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# ROLE OF ADDITIVE IN MITIGATION OF THE NEGATIVE EFFECTS OF SALINE WATER ON CABBAGE (*BRASSICA OLERACEA* VAR. CAPITATA L.)

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## ABSTRACT

A field experiment was conducted during the agriculture season (2014 -2015) In Horticulture station of the Ministry of Agriculture in Mahaweel which located 20 km north of Babylon city in sandy clay loam soil, using randomized complete block design (RCBD) with Systematic Arrangement of Whole – plots, to study the Effect of irrigation water quality and organic and mineral fertilization on the availability of some nutrient elements and cabbage yield, The experiment included 72 Treatment caused by the interaction between the two factors, The first factor represents the salinity of irrigation water (W) at three levels (1.4, 3 , 6 ds $m^{-1}$) The second factor represents the organic and mineral fertilization (T) with eight in fertilizer transactions which are (Control), (Composting corn cobs 20 tons $h^{-1}$), (Composting Cattle 20 tons $h^{-1}$), (Composting corn cobs+ composting cattles 20 tons $h^{-1}$ ratio of 1: 1), (Chemical fertilization), (Composting corn cobs 20 tons $h^{-1}$ + Chemical fertilization), (composting cattles 20 tons $h^{-1}$ + Chemical fertilization), ((Composting corn cobs + composting cattles 20 tons $h^{-1}$ rate of 1: 1) + Chemical fertilization)). With three replicates. The results of the study Summarized as follow :

The raised of water salinity levels led to significantly raise the values of electrical conductivity of the soil and nutrient elements availability (N, P and K) in the soil and A slight decrease in the PH and cabbage yield . While adding organic fertilizer led to a significant decrease in the electrical conductivity of the soil and PH, Also led to a significant increase in the nutrient elements availability (N, P and K) in the soil and cabbage yield. Mixing compost + Chemical fertilizers has led to a significant increase in available N and P in the soil, and yield compared with the addition of each of them individually. The mixing treatment ((Composting corn cobs + composting cattle's 20 tons $h^{-1}$ rate of 1: 1) + Chemical fertilizers)) outperformed on other treatments to give the highest yield values reflected significantly on the product of cabbage (60.92 ton $h^{-1}$), There was a significant decline in the leaves contents of Nutrient (N, P, and K) , the ratio of Potassium to Sodium dry weight of leaves, chlorophyll content in leaves rising of irrigation water salinity, However all the previously mention characteristics were significant raised with addition of organic and chemical fertilizers whether alone or as mixture, the mixed treatments gave the higher averages in all of the pervious characteristics.

***Key words*** : Cabbage, Salt stress, Saline water, Organic fertilizers, Mineral fertilizers

## INTRODUCTION

Water scarcity is a major challenge for dry and semi-dry regions, Iraq suffers from a shortage of water resources used for agricultural purposes due to drought in recent years, the increase in the populations need for food led to increase the demand for water, resulting in the use of alternative water resources of poor quality, including the use of drainage water to compensate for the shortage of good water. The random use of salt water leads to negative results on the soil and the soil through the toxicity of some ions when increasing its concentration in irrigation water, such as sodium and chloride, the accumulation of salts in the soil lead to increased Osmotic pressure and food imbalance and when using this water requires the creation of ways and means for the purpose of successful use without the adverse impact of land productivity and environmental pollution (Phocaides, 2001; Al-Azawi, 2015). The study and researches indicated to the possibility of using this water in irrigation with the method of coexistence in its use with the good management of soil and water and the use of salt resistant cultivars (Al-Taey, 2009 and Yassin, 2010). Organic fertilization is the most important way to develop and raising the agricultural production value and reduce the environmental pollution resulting from the excessive use of mineral fertilizers. The nutrients balance in the soil and meet the basic requirements of plant nutrient elements throughout the growth stages. It also reduces the intensive needs of mineral fertilizers, Reduce the loss of nutrient elements forms, the organic fertilization can behave as a slow releasing material for nutrients to the soil and achieving the nutrients equilibrium after the end of plant growth for subsequent seasons (Al-Taey and Majid, 2018).

## MATERIALS AND METHODS

A field experiment was conducted during cultivation season (2014-2015) at the Horticulture Station of the Ministry of Agriculture in Al-Mahaweel,

located 20 km north of Babylon, to cultivate Cabbage (Globe Master cultivar) in soil with sandy clay loam texture. Soil samples were taken before planting for chemical and physical analysis as shown in Table (1). the experiment was divided according to Randomized Complete Block Design (RCBD), according to the Systematic Arrangement of Whole Plots (Al-Sahuki and Wahib, 1990) into three equal plots with a 3 m separators between Plots, Each experimental unit was divided into 24 experimental units with dimensions of 2.55 x 3 m and a total area of 7.65 m 2. Each experimental unit was divided into three furrows and the distance between furrows and the other was 0.85 m, leaving a 1 m separators between experimental units , The total number of units was 72 experimental units and the first factor represented salinity levels of irrigation water (W), with three saline levels (1.4, 3, 6 $dS.m^{-1}$), It was obtained by mixing the river water with saline water at different percentages to reach the required salt levels using a potable electrical conductivity device.

