Effect of organic waste and aggregate sizes in some of soil physical properties, soil salinity and barley growth (Hordium vulgare L.)

Kawther A AL-mosawi

Soil sciences and water resources -College of Agriculture- University of Basrah -Iraqi

Email : kawther_aziz1965@gmail.com

Abstract : Laboratory experiment was conducted to study the effect of three types of organic waste (chicken, sheep, Cows wastes) and three different aggregate sizes (<2, <5, <10)mm on some soil physical properties, soil salinity and barley crop growth. The soil texture was clay loam. The soil samples were brought from north of Basrah governorate (Qurna district). The soil samples were dried in the air and then grinded. The soil samples were divided into three parts, one was passed through sieve of 2mm, the second through size of 5mm and the third through size of 10mm. The soils were distributed into plastic pots the amount of the soil was 2kg in each plastic pots the cows, sheep and chicken wastes were mixed with soil. The amount of the waste was 2% of the weight of the soil in each plastic pots the barley crop seeds (Hordium vulgare L.) were planted. The plastic pots were irrigated using tap water to the field capacity. The crop heights were measured after two months of crop planting. The green and dry weights of the crop were measured after harvesting. The some soil physical properties were also measured namely aggregate stability which expressed as mean weight diameter (MWD), aggregate index, bulk density, total porosity, saturated hydraulic conductivity and electrical conductivity. The results showed that the organic wastes significantly affected (improved) MWD, aggregate index, bulk density, total soil porosity, crop height and wet and dry weight of the crop green part. The values of the above parameters are 0.548mm, 0.395, 1.435 Mgm$^{-3}$, 43.51%, 38.908cm, 14.41 g pots$^{-1}$ and 2.592g pots$^{-1}$ respectively compared with control treatment. While the organic wastes did not significantly affect the soil saturated hydraulic conductivity and soil electrical conductivity. The chicken waste gave the highest MWD, aggregate index, total porosity, crop height and the wet and dry weight of the green part of the crop. The percentage of increased are 59.169, 64.890, 15.568, 16.000, 74.140 and 113.671% respectively, whereas the soil bulk density decreased by 9.730% compared with control treatment respectively. The results also showed the soil aggregate sizes significantly affected the aggregate index, soil bulk density, soil total porosity, soil electrical conductivity and crop growth, whereas it did not significantly affect MWD, soil saturated hydraulic conductivity, 2mm aggregate surpassed the other aggregates (5 and 10mm) in recording the height values for the above parameters except, soil bulk density and soil electrical conductivity which they decreased with 2mm aggregate.

Key word: organic waste, soil aggregate sizes, MWD, aggregate index, saturated hydraulic conductivity, bulk density.
1. Introduction

The soil is regarded as the main factor in agriculture production. The optimum using of the soil is through improving its physical, chemical and fertility properties to increase the agriculture production. The soils of meddle and south of Iraq suffer from high salinity due to the low water infiltration and that was because the heavy texture of the soils (clay soil) as well as the determination of their structures. In additional to that they suffer from the low organic material content. The organic material improve the soil physical properties such as the soil structure and increasing soil mean weight diameter (MWD) and that occurred by the products of their an analysis. The organic materials protect the soils from air and water erosion by adhering the soil particles together which resist air and water erosion (Tarchitzky and Chen, 2002). The effect of organic residuals on the soil physical properties (aggregate stability) was studied by Sadiq and AL-agool (2013). They used sheep, cows and chicken residuals at levels of 0, 5, 10, 15 and 20 ton ha\(^{-1}\). The soil aggregate stability increased with addition of the three residual types. However, sheep residual surpassed the other two types, whereas, the cows residual came second and the chicken residual came third. The aggregate stability values are 0.87, 0.84 and 0.81mm for sheep, cows, and chicken residuals respectively. The reason for improvement is related to their organic acids which produced during the residuals activities which adhered the soil particles together. Mahmood and Al-salmani (2010) studied the effect of sheep, cows and chicken residual on potato crop growth parameters such as plant height and dry weight of green part. The three residuals increased the crop parameters compared with control treatment. The chicken residual recorded the highest values of plant growth parameters whereas; the sheep residual came second then cows residual. The plant height values are 94.57, 90.15 and 89.36 cm and the dry weight for the plant green part are 7.676, 6.387 and 6.094 ton ha\(^{-1}\) for chicken, sheep and cows residuals respectively. They mentioned that the supervision of the chicken residual on other two residuals is related to its high nutrition elements content. Hmood (2013) mentioned that chicken residual increase potato crop height compared with cows and sheep residual which was added at for levels 0, 8, 16 and 32 ton ha\(^{-1}\). Al-Faris noticed (2017) that the soil bulk density decreased by 2.5% whereas the soil total porosity, mean weight diameter, sunflower crop height increased when cows residual was application at level of 45.5 ton ha\(^{-1}\) to silt loam soil. The percentages of increase are 1.90, 26.67 and 14.47% respectively. Application animal residual by 2% to the clay soil improved the soil physical properties. The soil bulk density decreased from 1.305 to 1.279 Mgm\(^{-3}\) while the soil total porosity from 49.99 to 51.00%. In additional to that the soil saturated conductivity and mean weight diameter increased by 196.42 and 68.75% compared with untreated soil respectively. This improvement in the soil physical properties positively improved corn crop growth parameters. The plant height and dry weight of green parts increased by 10.80 and 22.05% respectively (AL-Bazoon, 2018). Salman (1996) studied the effect of soil aggregate sizes of ranges <0.5 and (0.2-0.5),(2.0 – 4.0) and (4.0 – 8.0)mm on some of soil physical properties for clay loam soil and corn crop growth parameters. It was found that the moisture content increased with smaller size aggregate and the values are 10.8, 11.0, 11.5 and 12.7% for the above soil aggregate sizes respectively. The reason was related to the higher soil porosity and the domination of smaller of pores compared with larger pores of the bigger soil aggregates and that increased the soil water retention. In additional to that the aggregate stability and aggregate index for smaller aggregate were low due to the weakness of small aggregates for the irrigation water during the wetness operation. The balance between soil moisture content and the air for soil aggregate sizes (0.5 – 2.0) and (2.0 – 4.0) mm produced the highest dry weight for the crop green part compared with other aggregate sizes. Another study showed that the bulk density increased, the soil total porosity and soil saturated conductivity decreased as the soil aggregate sizes increase of less than 8mm. This was because it contains different ranges of aggregate sizes which probably interaction occurred between soil aggregate which resulted in soil pores blockade and that lead to higher soil bulk density and lower
soil total porosity and soil water saturated conductivity. In additional to that the soil electric conductivity went up (Al-Atab, 2001).

