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Effect of Vermincompost and Farmyard Manure and Their Combinations on Some Physical and Chemical Characteristics of Calcareous Soil in Maryout Area

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Abstract

A field experiment was conducted in Maryout station-West El Delta, in calcareous soil (Ca CO_3 34%), studied the effect of vermin compost (VC) , farmyard manure (FYM) and their combinations on some physical and chemical properties of the soil. The experiment was arranged in a randomized complete block design with three replicates. Different rates of farmyard manure (0, 5, 7.5 and 10) Mg/fed, vermin compost (0, 5, 7.5 and 10) Mg / fed and combination of 10 Mg/fed vermin compost with each of 5, 7.5 and 10 Mg / fed farmyard manure were incorporated into 15 cm of surface soil, fodder beet (Beta vulgaris) was planted in November (2017-2018) as indicator crop. The results revealed that highest values of productivity of fresh weight of root and shoot under treatment was combine of 10 Mg/fed vermin compost with 10 Mg /fed FYM. . Plots amended with vermin compost or/ and farmyard manure were improved compared with control. The results showed that addition of vermin compost at rate of 10 Mg / fed significantly affect at ($P < 0.05$) on the physical characteristic such as, total porosity, bulk density and pore size distribution in soil, farmyard manure, vermicompost and their combination had decrease significantly bulk density and values of quickly drainable pores in comparison to control soil. However, there were increased significantly effect on available water, porosity and water holding capacity compared with control. The greatest significant effect of the treatments were combine of VC with each of 5, 7.5 and 10 Mg /fed FYM on soil physical properties. Also increased significantly, N, P, K, Mn, Fe, Zn and Cu compared with untreated plots. The soils treated by farmyard manure, vermin compost and their combination had decrease significantly EC and soil pH values in comparison to control. Also, the effects of VC, FYM and their combination on shoot fresh weight were recorded. Shoot fresh weight was significantly greater under combine of VC with FYM.

Key word: Vermi compost, farmyard manure, soil physical and chemical properties, calcareous soils and fodder beet.

Introduction

Calcareous soils are the soils which contain calcium carbonate. The physical problems in soil and water for crop productivity are primarily due to the high content of $CaCO_3$, especially the active $CaCO_3$ with high surface area. The presence of active $CaCO_3$ in calcareous soils affects their physical properties such as soil – availability of water to plants and soil surface crust. High salinity, high pH, lack of adequate texture and structure, very poor in organic matter or biological activities, distractive effect of some macro and micronutrients availability. Also, The effect of carbonates were indirectly or directly, affect chemistry of the soil and availability of N, P, K, Fe, Zn, and Cu (**Obreza et al., 1993**). Cultivation of calcareous soils presents many challenges, such as poor structure , poor organic matter and clay content, low water holding capacity, high infiltration rate, surface crusting and cracking, low CEC, loss of nutrients via leaching or deep percolation, loss of nitrogen fertilizers and high pH, low availability of nutrients particularly phosphorous and micronutrients, and a nutritional imbalance between elements for example, magnesium, calcium and potassium (**El-Hady and Abo-Sedera, 2006 and FAO, 2016).**

Compost plays an important role in improving characteristic of soil physical and contains higher available nutrients levels relatively, which are essentially required to growth of plant. **Paramasivam et al., (2005)** found that the applied of organic amendment up to 98.8 Mg ha-1 due to increase of concentrations Zn, Fe and Mn with increasing irrespective of plant parts.. **Ali, (2001)** showed that DTPA extractable Fe, Mn and Zn were significantly increased due the application of such compost after either wheat or corn harvesting.

Abd El-Moez et al., (2002) found that, application of composted materials to the saline calcareous soil decreased both EC and pH values. **Abd El-Moez and Saleh, (1999)** found that, the organic materials have a different effect in modifications of the properties of soil as well as their influence on their nutrition status and soil fertility. **Gilley and Risse, (2000)** mentioned that long term annual compost and manure application increase soil organic matter and improved structure. OM of soil encourages granulation, highly of cation exchange capacity (CEC) and is responsible for adsorbing power of the soils up to 90 %, **Brady and Weil, (2005**) found that the addition of organic matter improves the physical, chemical and biological characteristic of soils and natural organic material are broken down slowly by soil microorganisms resulting more release of plant available nutrients**. El-Maaz et al., (2014),** concluded that compost application decreased soil pH and EC but increased soil OM, CEC and the contents of N, P, K, Zn, Mn, Fe and Cu. **Bokhtiar and Sakurai, (2005**) concluded that treatment of OM in combination by chemical fertilizer, and reported increasing of absorption of Nitrogen, Phosphor and Potassium in sugarcane tissue of leaves, compared to chemical fertilizer alone.