**Table 1:** Some chemical and physical traits to the soil of the experiment

| Traits | Unit | Value |
|---|---|---|
| Electrical conduction (EC) | $ds.m^{-1}$ | 7.1 |
| pH | - | 7.8 |
| Calcium | $mmol.L^{-1}$ | 14.40 |
| magnesium | | 13.10 |
| Sodium | | 19.32 |
| Potassium | | 0.24 |
| Chloride | | 21.5 |
| Sulfates | | 23.70 |
| Bicarbonates | | 2.9 |
| Carbonates | | - |
| Sodium adsorption rate (SAR) | $(mmol.L^{-1})$ (1/2) | 3.7 |
| Cation Exchange Capacity (CEC) | $cmol.kg^{-1}$ | 14.32 |
| Lime | $g.kg^{-1}$ | 255 |
| Gypsum | | 2.00 |
| Apparent density | $Mg.m^{-3}$ | 1.39 |
| Real density | | 2.5 |
| Organic materials (O.M) | $g.kg^{-1}$ | 8.89 |
| Sand | | 550 |
| Slit | | 180 |
| Clay | | 275 |
| Texture | SANDY CLAY LOAM (SCL) | |

The second factor is organic and mineral fertilizers and their mixture (T), with the eight treatments: T1 (control treatment, without addition), T2 (corn cobs compost, 20 $tons.h^{-1}$), T3 (Cattle manure 20 $tons.h^{-1}$) and T4 (corn cobs compost + Cattle manure, 20 $tons.h^{-1}$, 1:1), T5 (DAP 400 $kg.h^{-1}$), T6 ( 20 $tons.h^{-1}$ of corn cobs compost + DAP 400 $kg.h^{-1}$), T7 (Cattle manure 20 $tons.h^{-1}$ + DAP 400 $kg.h^{-1}$) and T8 (corn cobs compost + Cattle manure, 20 $tons.h^{-1}$, 1:1) + DAP 400 $kg.h^{-1}$).In this study, corncobs compost was used which taken from the organic fertilizer and fungus cultivation project of the Ministry of Agriculture in Babylon. Cattle manure was used after fermentation for three months and 1.5% fertilizer was added to accelerate the process of microbial degradation **,**Some chemical analyzes have been conducted for this fertilizer as shown in Table (2). The electrical conductivity and pH were estimated at extraction of (water: organic material) with ratio (1: 5). A sample of each organic fertilizer was extracted and dried at 60°C for estimation the total nitrogen and total phosphorus and total potassium by the methods used in plant analysis after digestion by a wet method.

**Table 2 :** Some chemical properties of organic waste fertilizers

| Traits | EC | PH | C/N | C | Total N | Total P | Total K | O.M |
|---|---|---|---|---|---|---|---|---|
| Unit | $ds.\ m^{-1}$ | - | - | $g.kg^{-1}$ | $g.kg^{-1}$ | $g.kg^{-1}$ | $g.kg^{-1}$ | $g.kg^{-1}$ |
| Corn cobs | 6.21 | 7.78 | 23.33 | 408.3 | 17.01 | 4.87 | 0.646 | 704.00 |
| Cattle manure | 13.13 | 8.03 | 15.82 | 221.56 | 14.00 | 12.23 | 5.32 | 399.40 |

The seeds produced from the Takii, Japanese Company were cultivated on 1-9-2014, the seedlings were moved to the field on 19/10/2014. Seedlings were distributed on the experimental units at a rate of 21 seedlings per one experimental unit divided into three furrows,. The distance between plant and another was 40 cm. Fertilization treatments were added according to the assigned amount (organic fertilizer at the level of 20 $tons.h^{-1}$, The chemical fertilizer The chemical fertilizer is ammonium diphosphate (DAP) 21% P, 18% N at 400 $kg.h^{-1}$) under cultivation line and at distance of 10 cm by opening a section along the length of the plant at a depth of 20 cm and cover the fertilizer with a layer of soil to prevent erosion before the irrigation process. Irrigation was conducted by plastic pipes with 2-inch diameter. All treatments were irrigated first irrigation with river water. The plants were irrigated when 50% drain from water availability and the quantities of water added to plots were calculated by weight method. Table (3) shows some chemical traits of the used irrigation water.