After plowing Salty clay soil and sieved by different sieves, <0.4, (0.4 – 1.0), (1.0 – 2.0), (2.0 – 3.0), (3.0 – 4.0), (4.0 – 6.0) mm greater than 6 mm. The aggregates of less than 0.4 mm retained more moisture than the other sizes. (Hassin and Al-Kahwagi, 2008). However, the soil infiltration increased as the soil aggregates increased the values were 0.016 cm sec\(^{-1}\) for aggregate size of less than 0.4 mm and 0.053 cm sec\(^{-1}\) for soil aggregate size of more than 6 mm.

The aim of this research is to study the effect of organic waste and aggregate sizes in some of soil physical properties, soil salinity and barley growth.

2. Materials and methods

The soil samples were collected from north of Basrah governorate (Qurna district). The soil texture is clay loam. The soil samples were taken from depth of (0 - 30) cm. The collected soil was air dried and grinded the passed through sieve of 2 mm size. The soil physical and chemical properties were measured and the results are shown in table (1). The soil texture and real density were measured by the hydrometer and Pycnometer respectively. The soil bulk density was calculated by dividing the soil dry mass by the total volume of plastic pot. The volume of the plastic pot was calculated by multiplying the area of the base by the height of soil into the pot. The total soil porosity was calculated using the soil bulk and real densities according to the method mentioned in Black et al. (1965). The Calcium (Ca\(^{+2}\)), Magnesium (Mg\(^{+2}\)), Chloride (Cl\(^{-1}\)) soluble ions and Soil pH were measured according to the methods described by Jackson (1958). The Sodium (Na\(^{+1}\)) and Potassium (K\(^{+1}\)) soluble ions and soil electrical conductivity (EC) of the soil substract of 1:1 (soil: water) were measured according to the methods mentioned in Page et al. (1982). The soluble Carbonate (CO\(_3^{2-}\)) and Bicarbonate (HCO\(_3^{-}\)) were measured according to methods mentioned in Richards (1954).

Experiment treatments

1. Organic waste which includes, cows, sheep and chicken wastes, non-addition treatments. The chemical properties were measured and the results are shown in table (2).

2. The soil aggregate sizes which includes <2, <5, <10 mm.

Experiment Layout

The soil samples were air dried and then grinded. The grinded soil was divided into three equal sizes amounts. The three amounts were passed through three different sizes of 2, 5 and 10 mm sizes individually. The soil was put in pots, 2 kg in each pot. The soil was mixed with organic waste which was added as 2% out of dry Weight of the soil. The barely crop seeds were planted in the pots. The local crop verity (Hordium vulgare L.) was used. The chemical fertilizer were added according the amount recommended by AL-Younis et al. (1987). Urea fertilizer (46%N) was added two applications at level of 80 kg ha\(^{-1}\). The first application during seeds planting whiles the second application after one month of the seeds emergency. Third superphosphate (54% P\(_2\)O\(_5\)) was added at level of 60 kg ha\(^{-1}\) at seeds planting time. The plants were irrigated to the soil field capacity using tap water. The plants were thinned after ten days of emergency period to ten plants per pots.

