutrient contents in the pigeon manure (**Zhong et al., 2011)**.

Table 8. Values of the NPK uptake by the maize plants as influenced by the different rates of the organic additives.

Soil		N-uptake					P-uptake					K-uptake				
		D 0	D_1	D_2	D_3	Mean	D_0	D_1	D_2	D_3	Mean	D_0	D_1	D_2	D_3	Mean
Sand	Biogas manure	146.50 ±3.50	194.50 ±13.30	196.30 ±40.10	381.90 ±19.60	229.68	6.39± 0.19	9.59± 0.51	18.70 ±0.30	20.78 ±0.73	13.86	19.50± 0.30	29.80± 0.50	31.90 ±0.70	46.20 ±0.30	31.85
	Pigeon dung	146.50 ±3.50	197.60 ±2.50	253.80 ±2.70	281.50 ±31.40	219.98	6.39± 0.19	11.92 ±0.70	16.48 ±0.15	24.77 ±0.52	14.89	19.50± 0.30	20.16± 0.22	25.90 ±0.40	31.50 ±0.30	24.27
	Mean	146.5	196.10	225.05	331.70	224.83	6.39	10.76	17.59	22.77	14.38	19.50	24.98	28.90	38.85	28.06
Light clay	Biogas manure	178.80 ±13.70	236.50 ±1.40	289.20 ±7.70	290.80 ±0.40	248.63	7.43± 0.07	11.72 ±0.52	15.36 ±0.23	33.83 ±0.88	17.08	22.70± 0.20	42.10± 0.40	60.00 ±0.36	59.40 ±0.30	46.05
	Pigeon dung	178.80 ±13.70	258.10 ±4.90	303.30 ±1.20	330.10 ±2.10	267.38	7.43± 0.07	24.80 ±0.29	30.75 ±0.09	54.36 ±0.16	29.34	22.70± 0.20	38.30± 0.30	44.30 ±0.30	51.30 ±5.23	39.15
	Mean	178	247.3	296.25	310.45	258.00	7.43	18.26	23.06	44.10	23.21	22.70	40.20	52.15	55.35	42.60
Heavy clay	Biogas manure	174.00 ±1.90	216.90 ±1.80	262.40 ±11.40 aB	306.40 ±5.70a A	239.93	7.08± 0.03	13.29 ±0.07	14.32 ±0.22	15.23 ±0.01	12.48	17.20± 0.30	24.50± 0.40	26.30 ±0.60	29.80 ±0.70	24.45
	Pigeon dung	174.00 ±1.90	205.40 ±5.80	213.90 ±19.30	274.70 ±3.70	217.00	7.08± 0.03	10.66 ±0.16	16.00 ±0.10	17.41 ±0.09	12.79	17.20± 0.30	21.10± 1.00	22.20 ±0.30	23.50 ±0.40	21.00
	Mean	174.00	211.15	238.15	290.55	228.46	7.08	11.98	15.16	16.32	12.63	17.20	22.80	24.25	26.65	22.73
		LSDD S	LSDM	LSDS	LSDD		LSDD S	LSD M	LSDS	LSD D		LSDD S	LSDM	LSDS	LSDD	
		15.64	6.39	7.82	9.03		0.41	0.17	0.21	0.24		1.34	0.55	0.67	0.77	
		LSDD SM	LSDS M	LSDD M			LSDD SM	LSDS M	LSDD M			LSDD SM	LSDS M	LSD DM		
		22.12	11.06	12.77			0.59	0.29	0.34			1.89	0.95	1.09		

For designations of D_0, D_1, D_2 and D_3 :see footnotes of Table 3.

Table 9. Available contents of NPK as influenced by the different rates and type of the organic additives.