**Table 3:** Some chemical properties for irrigation water.

| Trait | W1 | W2 | W3 | Unit |
|---|---|---|---|---|
| Electrical conduction | 1.4 | 3 | 6 | $ds.m^{-1}$ |
| pH | 7.72 | 7.65 | 7.43 | - |
| Dissolved ions | | | | |
| Calcium | 3.52 | 5.00 | 7.40 | $mmol.L^{-1}$ |
| magnesium | 2.95 | 4.2 | 8.50 | |
| Sodium | 4.80 | 10.21 | 18.70 | |
| Potassium | 0.14 | 0.16 | 0.199 | |
| Chloride | 3.34 | 10.00 | 22.00 | |
| Sulfates | 1.8 | 5.50 | 9.40 | |
| Carbonates | - | - | - | |
| Bicarbonates | 2.10 | 2.80 | 3.50 | |
| Sodium adsorption rate | 1.89 | 3.37 | 4.69 | $(mmol.L^{-1})$ ^(1/2) |

After harvest the soil samples were taken from each experimental unit and the following analyzes were performed: the electrical conductivity, pH and nutrient elements availability (N, P and K) in the soil.

## RESULTS AND DISCUSSION

Nitrogen, phosphorus and potassium availability in soil; Table (4,5,6) show a significant elevation in NPK availability in soil with increasing salinity levels of irrigation water for irrigation water levels with electrical conductivity (1.4, 3, 6 $ds.m^{-1}$) This may be due to the increase in osmotic pressure in the soil solution due to the elevated the EC of soil solution, resulting in a lack of nutrients absorption by the plant, leads to inhibition of activity Microorganisms (Tuteja, 2005; Wenjn *et al*., 2008). The tables showed too, that there is a significant effect of compost treatments compared to the control treatment, except for the treatments of (cattle manures + chemical fertilizer, corn cobs compost + cattle manures + chemical fertilizer compared to the control treatment, This agree with (Al-Zaidi, 2011), that indicated the increase in NPK availability content due to organic fertilization, as the decomposition and oxidation of organic fertilizer by microorganisms contribute to the release of nitrogen from organic fertilizer. While the chemical fertilizer alone contributed to a significant decrease in the value of the nitrogen availability in the soil 93.08 $mg.kg^{-1}$ table (4), soil compared to the control treatment, this is due to the fact that the chemical fertilizer contains a high percentage of phosphorus, which plays a large role in increasing the root system and total vegetative, thus increase the absorption of nitrogen availability in the soil (Al-Mamoori, 2004; Al-Zaidi, 2011) indicated that the addition of mineral fertilizer has led to the reduction of nitrogen an potassium availability table (4, 6), but its increased the phosurus availability in the soil. If added with compost or individually table (5) As for the effect of the type of organic manures, the same table shows the difference in nitrogen available in the soil according to the type of organic manures for (corn cobs compost, cattle manures, corn cobs compost + cattle manures), respectively. The corn cobs compost gave the lowest average of nitrogen available in the soil and significantly differs from the rest of fertilizer. Fertilizer gave the highest average of nitrogen available in the soil and did not differ significantly from (corn cobs compost + cattle manures). These results agree with (Al-Fadhli, 2011; Al-Delfi, 2013) indicated that the amount of NPK varies according to the organic sources. The results showed that fertilizer with low C / N ratio as shown in Table (2) gave the highest values of nitrogen available in the soil, which is the cattle manures, which leading to the provision of sufficient nitrogen for the activity of microorganisms, and increasing efficiency in the analysis of manures and the addition of an increase from nitrogen available in the soil. It is also noted that all organic fertilization treatments significantly excelled in the increase of nitrogen available in the soil on organic + chemical fertilizer treatments, which gave an average of nitrogen available (103.06, 108.54, 106.93 $mg.kg^{-1}$ soil) for (corn cobs compost + chemical fertilizer, cattle manures + chemical fertilizer, corn cobs compost + cattle manures + chemical fertilizer), respectively. This result is consistent with (Eifediyi and Remison, 2010) where found that the amount of nitrogen available in the soil is higher in the case of organic fertilizer with chemical fertilizer than chemical fertilizer only have significantly excelled the increase in nitrogen available in the soil on the chemical fertilizers treatment only, which gave an average of nitrogen available (93.08 $mg.kg^{-1}$ soil), This indicates the efficiency of organic fertilizer due to the release of the element of nitrogen slowly and reduce the loss, also notes the superiority of organic fertilizer treatment is also.