The studied parameters

The plants height, the wet and dry weight of the green part of the plants, soil MWD as indicator for soil aggregates stability were measured after two months of seeds planting. MWD was measured according to Kemper and Chepil method which was described in Black et al. (1965). The soil samples were air dried and passed through sieve of 8 mm and then sieve of 4 mm. soil sample of
25g was collected and wetted from underneath by soil vocabulary for 6 minutes. The soil sample was transferred to sieves of 4.00, 2.00, 1.00, 0.50, and 0.25mm. The soil sieving carried out by wet sieving method for 6 minutes using wet sieving system by vibration method. The system type is Re Tsch As 200(2009). The system vibration was 60 cycle per min. The water discharge from the system was (200ml min\(^{-1}\)). The soil sample left on the sieves were transferred to beakers and dried in oven at 105\(^\circ\)C. The weight of the samples was measured individually. MWD was calculated using the following equation.

\[
M = \sum_{i=1}^{n} \overline{X_i} W_i
\]

Where:
\(X_i\) = average of the diameter for any range of soil aggregate sizes (mm).
\(W_i\) = the weight of the soil remained on the sieve within the range of certain size as percentage of the total dry weight of the soil sample (gm).
MWD = mean weight diameter (mm).

The aggregate index for each experiment units using equation of Mukhtar et al. (1974)

\[
Kc = \frac{X_2 + X_3 + X_4 + X_5}{X_1 + X_6}
\]

\(X_{1a}\) = weight of the dried remained soil on the sieve (4)mm
\(X_{2a}\) = weight of the dried remained soil on the sieve (2)mm
\(X_{3a}\) = weight of the dried remained soil on the sieve (1)mm
\(X_{4a}\) = weight of the dried remained soil on the sieve (0.5)mm
\(X_{5a}\) = weight of the dried remained soil on the sieve (0.25)mm
\(X_{6a}\) = weight of the dried remained passed through the sieve (0.25)mm

The soil bulk density, total soil porosity and electrical conductivity were measured for all experimental units as well as they were measured with other soil primary properties. The soil saturated hydraulic conductivity was measured by collecting disturbed soil and sieved through 2mm sieve. The soil sample was wetted from underneath and the contact water column was used according to method suggested by Klute which was described by Black et al. (1965). The water dome was foxed above the soil column then the passed water amount was recorded during a certain time until the values became constant with time. The values of the soil saturated hydraulic conductivity using Darcy equation.
The soil saturated hydraulic conductivity \( K_s \) is defined as:

\[
K_s = \frac{Q}{A} \times \frac{L}{h}
\]

**Ks:** The soil saturated hydraulic conductivity (cm/hr). **Q:** volume of water passed through the soil column (cm³). **L:** length of the soil column (cm). **A:** area of the section width for the soil column (cm²). **t:** time (hr). **h:** \( L + \) height of the water above the soil surface in the column (cm).

The experiments were conducted using CRD. The treatments were replicated three times. The results were analyzed using SPSS (1998) Version 9 program for ANOVA table. The difference between the treatments was tested by F-test. The comparison between the treatments was carried out by RLSD(AL-Rawi and Khalfalla, 1980).

3. Results and Discussion

3.1. Effect of organic waste and soil aggregate sizes and the interaction between them on the mean weight diameter (MWD).

The organic waste significantly affected the mean weight diameter values (MWD) (table 3). MWD of the soil treated with organic waste increased by 33.98% compared with that of untreated soil (table 4). This was because the organic waste improved the soil aggregates stability in the water through adhering the soil particles by the active materials as well as the adhesive materials which the organic waste produce due to the soil organisms. The plants roots distribution in the soil links the soil particles together. (AI-sheikhly, 2000) and (Abdalhamza, 2010).

Comparing between the three organic wastes showed that chicken waste gave the highest MWD and then sheep's waste and cows waste became third. The values of MWD for the three wastes are 0.651, 0.526 and 0.467mm respectively (figure 1). The supervision of the chicken waste over the remaining wastes was because it contains greater construction of N, P elements. Those two element improved plants growth and roots distribution in the soil at the end of growth season. The roots link the soil particles with each other by the adhesive material which the roots produced as well as the roots penetrate the soil pores and push the soil particles toward each other. These factors improve the soil aggregate stability in the water. These results are supported by that found by AI-shamy (2013).