Dutta et al., (2003) demonstrated that the use of chemical and organic fertilizers had a higher increasing effect on microbial biomass due to soil health. Compared to the addition of organic fertilizers alone. Food waste, horticultural waste, organic waste, poultry droppings and food industry sludge were digestion by earthworms produced of Vermicompost (V.C). (**Yadav and Garg, 2011**). This material received increasing attention in recent years because it's improving of interesting physical, chemical and biological properties (**Huang *et al*., 2014).** V.C is a sustainably source of the mineral nutrient elements, micro- and macro -nutrients in V.C are easily absorbed by plants **(Atiyeh *et al*., 2000**). Moreover, V.C has a fine fractions structure with a highly specific surface area. It allows to absorb and keep nutrients **(Lalander *et al*., 2015**). Plant hormones of large number are found in V.C (e.g. kinetin, GA3, IAA) and Vermicompost may be the result of connecting activity of earthworms and microorganisms ***(*Ravindran *et al*. 2016).** Overall, vermicompost (VC) has the basic characteristics related to a material that could be employed to improve soil quality. The application of VC has been found to be an effective method for rejuvenation of soil fertility enrichment of available nutrient pools, and conservation of water (**Makode, 2015).**

The present investigation aims to study the effects of different soil amendments as a tool for improving some physical and chemical properties of calcareous soil (sandy clay loam) and its productivity in Maryout area- West El Delta- Egypt.

Materials and Methods

Field experiment was carried out at Maryout station in West El Delta- Egypt, calcareous sandy clay loam, to study the effect of the amendments on improvement some physical and chemical properties of soil.

Four rates of farmyard manure (0, 5, 7.5 and 10) Mg /fed, vermicompost (0, 5, 7.5 and 10) Mg / fed and combination of 10 Mg/fed vermicompost + each of 5, 7.5 and 10 Mg / fed farmyard manure were used to incorporation the upper 15 cm of the surface soil before planting. The used Vermicompost was made of rice straw and wastes of animal with earthworm species e.g (Dendrobaena veneta and Eisenia fetida).

The treatments were arranged in a randomized complete block design with three replicates. The fodder beet (Beta vulgaris) was planted in November (2017-2018) as an indicator crop.

All treatment plots had the recommended rates of N, P and K. After maturity, plant were harvest. The Shoot fresh weight and the root fresh weight of each plot were recorded. Composite soil samples were taken before treatments and planting for the determination of some chemical and physical properties in (**Table, 1).** Also analysis of V.C and Farmyard manure (FYM) were shown in **Table (2).**

Table 1. Physical and chemical properties of the experimental soil

Soil property	values
Particle size distribution %	
Coarse sand %	5.11
Fine sand %	52.08
Silt %	17.19
Clay %	25.62
Texture class	Sandy Clay Loamy
Field capacity%	16.28
Wilting point%	7.51
Available water%	8.77
Chemical properties	
$CaCO_3$ gkg^{-1}	334.7
Organic matter gkg^{-1}	8
EC dS/m	6.13
pH	7.83
Available nutrients ($mgkg^{-1}$)	
N	78.89
P	3.91
K	191

Table 2. Chemical properties of vermicompost and farmyard manure

Treatments	pH	EC dS/m	Organic matter gkg^{-1}	Organic carbon gkg^{-1}	C/N ratio	N gkg^{-1}	P gkg^{-1}	K gkg^{-1}
Vermicompost	6.87	2.03	518	291.3	24:1	12.1	7.2	7.9
Farmyard Manure	8.7	4.20	280	142	18:9	7.5	5.4	6.2

At the end of the experiment composite samples of soil were collected from the surface layer (0- 30 cm) of each treatment plot for the determination of chemical and physical properties according to the methods given by **Page et al., (1982).**

Soil organic matter, cation exchange capacity and pH were determined according to described by **Page et al., (1982).** The (EC) values were determined in soil paste extract as dSm^{-1} **(Jackson, 1973).** Also available nutrients (N, P , K, Mn, Zn, Fe and Cu) in soil were determined according to described **by Cottenie et al., (1982).**

All data obtained from this study were statistically analyzed according to **Gomez and Gomez, (1984).**

Results and Discussion

Soil bulk density and total porosity:

Data in **Table 3** reveal that the effect all treatments bulk density (B.D.) of the studied soil was decreased significantly at (p<0.05), except for farmyard manure FYM treatment at 5 Mg/fed, compared to the control was decreased insignificantly. The (VC) treatment recorded higher reduction in BD than FYM treatment. Meanwhile, combination of 10 Mg/fed VC + 10 Mg/fed FYM resulted in the highest reduction in B.D. (20.39%) in below the control treatment.

Also, data showed that combined treatments of VC and various ratio of FYM influenced differently the soil BD when compared with VC or FYM treatments individually. As shown in Table 3, the decrease in B.D. could be arranged in the following order: 10 Mg/fed VC+ 10Mg/fed FYM > 10 Mg/fed VC+ 7.5 Mg/fed FYM > 10 Mg/fed VC+ 5 Mg/fed FYM > 10 Mg/fed VC > 7.5 Mg/fed VC > 10 Mg / fed FYM > 5 Mg/fed VC = 7.5 Mg /fed FYM > 5 Mg /fed FYM > control. As the values of bulk density decreased by 20.39, 18.42, 15.13, 12.50, 9.21, 6.58, 7.24, 6.58 and 2 %, respectively below the control. In addition the increasing percentage of porosity over the control were, 27.44, 24.78, 20.36, 16.82, 12.39, 8.85, 9.74, 8.85, and 3.5% respectively.