Soil	Manure organic	Available N (mg kg-1)					Available-P (mg kg-1)					Available-K (mg kg-1)				
		D0	D1	D2	D3	Mean	D0	D1	D2	D3	Mean	D0	D1	D2	D3	Mean
Sand soil	Biogas manure	138.00 ± 0.90^{aD}	205.80± 0.30^{aC}	214.20 ± 0.90^{bB}	224.70 ± 0.50^{bA}	195.6	4.87± 0.37^{aD}	5.79± 0.28^{bC}	29.40± 0.70^{aB}	31.99± 0.48^{bA}	18.01	177.50± 0.10^{aD}	187.20± 2.10^{aC}	198.73 ± 3.50^{aB}	233.10 ± 0.90^{bA}	199.2
	Pigeon dung	138.00 ± 0.90^{aD}	201.20± 1.00^{bC}	220.00 ± 0.50^{aB}	269.70 ± 2.50^{aA}	207.2	4.87± 0.37^{aD}	24.11± 0.39^{aC}	24.57± 0.37^{bB}	36.85± 0.15^{aA}	22.60	177.50± 0.10^{aD}	114.50± 2.40^{bC}	188.10 ± 0.40^{bB}	289.80 ± 0.30^{aA}	192.4
	Mean	138.0	203.5	217.1	247.2	201.4	487.0	14.95	26.98	34.42	20.30	177.5 150. 8	193.5	261.4		195.8
Light clay	Biogas manure	224.00 ± 1.10^{aD}	228.40± 2.30^{bC}	244.40 ± 3.67^{bB}	756.00 ± 3.90^{aA}	363.7	12.47 ± 0.35^{aD}	15.99± 0.49^{bC}	17.37± 0.17^{bB}	22.25± 0.03^{bA}	17.02	246.20± 0.30^{aD}	283.53± 0.15^{aB}	295.00 ± 0.60^{aA}	268.70 ± 1.60^{aC}	273.4
	Pigeon dung	224.00 ± 1.10^{aD}	291.20± 0.90^{aC}	302.40 ± 0.10^{aB}	392.00 ± 0.10^{bA}	302.4	12.47 ± 0.35^{aD}	19.24± 0.01^{aC}	20.17± 0.05^{aB}	36.62± 0.96^{aA}	22.13	246.20± 0.30^{aD}	283.70± 1.40^{bB}	295.00 ± 1.90^{aA}	268.53 ± 6.95^{aC}	297.2
	Mean	224.0	254.8	274.4	574.0	331.8	12.47	17.61	18.77	229.40	24.07	246.2	362.6	252.2	280.3	285.8
Heavy clay	Biogas manure	746.00 ± 3.90^{aD}	756.00± 4.00^{aC}	823.20 ± 2.10^{aB}	896.00 ± 0.90^{aA}	805.3	16.69 ± 0.09^{aD}	27.11± 0.09^{aC}	28.28± 0.06^{bB}	35.23± 0.01^{bA}	26.82	689.50± 7.90^{aD}	751.50± 0.60^{aC}	809.30 ± 4.20^{aB}	833.10 ± 1.00^{aA}	770.8
	Pigeon dung	746.00 ± 3.90^{aD}	588.00± 0.20^{bC}	761.00 ± 1.20^{bB}	832.60 ± 1.40^{bA}	731.9	16.69 ± 0.09^{aD}	20.17± 0.05^{bC}	31.29± 0.91^{aB}	36.85± 0.35^{aA}	26.20	689.40± 7.75^{aD}	702.00± 1.00^{bC}	752.00 ± 0.10^{bB}	832.10 ± 1.00^{aA}	744.0
	Mean	746.0	672.0	792.1	864.3	768.6	16.69	23.84	29.78	36.04	25.83	689.5	726.7	781.6	832.9	707.6
LSD																
		Soil (S)	Manure (M)	Rate (R)	S×M		Soil (S)	Manure (M)	Rate (R)	S*M		Soil (S)	Manure (M)	Rate (R)	S*M	
		1.39	1.20	0.98	2.40		0.27	0.23	0.19	0.46		2.05	1.78	1.45	3.55	
		S×R	M×R	S×M×R			S×R	M×R	S×M×R			S×R	M×R	S×M×R		
		1.96	1.70	3.40			0.38	0.33	0.65			2.9	2.51	5.02		

D_0, D_1, D_2 and D_3 :see footnotes of Table 3.