The soil aggregate sizes did not significantly affect MWD, while the values of MWD significantly increased due to the interaction between the organic wastes and the soil aggregate sizes. (table3). The soil aggregate size <2mm treated with sheep waste gave the highest values of MWD. The value of MWD is 0.737mm but this value did not significantly differ from the values of MWD for treatments <2 and <5mm which they were treated by chicken waste, the value is 0.707mm for both of them. The soil treatment of less than 5mm treated with sheep waste and untreated soil treatment of less 2mm recorded the lowest values of 0.320 and 0.340 mm without significantly difference with other values respectively. (table4).

3.2. Effect of the organic waste and soil aggregate sizes and the interaction between them on the soil aggregation index (K).

The organic waste and the soil aggregate sizes significantly affect the soil aggregation index (table 3). The addition of the organic waste increased the k by 23.82% compared with control treatment (figure 2). This was due to the effect of the organic waste is increased of the mean weight diameter as well as the crop roots distribution and growth with crop growth advance which they push the soil particles. Toward each other's. (Jassim, 2015).

Comparing the effect of the three organic waste types on the k, chicken waste surpassed the other waste types in giving higher k, then sheep and cows wastes and finally the control treatment. The values of the k are 0.526, 0.334, 0.326 and 0.319 respectively. The percentage of increase compared...
with the control treatment 6.49, 4.70, and 2.19% respectively. This is related to the increase in MWD due to chicken waste, there is high and positive correlation between the aggregation index and MWD (AL-mosawi, 2007).

However, the soil k significantly decreased as the soil aggregate sizes increased (table 3). The reduction percentage of the sizes <5 and <10 mm are 24.12 and 26.11 % compared with size <2 mm respectively (figure 3). This is related to the increased in the soil bulk density and the reduction in the soil total porosity. With greater soil aggregate sizes. This resulted in roots impending and that prevented the soil from benefit from the roots effect in link the soil particles together.

The interaction between the organic wastes and the aggregate sizes significantly affected the soil k as it can be seen from the statistical analysis table. The interaction between the chicken waste and the aggregate <2mm surpassed the other interactions. The value of the k of the above interaction is 0.640, the second highest value was recorded 0.537 for the same waste but with aggregate size of <5mm. while the cows waste with medium aggregate size and that less than 5mm recorded the lowest value (0.187mm). This treatment did not significantly differ from the treatment of sheep waste and the same aggregate sizes.

3.3. Effect of the organic waste and soil aggregate sizes and the interaction between them on the soil bulk density and total porosity (Pb & f).

Addition of organic waste to the soil significantly affected the values of the bulk density and soil total porosity (table 3), it decreased soil pb by 8.13 % and increased the f by 13.29 %( tables 6 and 7). This was because it improved soil structure and increased MWD in additional to that the organic waste is regarded as nutrient source for bacteria and fungi. The material produced by the organic waste analysis produces new aggregates which improving soil structure and reducing soil bulk density (Suuster et al.,2011).comparing the organic waste types and their resources showed that the chicken waste recorded the lowest soil pb values (Figs.4 and 5) but did not significantly differed for sheep waste . The soil pb values are 1.410, 1.418 and 1.477Mgm⁻³ and the soil f values are 44.487, 44.182 and 41.861 % for chicken, sheep and cows waste respectively. The control treatment recorded the highest soil pb value 1.562Mgm⁻³ and lowest soil f 38.494%. The superiority of the chicken waste to the other types of wastes in reducing the soil bulk density and increasing the soil total porosity is related to that it increased the plant height,green and roots growth. These parameters improved the soil aggregates which decreased the soil bulk density and increased the total soil porosity.

The different soil aggregate sizes significantly affected the soil pb and f. Soil pb increased while f decreased with increasing the soil aggregate sizes. The aggregates size lower than 10mm recorded the highest pb value 1.503Mgm⁻³ where and lowest f 40.813%, with significant difference with that of lower sizes than 5 and 2 mm. However, the aggregate sizes lower than 5 and 2mm, there was no significant between their effect on pb and f. The reason of that the small size aggregates produced higher pb and lower f was related to that the soil clods were crashed and the soil particles filled the soil pores in additional to that the soil compaction due to the repeated irrigation operations (Al-muraad, 1998).

The interaction between the organic residuals and the soil aggregate sizes did not significantly affect the soil pb and soil f (table 3).

3.4. Effect of the organic waste and soil aggregate sizes and the interaction between them on the soil saturated hydraulic conductivity (Ks).