The total porosity was improved by the use of vermicompost (VC), farmyard manure (FYM) and their combination (Table 3). The greater porosity in the soil treated with the combined treatment of vermicompost + farmyard manure > vermicompost > farmyard manure. The increasing rates of porosity were 24.19, 12.69 and 7.97 % respectively compared to control. This increasing could be attribute to the certainty of OM possesses low B.D. and could therefore reduce soil B.D. which leads to the increase of the soil aggregate stability **(Mbah and Onweremadu, 2009**).

These results are in agreement with **Kalantari et al. (2010)** who found that soil B.D. decreased and increased total porosity under the effect of FYM and VC applications. The obtained results indicate that the application of VC with FYM improved the values of B.D. and porosity. However, FYM application individually effect on B.D. and porosity, especially at high rates. Higher mixing rates of VC with FYM, improved soil B.D. and total porosity. In general, the decreasing of B.D. means the improving of the structural status, plant available water, water retention and nutrient uptake, which may reflect in improving soil productivity.

Soil moisture characteristics:

Data showed in **Table 3** indicate that the addition of vermicomost (VC) , farmyard manure (FYM) and their combination, significant increasing effect on available water (AW), field capacity (FC) and wilting point (WP) as compared to soil without any conditioners (control). Also, results reveal that AW, FC and WP values increased significantly by increasing the rate of treatments under this study. Moreover, combination of VC + FYM treatments were superior in increasing values of AW, FC and WP as compared to FYM, and VC alone.

The addition of the experimental treatments caused a significant increase at (p <0.05) in the available water compared to the control (**Table 3).** The obtained data indicate that FYM addition at 5, 7.5 and 10 Mg /fed increased the available water by 46.27, 38.31 and 38.51%, respectively compared to the control. The increments of the available water upon the addition of 5, 7.5 and 10 Mg/fed vermicompost were 48.76, 65.97 and 73.13 %, respectively, compared to the control. Meanwhile, the combination, of 10 Mg/fed vermicompost + each of 5, 7.5 and 10 Mg / fed FYM lead to increase available water by 50.65, 69.95 and 89.25%, respectively. These results indicate that increasing the levels of VC resulted in higher available water value, but the increments highest available water value upon the addition combination 10 Mg /fed VC + each of 5, 7.5 and 10 FYM agreement with **Hudson (1994)** who reported a significant increasing correlations between OM content, and available water capacity, for texture groups (sandy soil, silt loam soil and silty clay loam soil). These results are in good agreement with those obtained by **Seddik et al., (2006).** On the reversely, data show a slight increase in soil moisture content in case of treatment of solely FYM or vermicompost.

Table 3. Effect of different treatments of FYM and VC on some soil physical properties.

Treatment	B.D. (gcm^{-3})	Total porosity (%)	Soil water characteristics		
			Field capacity(%)	Wilting point (%)	Available water (%)
Control	1.52 a	42.64 g	18.83 e	8.78 c	10.05 e
5 Mg/fed FYM	1.48 ab	44.91 f	24.83 d	10.13 b	14.70 d
7.5 Mg/fed FYM	1.42 bc	46.42 ef	25.32 d	11.42 ab	13.90 d
10 Mg/fed FYM	1.41 bc	46.79 ef	25.98 cd	12.06 a	13.92 d
5 Mg/fed VC	1.42 bc	46.42 ef	26.9 bc	11.95 a	14.95 d
7.5 Mg/fed VC	1.38 cd	47.92 de	27.91 bc	11.23 ab	16.68 bc
10 Mg/fed VC	1.33 de	49.81 cd	28.66 ab	11.26 ab	17.40 ab
(10 VC+ 5 FYM) Mg/fed	1.29 ef	51.32 bc	27.1 bc	11.96 a	15.14 cd
(10 VC+ 7.5FYM) Mg/fed	1.24 fg	53.21 ab	29.2 ab	12.12 a	17.08 b
(10 VC+ 10FYM) Mg/fed	1.21 g	54.34 a	30.35 a	11.33 ab	19.02 a

Where: - FYM = Farmyard Manure VC = Vermicompost

The same letter in each column means that there is no any significant difference at 0.05 level.