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المدي القصير لتاثيرمعدلات مختلفة من مضافات عضوية علي الخصائص الفيزيائية و الكيماوية لبعض انواع الاراضي والنبات النامي عليها

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إضافة المادة العضوية إلي الأرض يحسن من خواصها الفيزيائية و الكيماوية التي تؤثر بدورها علي مقدرة التربة علي الاحتفاظ بالماء عند ثوابت الرطوبة الارضية المختلفة و كذلك علي سعة التربة التبادلية الكاتيونة و من ثم خصوبة الأرض و محتواها من المغذيات الصغري و الكبري وبالتالي علي مادة النبات الجافة كمحصلة نهائية للتغير الذي يحدث في خواص التربة وقد تم في هذا البحث إجراء تجربتين استهدافا لدراسة الأثر القصير المدي (120 يوما) لاضافة نوعين من المخلفات العضوية (سماد البيوجاز وذبل الحمام) علي خواص ثلاثة انواع من الاراضي(طينية من قرية مشتهربالاضافة الي ارضين أخريتين من قرية ميت كنانة احداهما رملية القوام و الأخري طينية رملية) وفي التجربة الاولي تم تحضين عينات تربة غير مثارة في اصص يحتوي كل منها علي ثلاثة كيلوجرام تربة (علي أساس الوزن الجاف) مع معدلات من المضافات العضوية مقدارها 0.0 و10.0 و20.0 و 40.0 جرام لكل كيلوجرام تربة ثم اضيف ماء صنبور لتوصيل كل تربة الي سعتها الحقلية التي ثبت عليها المحتوي الطوبي خلال فترة التحضين التي استمرت لستين يوما من خلال اضافة الماء كل ثاني يوم وقد كررت كل معاملة ثلاث مرات,

وفي التجربة الثانية(تجربة صوبة زراعية) كررت نفس المعاملات التي استعملت في تجربة التحضين بالاضافة الي زراعة كل إصيص بخمسة حبات من الذره هجين فردي 168 و اضيفت الإحتياجات السمادية لكل اصيص تبعا لتوصيات وزارة الزراعة المصرية و استمرت التجربة لستين يوما بعدها تم حصاد النبات وتقدير الوزن الجاف للمعاملت المختلفة. تتلخص اهم النتائج في ان الإضافات العضوية أدت الي نقص الكثافة الظاهرية للتربة و في نفس الوقت أدت الي زيادة كمية الرطوبة التي تحتفظ بها الاراضي موضع الدراسة عند الثوابت الرطوبية المختلفة مما كان له تاثير مباشر علي كمية الرطوبة الميسرة في انواع الاراضي الثلاثة و علي الجانب الاخر فقد ادت المضافات العضوية الي ذيادة متوي الاراضي من المادة العضوية و من ثم سعتها التبادلية الكاتيونية و تبعا للتحسين الذي طرأ علي خواص الاراضي نتيجة هذه المضافات العضوية زاد مستوي خصوبتها من عناصر النتروجين و الفوسفور و البوتاسيم و بالتبعية ذاد محصول المادة الجافة للنبات كما زاد الممتص من هذه العناصر بواسطة النبات

وتوصي النتائج المتحصل عليها هنا باستخدام الإضافات العضوية لتحسين خواص الاراضي المختلفة الا أنة يجب الاخذ في الاعتبار سهولة تحلل هذة المضافات العضوية في ظل ارتفاع درجات الحرارة في المناطق الجافة و الشبه جافة ومن ثم ضرورة اضافة هذه المحسنات دوريا.