Soil saturated hydraulic conductivity increased insignificantly when the organic waste was added compared with the control treatment. Chicken waste surpassed the sheep and cows waste in
giving higher Ks. the values are 0.747, 0.720 and 0.689 cm hr\(^{-1}\) respectively (tables 3, 6). The statistical analysis did not show any significant effect for aggregate sizes on the Ks. The interaction between the organic waste and the aggregate sizes highly significantly improved Ks (table 3). The interaction between the chicken waste and the aggregate size less than 5mm gave the highest Ks and the second interaction was the sheep waste with soil aggregate size of less than 10mm but without significantly difference. Both interactions recorded the following values 1.450 and 1.140cm hr\(^{-1}\) respectively. This improvement in Ks is related to the soil structure improvement and the increase in the soil total porosity which was due to the new aggregate which withstand destruction. This resulted in greater soil pore sizes which responsible on the water movement in the soil.

### 3.5. Effect of the organic waste and soil aggregate sizes and the interaction between them on the soil electrical conductivity (EC).

The soil electrical conductivity increased insignificantly with organic waste application (0.83%). This increase in soil EC did not affect soil physical properties and crop growth parameters (table 3). The soil aggregate sizes significantly affected soil EC, it increased as the soil aggregate sizes increased. The amount of EC increased for aggregate sizes lower than 5 and 10mm 32.837 and 49.137% compared with sizes lower than 2mm respectively (Fig.8).

The interaction between the organic waste and soil aggregate sizes significantly affected the soil EC (table 3). The results showed in table (7) the soil aggregate less than 10mm and untreated treatment with organic waste recorded the highest EC value. The same size after treatment with chicken and sheep's waste came second. The EC values are 15.733, 15.093 and 15.053 dsm\(^{-1}\) respectively, but with insignificant deference between them. The control treatment of size less than 2mm the lowest EC value (7.370 dsm\(^{-1}\)) which insignificantly different from the treatment treated with sheep's waste of less than 2mm, EC value is 7.960 dsm\(^{-1}\). The other interaction treatments gave medium valises of EC.

### 3.6. Effect of the organic waste and soil aggregate sizes and the interaction between them on the parameters of the barley plant growth

The organic waste significantly increased the plant height, wet weight, dry weight for green parts of the barley crop (table8). Comparing the increased in the above parameters with that of control treatment the percentage of average increase are 14.11, 50.86 and 77.17 % respectively (Figs. 9, 10 and 11). This results can be related to the improvement in the soil structure due to the increase in the soil mean weight diameter (MWD),decreasing soil bulk density ,improvement in soil permeability which positive improved soil water holding capacity and that lead to increase in the available water to the plants. In additional to that the organic waste improved soil fertility, increasing the nutrition element, and that improved the plant sells division and elongation especially Nitrogen element which inter in the chlorophyll , protein and nuclear acids structure. These processing increased the plant photo thesis and food manufacturing (Uzoma et al., 2011 and Oshundiya, 2014).

Comparing the effect of the three organic waste types on plant height, chicken waste surpassed the sheep and cows waste in increasing the plant height but significantly (Fig.9). The plant height as average are 39.556, 39.167 and 38.000 cm for chicken, sheep and cows waste respectively. For green yield of the plants, there was significant difference between chicken and cows waste and sheep and cows but there was no significant difference between the chicken and sheep waste. The percentage of increase in green yield due to the waste effect of chicken and sheep compared with that of cows are 39.92 and 23.64% respectively. (Fig.10). The dry weight of plants green parts increased insignificantly when the soil was treated with chicken waste compared with sheep waste, The percentage of increase is 11.32 %. Whereas the increase in the dry weight was significantly with chicken waste compared with cows waste and the increase was significant between the sheep and cows waste. The increase in
the dry weight is 69.71 and 52.44 % for chicken and sheep waste compared with cows waste respectively (Fig.11). The supervision of the chicken waste on the sheep and cows waste was related to its high containing of Nitrogen and phosphor are elements which they improve green parts growth due to the proteins, under amine acids and the protoplasm construction. The latter is necessary for cells division, respiration and provide the energy to construct new cells which improves plants growth.(AL-Shammary et al.,2016).

The soil aggregate sizes significantly affected the crop growth parameters. The aggregate size less than 2mm surpassed in giving significantly higher plant height, green yield and dry weight. The values are 43.433, 21.645 and 2.875 gm pot⁻¹ respectively. This was related to the suitable condition existed during the growth period such as water – air balance and that was due to the improvement in soil porosity which let the roots of the plant grow free in the soil.

The variation analysis (table8) showed that there was high significantly effect of the interaction between organic waste and the soil aggregate sizes on the plant height of parley crop. Table (9) showed that soil aggregate less than 2mm and chicken waste gave the highest plant (46 00cm) where the soil aggregate of less than 10mm without waste application gave shortest plant (26.367cm). The remaining interaction treatments gave medium results. The interaction between the organic waste and the soil aggregate sizes did not significantly affect the green yield and dry weight (table 8).