Pores size distribution:

The effect of soil different types and different rates of treatments under studied on pores size distribution is given in **Table 4.** Reveal that, Pore size distribution was highly significant affect at ($p<0.05$). The most positively affected categories of pores were the quickly-drainable pores (QDP), slowly drainable pores (SDP) and the water-holding pores (WHP). These three categories also represent major portions of soil porosity, and they are of a very important significance in soil fertility and plant growth. The addition of soil amendments decreased significantly at ($p <0.05$) the quickly drainable pores (QDP) compared to the control. Table (4). The obtained data indicate that FYM addition at levels of 5, 7.5 and 10 Mg /fed, decreased the QDP by 20.81, 27.06 and 20.12% respectively, below the control. While the respective decrement in QDP reached 28.94, 23.31 and 20.82 %, due to vermicompost application rates. Under the combination, of 10 Mg/fed vermicompost + each of 5, 7.5 and 10 Mg /fed FYM lead to decrease QDP by 39.67, 22.24 and 26.35%, respectively. These results indicate that decreasing the levels of VC resulted of QDP value in lower.

The lowest QDP values were obtained with the combination of 10 Mg /fed of VC + 5 Mg/fed FYM, the increasing was (39.67%). Moreover, the differences between the high levels of the added VC and the control were highly significant. On the other hand, the difference between the low and high level of the added FYM is no significant. The QDP in the plots treated with the VC and FYM combinations at three levels were enhanced when compared to VC or FYM individually. The slowly drainable pore (SDP) was insignificantly for all treatments except for treatments combination 10 Mg /fed VC + each of 5, 7.5 and 10 Mg /fed FYM (**Table 4).**

The highest increment in SDP (93.1%) over the control was obtained from combination of 10 Mg /fed VC + 5 Mg /fed FYM soil treatment. The SDP in the soil treated with the VC or FYM combinations at three rates were not significantly among the rates, as shown in **Table 4.** Meanwhile, the SDP in the soil treated by VC + FYM combinations at three rates were significantly different from the other treatments as compared to the control.

Inversely, the addition of soil amendments increased significantly at ($p <0.05$) the water holding pores (WHP) compared to the control (**Table 4).** The obtained data indicate, that FYM addition at levels of 5, 7.5 and 10 Mg /fed, increased the WHP by 46.27, 38.31 and 38.51% respectively, compared to the control. The increments of the WHP upon the addition of 5, 7.5 and 10 Mg/fed vermicompost were 48.76, 65.97 and 73.13 %, respectively, compared to the control. Meanwhile, under the combination, of 10 Mg/fed vermicompost + each 5, 7.5 and 10 Mg /fed FYM lead to increase WHP by 50.65, 69.95 and 89.25%, respectively. These results indicate that increasing the levels of vermicompost resulted in higher WHP value, but the increments highest WHP value upon the addition combination VC + each of 5, 7.5 and 10 Mg /fed FYM. **Vengadaramana, and Jashothan, (2012)**

Also, the results showed that the addition of treatments increased the pore size distribution (WHP, SDP and QDP) on the other hand decreased fine capillary pores (FCP), this resulted in improvement of soil structure. These findings are in agreement with the those findings of **Pagliai et al. (1981)** who found that of medium and small sized pores and their number increased in organic amended soils and VC, indicating a improving of structure and potential plant growth**. Moodley and Hughes (2006)** found out that added of VC to soils, changes of particularly the macro porosity and the pore size distribution,

Table 4. Effect of different treatments of FYM and VC on pore size distribution of Maryout soil.

Treatment	Pore size distribution (μ)			
	Quickly D.P	Slowly D.P	Water Holding Pores	Fine capillary Pores
Control	13.84 a	5.07 b	10.05 e	8.78 c
5 Mg/fed FYM	10.96 b	4.27 b	14.70 d	10.13 b
7.5 Mg/fed FYM	10.10 b	5.19 b	13.90 d	11.42 ab
10 Mg/fed FYM	11.06 b	5.22 b	13.92 d	12.06 a
5 Mg/fed VC	9.84 bc	4.88 b	14.95 d	11.95 a
7.5 Mg/fed VC	10.61 b	4.63 b	16.68 bc	11.23 ab
10 Mg/fed VC	10.96 b	5.47 b	17.40 ab	11.26 ab
(10 VC+ 5 FYM) Mg/fed	8.35 c	9.79 a	15.14 cd	11.96 a
(10 VC+ 7.5FYM) Mg/fed	10.76 b	8.61 a	17.08 b	12.12 a
(10 VC+ 10FYM) Mg/fed	10.19bc	8.59 a	19.02 a	11.33 ab

Where: - FYM = Farmyard Manure VC = Vermicompost.
The same letter in each column means that there is no any significant difference at 0.05 level.

Soil chemical properties as affected by the experiment treatments:

Soil pH:

Data presented in Table 5 show that soil pH values were slightly decrease by adding farmyard manure (FYM) and vermicompost (VC) either individually or combination. This may be refer to the production of organic acids (cysteine, glycine and amino acid, humic acid) during mineralization of organic matter. These results are in agreement with **Abd El-Moez et al., (2002).**

Soil pH of calcareous soil was decreased leads to increases in availability of nutrients. The reduction of pH was affected by the application different rates and types of amendment. Also **Franco-Otero et al. (2012)** found that pH decrease may be due to the presence of fatty acids and phenolic created by decomposition of the amendments, which decreases soil pH. Data in Table 5 show that, the pH values were decreased insignificantly with increasing FYM or /and VC applied in the soil under study.