4. References

[1] AL- Atab,S.M.S.(2001). Effect of soil aggregate sizes on soil physical properties, water movement and growth of corn plant (Zea mays L.). M.Sc. Thesis, Coll. of Agric., Univ. of Basrah, Basrah, Iraq.
[2] AL-Bazoon,A.J.O. (2018).The effect of use system dual drip irrigation and conditioners soil in reducing the impact of irrigation water salinity in soil properties and growth of corn plant (Zea mays L.) . M. Sc. Thesis, Coll. of Agric., Univ. of Basrah, Basrah, Iraq.
[3] Abdulhamza, J.S.(2010).effect the different organic manure on some soil properties and corn yield. M. Sc. Thesis, Coll. of Agric., Univ. of Bagdad, Bagdad, Iraq.
[4] Al-Paris,M.A.A.(2017).Design, manufacture and evaluate its mechanical performance an implement operating at different plowing depths and adding manure to the soil and studying its effect on some soil properties and yield of sunflower plant (Helianthus annus L.). Ph. D. Thesis, Coll. of Agric., Univ. of Basrah, Basrah, Iraq.
[5] AL-Mosawi, K. A. (2007). Effect of Irrigation Water Quality Frequency and Soil Moisture Contents on Soil Physical And Chemical Properties of Al-Hammar Marsh Soil and Consumptive Water Use of Sorghum Crop. Ph. D. Dissertation, Dept. of Soil and Water Sci., Coll. of Agric., Univ. of Basrah, Basrah, Iraq.
[6] AL-Rawi, K. M. And, A. M. Khalfalla. (1980). Design and Analysis of Agricultural Experiments. Coll. of Agric. And Forestry, Univ. of Mosul , pp. 487..
[7] AL-Shamy, Y. A.(2013). Effects of Soil Conditioners Addition on Physical and Chemical Properties , the Efficiency of Drip Irrigation and Surface Irrigation in Clay Soil and Growth of Maize Plant (Zea Mays L.) .M. Sc. Thesis, Dept. of Soil Sciences and Water Resources, Coll. of Agric., Univ. of Basrah, Basrah, Iraq.

[8] AL-Shammary, A.M.A.; D.AM.AL-tamim and S.S.KH.Juneed (2016). The effect of organic and chemical fertilizer in vegetative growth for characteristics and yield of three genotypes of Cauliflower. Diyala Journal of Agricultural Science, 8(2):229-241
[9] Al-Sheikhiy, A.H. (2000). Effect of organic matter on aggregate stability in some Iraqi soils. The Iraqi Journal of Agricultural Science, 31(4)
[10] AL-Younis, A. A.; M. A. Mohammed And Z. Abd Alias (1987). Grain Crops. Ministry of Higher Education and Scientific Research. Univ. of Mosul. Mosul, Iraq. pp. 368.

[11] Black, C. A.; D.D. Evans; L.L. White; L.E. Ensminger and F.E. Clark (1965). Method of soil analysis, Am. Soc. of Agronomy, No. 9 part I and II.

[12] Hassan, H.M. and H.A. El-kahwaji (2008). Effect of soil aggregate size on water properties. The Journal of Kirkuk University, 3(1): 13-26.

[13] Hmood, N.M. (2013). Effect of the type and level of organic manure in growth and potato yield (Solanum tuberosum L.). AL-Kufa Journal of Agricultural Science, 5(2).

[14] Jackson, M. L. (1958). Soil chemical Analysis. Prentice – Hall. Inc., Engle wood cliffs., N. Y.

[15] Jassim, A. H. M. (2015). Effect of magnetization of different water qualities on some chemical and physical properties for clay loam soil, growth and consumption of water for barley crop (Hordeum vulgare L.). M. Sc. Thesis, Coll. of Agric., Univ. of Basrah, Basrah, Iraq.

[16] Mahmoud, J.T. and H.K. Alsalmi (2010). Effect of organic and mineral manure on some parameter of growth and yield potato. AL- Furat Journal of Agricultural Science, 2(3): 71-79.

[17] Mukhtar, O. M. A.; A. R. Swoboda and Goderey, (1974). The effect of sodium and calcium chlorides on structure stability of two vertisols. Gezira clay from Sudan and Houston Black clay from Texas. Soil Sci., 118 (2) pp. 109.

[18] Oshundiya, F.O.; V.I.O. Olowe; F.A. Sowemimo and J.N. Odedina (2014). Seed Yield and Quality of Sunflower (Helianthus annuus L.) as Influenced by Staggered Sowing and Organic Fertilizer Application in the Humid Tropics. Helia 37 (61): 237-255.

[19] Page, A. L.; R. H. Miller and D. R. Keeney (1982). Methods of soil analysis, part (2) 2nd ed. Agronomy. Wisconsin, Madison. Amer. Soc. Agron. Inc. Publisher.

[20] Richards, A. (1954). Diagnosis and Improvement of Saline and Alkali Soils Agriculture. Hand book No. 60. USDA Washington.

[21] Sadiq, M.H. and A.M. Agool (2013). The effects of organic matter addition on soil structure. AL- Furat Journal of Agricultural Science, 5(4): 188-198.

[22] Salman, R.F. (1996). Effect of soil conditioner on physical properties of soil aggregates and water consumption of corn plant (zea mays L.). B.Sc. thesis, Coll. of Agric., Univ. of Basrah, Basrah, Iraq.

[23] Suuster, E.; C. Ritz; H. Roostalu; E. Reintam; R. Kolli and A. Astover (2011). Soil bulk density pedotransfer functions of the humus horizon in arable soils. Geoderma 163: 74-82.

[24] Tarchitzky, J. and Y. Chen (2002). Rheology of sodium montmorillonit suspensions. Soil Sci. Soc. Am. J. 66: 406-41.

[25] Uzoma, K.C.; M. Inoue; Andry; H. Fujimaki; A. Zahoor, and E. Nishihara, (2011). Effect of cow manure biochar on maize productivity under sandy soil condition. Soil Use and Management, June 2011, 27.: 205-212.

Table (1): physical and chemical properties of the soil

| Properties       | Units             | Values     |
|------------------|-------------------|------------|
| Sand             | gm kg⁻¹           | 394.00     |
| Silt             | gm kg⁻¹           | 296.00     |
| Clay             | gm kg⁻¹           | 310.00     |
| Texture          |                   | Clay loam  |
| Bulk density     | Mgm⁻³             | 1.65       |
| Real density     | Mgm⁻³             | 2.55       |
| Total porosity   | %                 | 35.29      |
| Calcium          | M mole L⁻¹        | 13.30      |
Table (2): Some of chemical properties of the organic waste

| properties          | Units    | Cows | Sheep | Chicken |
|---------------------|----------|------|-------|---------|
| Organic matter      | gm km⁻¹  | 363.22 | 250.00 | 212.10  |
| Organic carbon      | gm km⁻¹  | 210.69 | 145.00 | 123.00  |
| Total Nitrogen      | gm km⁻¹  | 17.37  | 17.50  | 7.30    |
| C/N Ratio           | ---------| 12.13  | 8.20   | 7.10    |
| Total phosphor      | gm km⁻¹  | 7.16   | 18.00  | 20.00   |
| Total potassium     | gm km⁻¹  | 10.44  | 32.00  | 41.00   |
| EC                  | ds m⁻¹   | 13.25  | 29.50  | 34.60   |
| pH                  | 5:1      | 6.42   | 6.71   | 6.95    |

(AL-Faris, 2017) (and) 2010 Mahmoud and AL-Salmani)

Table (3): The statistical analysis for F-test of the mean weight diameter (MWD), aggregation index (K), soil bulk density (Pb), total porosity (f), saturated hydraulic conductivity (Ks) and electrical conductivity (EC)

| Source | df | MWD   | K     | Pb     | F     | Ks     | EC    |
|--------|----|-------|-------|--------|-------|--------|-------|
| A      | 3  | 6.758*| 32.454**| 13.184**| 13.481**| 1.226ns| 2.735ns|
| B      | 2  | 1.446ns| 18.664**| 3.588* | 3.665* | 0.150ns| 18.072**|
| C      | 6  | 3.500*| 14.463**| 1.506ns| 1.538ns| 15.873**| 3.590* |

A = organic waste treatments; B = soil aggregate sizes treatments:

** = significant difference at level of 0.01; * = significant difference at level of 0.05; ns = there is no significant difference.
Table (4): Effect of the interaction between organic waste and soil aggregate sizes in mean weight diameter (mm)

| Aggregate sizes | Organic waste | <2 (mm) | <5 (mm) | <10 (mm) | Mean of the organic waste |
|-----------------|---------------|---------|---------|----------|--------------------------|
| Chicken         | 0.707         | 0.707   | 0.540   | 0.651    |
| Sheep           | 0.737         | 0.320   | 0.520   | 0.526    |
| Cows            | 0.460         | 0.490   | 0.450   | 0.467    |
| Control         | 0.340         | 0.427   | 0.460   | 0.409    |
| Mean of the Aggregate sizes | 0.561 | 0.486 | 0.492 | 0.513 |
| RLSD 0.05       |               |         |         | 0.206    |