Table 5. Effect of different treatments of FYM and VC on Some chemical properties of Maryout soil.

Treatments	pH	EC dS/m	Soluble anions (mmolcl^{-1})			Soluble cations (mmolcl^{-1})				O.M mgkg^{-1}	CEC Cmolkg^{-1}
			HCO_3^-	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+		
Control	7.75 a	6.84 a	8.02	29.38	28.79	22.57	16.84	25.77	1.01	8.6 h	11.81 f
5 Mg/fed FYM	7.66 b	5.95 b	5.20	13.84	39.48	20.29	14.74	22.52	0.97	12.8 g	11.97 ef
7.5 Mg/fed FYM	7.58 cd	5.87 cd	5.85	23.84	28.98	21.36	14.63	21.45	1.23	13.3 f	12.23 de
10 Mg/fed FYM	7.58 cd	5.55 e	9.1	20.7	26.02	21.5	14.55	18.39	1.38	15.9 d	12.45 de
5 Mg/fed VC	7.65 bc	5.89 c	5.2	28.45	24.73	22.4	15.1	20.02	0.86	15.2 e	12.49 cd
7.5 Mg/fed VC	7.58 cd	5.84 d	3.9	28.45	26.51	18.7	16.8	22.13	1.23	15.6 d	12.97 bc
10 Mg/fed VC	7.54 d	5.28 g	3.9	19.99	28.89	16.3	12.2	23.21	1.08	16.4 c	13.32 b
(10 VC+ 5 FYM) Mg/fed	7.55 d	5.85 d	5.85	27.68	26.01	19.81	14.45	24.13	1.13	17.1 b	14.87 a
(10 VC+ 7.5FYM) Mg/fed	7.54 d	5.42 f	4.55	25.38	24.27	18.4	15.35	19.59	0.86	17.6 a	15.02 a
(10 VC+ 10FYM) Mg/fed	7.53 d	5.19 h	7.15	25.15	26.15	23.2	16.8	17.39	1.06	17.9 a	15.12 a

Where: - FYM = Farmyard Manure VC = Vermicompost.
The same letter in each column means that there is no any significant difference at 0.05 level.

Soil electrical conductivity:

Data in Table 5 show that the soil EC (dSm^{-1}) values decreased significantly as a result of the different rates of FYM, VC and combination of FYM + VC. These results are in agreement with those of **El-Maaz et al., (2014**). The decrease was attained by using vermicompost (VC) and farmyard manure (FYM). These results are similar to those obtained by **Ashour, (2014**) who revealed that the application of vermincompost led to decrease of EC soil.

Soil organic matter (SOM) and cation exchange capacity (CEC):

Data presented in Table 5 show that, the content (%) of O.M was increased by soil treated with vermicompost (VC) and farmyard manure (FYM) compared with control. These results are in agreement with those of **El-Maaz et al., (2014)** who mentioned that application by compost and manure application increase soil organic matter and cation exchange capacity. The presented data in Table 5 show that, the CEC were increased significantly ($p < 0.05$) with increasing FYM or / and VC applied compared to the control in the soil under study. The obtained data indicate, that FYM addition at levels of 5, 7.5 and 10 Mg /fed, increased the CEC by 1.35, 3.56 and 5.42% respectively, compared to the control. The increments of the CEC upon the addition of 5, 7.5 and 10 Mg/fed vermicompost were 5.76, 9.82 and 12.79 %, respectively, compared to the control. Meanwhile, under the combination, of 10 Mg/fed vermicompost + each 5, 7.5 and 10 Mg /fed FYM lead to increase CEC by 25.91, 27.18 and 28.03%, respectively. These results indicate that increasing the levels of VC resulted higher CEC values than farmyard manure, but the increments highest CEC value upon by the addition combination VC + each of 5, 7.5 and 10 Mg /fed FYM, this is due to the organic amendments (VC + FYM), improve of CEC through humic, human acid and increase nutrients concentrations, such as Mg and Ca as a result of decomposition agree with **(Jenkinson (1990).** Also lowering pH of soil environment that leads to solubilization of Mg and Ca from carbonates which are present in high level in the test soil. Nevertheless, VC appeared to be more effective to increase exchangeable Ca and Mg contents of soils when the VC and FYM applied in the same doses are compared with each other. This result is in agreement with the observation previously reported (**Azarmi et al., 2008).** This reveal that VC application due to more gradual release of nutrients from VC to the soil environment than FYM.