Table (5): Effect of the interaction between organic waste and soil aggregate sizes in aggregation index

| Aggregate sizes | Organic waste | <2 (mm) | <5 (mm) | <10 (mm) | Mean of the organic waste |
|-----------------|---------------|---------|---------|----------|--------------------------|
| Chicken         | 0.640         | 0.537   | 0.400   | 0.526    |
| Sheep           | 0.487         | 0.220   | 0.297   | 0.334    |
| Cows            | 0.420         | 0.187   | 0.370   | 0.326    |
| Control         | 0.260         | 0.427   | 0.270   | 0.319    |
| Mean of the Aggregate sizes | 0.452 | 0.343 | 0.334 | 0.376 |
| RLSD 0.05       |               |         |         | 0.084    |

Table (6): Effect of the interaction between organic waste and soil aggregate sizes in saturated hydraulic conductivity (cm hr⁻¹)

| Aggregate sizes | Organic waste | <2 (mm) | <5 (mm) | <10 (mm) | Mean of the organic waste |
|-----------------|---------------|---------|---------|----------|--------------------------|
| Chicken         | 0.650         | 1.450   | 0.140   | 0.747    |
| Sheep           | 0.650         | 0.370   | 1.14    | 0.720    |
| Cows            | 0.397         | 0.590   | 1.080   | 0.689    |
| Control         | 1.093         | 0.323   | 0.220   | 0.546    |
| Mean of the Aggregate sizes | 0.698 | 0.683 | 0.645 | 0.675 |
| RLSD 0.05       |               |         |         | 0.372    |

Table (7): Effect of the interaction between organic waste and soil aggregate sizes in electrical conductivity (dSm⁻¹)

| Aggregate sizes | Organic waste | <2 (mm) | <5 (mm) | <10 (mm) | Mean of the organic waste |
|-----------------|---------------|---------|---------|----------|--------------------------|
| Chicken         | 13.183        | 12.770  | 15.093  | 13.682   |
| Sheep           | 7.960         | 14.340  | 15.053  | 12.451   |
| Cows            | 9.943         | 13.113  | 11.470  | 11.509   |
| Control         | 7.370         | 10.860  | 15.733  | 11.321   |
| Mean of the Aggregate sizes | 9.614 | 12.771 | 14.338 | 12.241 |
| RLSD 0.05       |               |         |         | 3.409    |
**Table (8):** The statistical analysis for F-test of the plant height (H), shoot wet weight (WW) and shoot dry weight (DW).

| Source | df | H    | WW   | DW    |
|--------|----|------|------|-------|
| A      | 3  | 12.429** | 11.676** | 11.737** |
| B      | 2  | 65.614** | 86.088** | 6.261** |
| AB     | 6  | 15.974** | 0.669ns | 0.507ns |

A = organic waste treatments; B = soil aggregate sizes treatments; ** = significant difference at level of 0.01; ns = there is no significant difference.

**Table (9):** Effect of the interaction between organic waste and soil aggregate sizes in Barley plant height (cm)

| Aggregate sizes | Organic waste | <2 (mm) | <5 (mm) | <10 (mm) | Mean of the organic waste |
|-----------------|---------------|---------|---------|----------|--------------------------|
| Chicken         |               | 46.000  | 39.500  | 33.167   | 39.556                   |
| Sheep           |               | 43.000  | 33.200  | 41.300   | 39.167                   |
| Cows            |               | 39.467  | 35.867  | 38.667   | 38.000                   |
| Control         |               | 45.267  | 30.667  | 26.367   | 34.100                   |
| Mean of the Aggregate sizes |               | 43.433  | 34.808  | 34.875   | 37.706                   |

RLSD 0.05 3.247

**Figure (1):** Effect of the organic wastes in mean weight diameter (mm)
Figure (2): Effect of the organic wastes in aggregation index

Figure (3): Effect of the soil aggregate sizes in aggregation index
Figure (4): Effect of the organic wastes in soil bulk density (Mg m$^{-3}$)

Figure (5): Effect of the organic wastes in soil total porosity (%)
Figure (6): Effect of the soil aggregate sizes in bulk density (Mg m$^{-3}$)

Figure (7): Effect of the soil aggregate sizes in total porosity (%)
Figure (8): Effect of the soil aggregate sizes in electrical conductivity (dSm$^{-1}$)

Figure (9): Effect of the organic wastes in barley plant height (cm)
Figure (10): Effect of the organic wastes in wet weight of barley plant (gm pot⁻¹)

Figure (11): Effect of the organic wastes in dry weight of barley plant (gm pot⁻¹)
Figure (12): Effect of the soil aggregate sizes in barley plant height (cm)

Figure (13): Effect of the soil aggregate sizes in wet weight of barley plan (gm pot$^{-1}$)
Figure (14): Effect of the soil aggregate sizes in dry weight of barley plant (gm pot⁻¹)