The amount of OM and OC increase tends to correspond with the quantities of added FYM or /and VC in each treatment; so, the greatest increasing of CEC values were noticed with combine 10 Mg /fed CV + 5, 7.5 and 10 Mg /fed by 25.91 , 27.18 and 29.03 % respectively, compared to control. **Eghball (2002)** found significantly highest levels of soil OM in treated plots with FYM than those control. The increasing rates of FYM and VC amendments soil may be due to the high microorganism's activity during the mineralization of organic components. The microorganism's activity enhances the production of dissolved organic carbon (carbon dioxide) in presence of the OM. The amount of dissolved organic carbon in this study is in agreement the results found by **Ouedraogo et al. (2001).**

The cation exchange capacity of the soil as affected by all treatments took the same trend of organic matter and this may be attributed to that soil organic encourages granulation, increases cation exchange capacity (CEC) and is responsible up to 90 % adsorbing power of the soils. These results are in a great harmony with those of **El-Maaz et al., (2014).**

Macronutrient contents in the studied soil:

Concerning macronutrients availability, data in Table 6 indicate that adding vermicompost (VC) and farmyard manure (FYM) increased available Nitrogen, phosphorus and Potassium in soil compared to the control. Also, results show that available N, P and K had increased significantly with increasing the rate of vermicompost (VC) and farmyard manure (FYM). Moreover, combine VC and FYM treatments were superior in increasing available Nitrogen, phosphors and Potassium compared to other treatment solely FYM or VC or control. This is due to the treatment of FYM to calcareous soil, which resulted in decrease of pH values and increasing the soluble ions and total soluble salts **(seddik et al., 2006).** Also this may be attributed to pH decreased as a result of adding VC or / and FYM to the soil which is responsible for nutrients availability in soils. **Malakouti, (1993)** with increasing pH leds to solubility of most nutrients usually decreases. Potassium status of soil was improved significantly. **El-Maaz et al., (2014)** found that there was a general increase in nutrient supplying capacity of soils with addition of compost. These results are in agreement with those of **Awad, (2002)** and **EL-Etr et al., (2004). Moreover**

All treatments FYM or / and VC were effective at adding Nitrogen, phosphors and Potassium in calcareous soil. Organic materials mineralization similar to the nutrients of vermicompost (VC) and farmyard manure (FYM) are answerable of increase the nutrients availability of plant in soil. Moreover, FYM or VC should be adding before sowing to give sufficient time for natural oxidation of organic materials, which in turn enhances the soil available nutrients. These results are according to those obtained by **(Eghball, 2002),** who found that incubation of some organic matter resulted high total N**.** Also these results agree with the results that by **Yu et al. (2013**) who found that the treatment of composted organic fertilizer or poultry manure lead to the increase of available phosphorus and OM content in soil. In addition, as a result of organic matter decomposition and decrease in soil pH which lead to the increasing in available phosphorus in soil. **Herencia et al. (2007)** found that higher soil organic matter, soil nitrogen content, available Phosphors and Potassium as resulted of organic fertilizer than in untreated soils. These results different from those of **Hartl et al. (2003)** in a field study, who mentioned that, concentrations of nutrient in soil don't change between soils receiving composted bio-waste or no organic, on the other hand **Gutser et al. (2005)** found that adding of organic manure (O.M), increased the organic matter content, which in turn increased the levels of Ca, Mg and K.

Table 6. Effect of the experimental treatments on the availability of some macro. and micronutrients of Maryout soil.

Treatment	mg kg^{-1}						
	N	P	K	Fe	Mn	Zn	Cu
Control	78 h	4.40 c	198 g	3.84 g	2.21 f	1.19 f	0.36 h
5 Mg/fed FYM	105 g	5.10 bc	341 f	5.09 f	2.44 e	1.35 d	0.59 ef
7.5 Mg/fed FYM	140 f	5.7 b	373 e	5.23 e	2.49 de	1.38 d	0.62 e
10 Mg/fed FYM	175 e	6.9 a	396 d	5.35 d	2.66 cd	1.45 c	0.7 d
5 Mg/fed VC	145 f	6.8 a	387 de	5.24 e	2.52 de	1.31 e	0.55 g
7.5 Mg/fed VC	175 e	7.1 a	416 c	5.28 de	2.63 cd	1.35 d	0.58 fg
10 Mg/fed VC	196 d	7.75 a	431 bc	5.67 c	2.72 bc	1.43 c	0.67 d
(10 VC+ 5 FYM) Mg/fed	232 c	7.63 a	426 c	5.83 b	2.78 bc	1.49 b	0.74 c
(10 VC+ 7.5FYM) Mg/fed	245 b	7.8 a	445 ab	5.76 b	2.87 ab	1.53 a	0.78 b
(10 VC+ 10FYM) Mg/fed	382 a	7.84 a	456 a	5.98 a	2.93 a	1.55 a	0.92 a

Where: - FYM = Farmyard Manure VC = Vermicompost.
The same letter in each column means that there is no any significant difference at 0.05 level.

Micronutrients content in the studied soil:

Decrease availability of Micronutrients (Mn, Zn, Fe and Cu) are related in soils which contain of high $CaCO_3$ **(Marschner, 1995).** Effect of pH and interactions of carbonates which occur in soil related to limited availability of these elements **(Loeppert et al., 1984).** The treatments under studied supply micronutrients to enrich the calcareous soil.

Data presented in Table (6) show that there is an increase in soil content (mg kg^{-1}) of available micronutrients (Fe, Mn and Zn) which considered as a result of the used treatments. The high increase was from additions of vermicompost (VC) and farmyard manure (FYM). This may be due to the increase of soil organic matter (OM) as a result of increasing rates adding FYM or / and VC. Effect of different rates of FYM and VC on available Mn, Zn and Fe content in soil were increasing significantly. These results are in a great harmony with reported by **Ali, (2001)** and **Paramasivam et al., (2005).** These results are similar to those of Brown **and Matt, (2011)** who reported that the applied of compost amendment in soil increased available nutrient for Fe, Mn, Zn and Cu compared to these content in soil.

The organic compounds mineralization leads to decrease pH in soil, which increases the availability of micronutrient in soil. Organic acids which low molecular weight released from decomposition of soil organic matter form soluble complexes with metal ions **(Ramachandran and D'Souza, 1998).** These results are in agreement with the results mentioned by **Bhanooduth (2006)** who reported that the available micronutrients (Mn, Zn, Fe, and Cu) increased by applied organic wastes and compost. This increase may be due to more gradual release of nutrients from VC to the soil environment (**Kale et al., 1987; Nethra et al., 1999; Lazcanoet al., 2008**).

Fresh weight of Shoot and root:-

With respect to fresh weight of shoot and root of fodder beet yield. Data illustrated in Table 7 and Fig 1 show that values of fresh weight of shoot and root, plants increased significantly with the application of both VC, FYM and their combination as compared to control treatment Also, results indicate that shoot and root of fodder beet yield increased gradually by increasing the rates of VC, FYM conditioners. Moreover, combine of VC + FYM treatment had recorded the highest values of fresh weight of Shoot and root of fodder beet yield as compared to those given by solely of VC or FYM conditioners. The obtained results that good evidence that VC application promotes growth of plants and it has been found to have a positive effect on growth and productivity of fodder beet yield. There was an increasing interest in the potential use of VC as soil amendment, where the addition of VC improves the soil physical and chemical properties. (**Azarmi *et al.*, 2008).** Who found that, the yield of Zea maize was higher in soils receiving compost amendment as compared to FYM. The highest shoot and root fodder beet yield were, obtained by treatment by combine of 10 Mg/fed VC + each of 5, 7.5 and 10 Mg /fed FYM, where the increasing rates were 70.73, 65.28 & 54.88 and 49.59, 48.30 & 39.84 % of fresh weight of shoot and root respectively, compared to control **Abdel-Gawad et al (1997)** and **(2008).** Also, the same obtained results recorded by **Wanas et al.,(2007**), who proved the importance of adding compost to clay soil for increasing the productivity of root crops such as fodder beet. Also, **Ibrahim et al., (2012)** found that compost tea increased root and sugar yields of sugar beet cultivated in saline calcareous soil.

Table 7. Effect of different treatments of FYM and VC on yield productivity of Maryout soil.

Treatment	Yield (Mg/fed.)			
	Shoot fresh weight	Root fresh weight	Rated of change %	
			Shoot	Root
Control	461.84d	1003.4f	0	0
5 Mg/fed FYM	513.61cd	1114.4e	11.21	11.07
7.5 Mg/fed FYM	584.44bc	1127.3e	26.55	12.35
10 Mg/fed FYM	585.45bc	1212de	26.76	20.77
5 Mg/fed VC	525.27cd	1125.4e	13.73	12.16
7.5 Mg/fed VC	680.97ab	1270cd	47.45	26.58
10 Mg/fed VC	771.11a	1381 bc	66.96	37.57
(10 VC+ 5 FYM) Mg/fed	788.5a	1500.9a	70.73	49.59
(10 VC+ 7.5FYM) Mg/fed	763.33a	1488 ab	65.28	48.30
(10 VC+ 10FYM) Mg/fed	715.28a	1403 ab	54.88	39.84

The same letter in each column means that there is no any significant difference at 0.05 level.

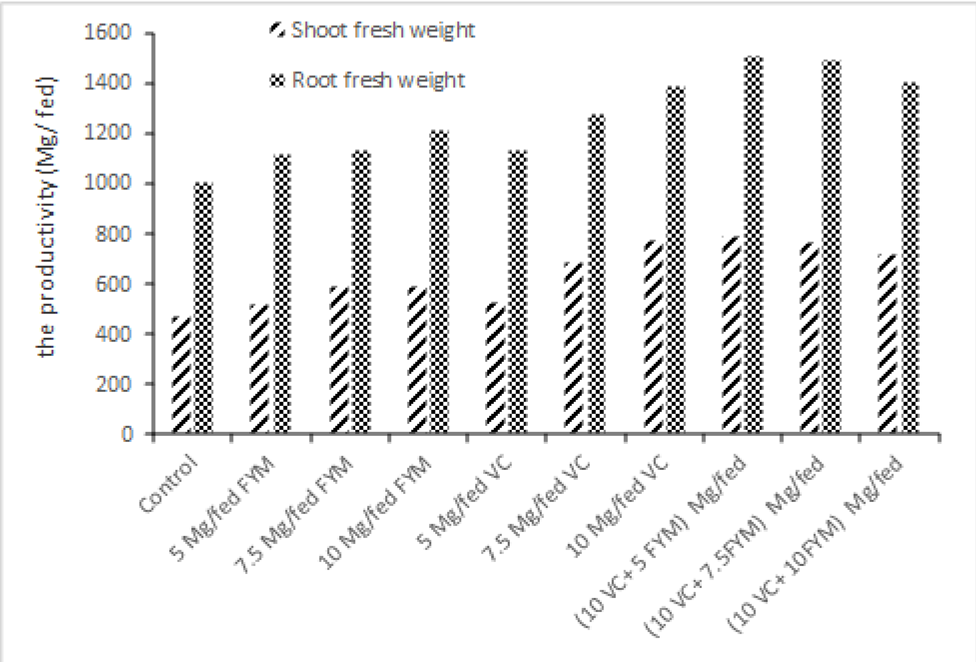

Fig (1) Effect of treatments of FYM and VC on shoot and root of fodder beet productivity.

Conclusion

The addition of FYM, VC and combination of FYM + VC led to improvement and increasing significant on porosity, field capacity, available water, WHP, macronutrients and micronutrients. The increments highest values in field capacity, available water and water holding pore upon by the addition combination VC + each of 5, 7.5 and 10 Mg /fed FYM.

The addition of FYM, VC and combination of FYM + VC led to decrease significantly values of bulk density, QDP, soil pH and salinity.

Soil organic matter content was significant higher in all amended treatments than the control.

In addition, soil amendments improved the weight of fresh shoot and root fodder beet productivity compared to control treatment. The fresh shoot and root fodder beet productivity increased with increasing rates of adding FYM, VC as the highest weight of fresh shoot and root fodder beet productivity by treated by combine FYM +VC.

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دراسة تأثير الفيرميكومبوست وسماد المزرعة على بعض الخواص الفيزيائية والكيميائية للتربة الجيرية في منطقة مريوط

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أجريت تجربة حقلية في محطة بحوث مريوط غرب الدلتا. تحت ظروف التربة الجيرية والتي تحتوي على نسبة 34 % من كربونات الكالسيوم. بهدف دراسة تأثير الفيرميكومبوست وسماد المزرعة وخليطهما على بعض الخصائص الفيزيائية والكيميائية. أجريت التجربة في تصميم كامل العشوائية مع ثلاث مكررات. معدلات مختلفة من سماد المزرعة (0 ، 5 ، 7.5 و 10) طن / فدان ، الفيرميكومبوست (0 ، 5 ، 7.5 و 10) طن / فدان وخليط 10 طن / فدان من الفيرميكومبوست مع كلا من 5 ، 7.5 , 10 طن / فدان سماد المزرعة تم خلط هذه المعاملات حتى 15 سم من التربة. مع زراعة بنجر العلف في نوفمبر (2017–2018) كمحصول دليلي.أظهرت النتائج أن أفضل المعاملات على إنتاجية المجموع الخضرى الطازج والمجموع الجذري الطازج كانت معاملة خلط 10 طن / فدان فيرميكومبوست + 10 طن / فدان سماد المزرعة. أظهرت النتائج أن إضافة فيرميكومبوست بمعدل 10 طن / فدان أدت إلى تحسين الخواص الفيزيائية مثل الكثافة الظاهرية والمسامية الكلية والماء الميسر والتوزيع الحجمى للمسام في التربة مقارنة بالكنترول. اظهرت النتائج أيضا إلى تحسين الخواص الطبيعية للتربة مع زيادة معدلات الخلط فيرميكومبوست + كلا من 5 ، 7.5 و 10 طن / فدان سماد المزرعة . أيضا كان هناك انخفاض معنوى فى قيم الكثافة الظاهرية ومسام الصرف السريع فى التربة وأيضا زيادة معنوية فى كلا من الماء الميسر ومسام حفظ التربة للماء .أظهرت النتائج أيضا انه توجد زيادة بشكل كبير فى المغذيات الصغرى والكبرى (النتروجين والفوسفور والبوتاسيوم والحديد و المنجنيز والزنك و النحاس) بشكل كبير مقارنة بالكنترول. وان الوحدات التجريبية المعاملة بالفيرميكومبوست قد انخفضت بدرجة ملحوظة في قيم EC ودرجة الحموضة في التربة مقارنة بالكنترول. معاملات سماد المزرعة والفيرميكومبوست والخلط أدت الى زيادة معنوية على الوزن الطازج لكلا من المجموع الخضري ووزن الدرنات مقارنة بالكنترول وكان التأثير الزائد اكبر فى حالة معاملة خلط الفيرميكمبوسب + سماد المزرعة.