**Table 4 :** Nitrogen availability

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 104.3 | 107.72 | 110.32 | 107.45 |
| T 2 | 109.3 | 110.6 | 119.3 | 113.06 |
| T 3 | 112.0 | 118.3 | 127.3 | 119.2 |
| T 4 | 111.3 | 118.1 | 126.7 | 118.7 |
| T 5 | 85.42 | 93.23 | 100.6 | 93.08 |
| T 6 | 94.78 | 103.6 | 110.8 | 103.06 |
| T 7 | 97.82 | 109.2 | 118.6 | 108.54 |
| T 8 | 96.7 | 106.9 | 117.2 | 106.93 |
| Average | 101.45 | 108.46 | 116.35 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 2.668 | N.S | | 3.167 |

**Table 5 :** Phosphorus availability

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 7.60 | 10.30 | 14.60 | 10.83 |
| T 2 | 10.20 | 12.90 | 15.20 | 12.76 |
| T 3 | 13.90 | 14.30 | 16.30 | 14.83 |
| T 4 | 13.20 | 14.0 | 17.00 | 14.73 |
| T 5 | 15.60 | 20.30 | 24.60 | 20.16 |
| T 6 | 17.00 | 20.90 | 25.20 | 21.03 |
| T 7 | 17.90 | 22.80 | 27.10 | 22.60 |
| T 8 | 18.20 | 23.20 | 27.80 | 23.06 |
| Average | 14.20 | 17.34 | 20.96 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 0.429 | 0.883 | | 0.510 |

**Table 6 :** Potassium availability

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 200.3 | 280.72 | 340.3 | 273.77 |
| T 2 | 283.5 | 317.0 | 395.6 | 332.03 |
| T 3 | 296.1 | 325.3 | 410.66 | 344.02 |
| T 4 | 330.1 | 337.8 | 408.3 | 358.73 |
| T 5 | 199.95 | 212.3 | 250.6 | 220.95 |
| T 6 | 240.3 | 299.7 | 360.3 | 300.1 |
| T 7 | 251.3 | 309.6 | 371.4 | 310.76 |
| T 8 | 285.96 | 320.2 | 379.9 | 328.69 |
| Average | 260.94 | 300.33 | 364.63 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 7.5 | 15.56 | | 8.9 |

## Electrical Conductivity (ECe)

Table (7) shows a significant increase in salinity of soil with increasing salinity of irrigation water. The averages of electrical conductivity of soil (5.64, 7.45, 9.49 ds.m$^{-1}$) for levels of salinity irrigation water with electrical conductivity (1.4, 3, 6 ds.m$^{-1}$) This is due to the difference in the ionic composition of the used irrigation water, as shown in Table (3), which leads to an increase in saline concentrations. This result is consistent with (Halub, 2014). Table (7) shows a significant differences in soil salinity between fertilizer treatments compared to the control treatment. Organic fertilization contributed significantly to soil salinity reduction (6.17, 7.35, 6.56 ds.m$^{-1}$) for (corn cobs compost, Cattle manures and corn cobs compost + Cattle manures), respectively, compared with the control treatment of (7.95 ds.m$^{-1}$). This is due to the fact that the addition of organic fertilizer to the saline soil reduced the soil density, increased porosity, improved construction and thus easy washing of salts (Tejada and Gonzalez, 2007). This results are agreement with (Al-Delfi, 2013) indicated to the low salinity of the soil when adding organic manures. While the chemical fertilizer alone contributed to a significant increase in the electrical conductivity of the soil 8.76 ds.m$^{-1}$ compared to the control treatment and this is agreement with (Mahdy, 2011) to increase soil salinity because of chemical fertilizer. The effect of the type of organic manures is shown in table (7). The soil salinity varies according to the type of organic manures. The average salinity was (6.17, 7.35, 6.56 ds.m$^{-1}$) for (corn cobs compost, Cattle manures, corn cobs compost + Cattle manures), respectively. corn cobs compost gave the lowest average of soil salinity and significantly excelled on all the treatments, while Cattle manures gave the highest average of ECe and a significant difference from the rest of the treatments, this may be due to the different role of organic manures sources in improving physical soil traits such improved soil permeability, increase salt washing in addition to What can be added by the organic source of salts may reduce its efficiency in reducing soil salinity (Mahdy, 2011). The difference between salinity of irrigation water and organic and chemical fertilizers in soil salinity was significant as it was the highest value of 11.58 ds.m$^{-1}$ when irrigated with irrigation water with electrical conductivity of 6 ds.m$^{-1}$ and addition of chemical fertilizers without adding organic fertilizer and differed significantly with The rest of the overlap treatments and the lowest value were 4.9 ds.m$^{-1}$ when using the river water and add corn cobs compost + Cattle manures. Table (7) shows the effect of salinity levels of irrigation water and organic and chemical fertilizers and their overlap in the electrical conductivity (ds.m$^{-1}$) of soil after harvest.

**Table 7 :** ECe in soil

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 5.92 | 7.94 | 9.99 | 7.95 |
| T 2 | 5.59 | 5.7 | 7.22 | 6.17 |
| T 3 | 5.87 | 7.72 | 8.46 | 7.35 |
| T 4 | 4.9 | 6.8 | 8.0 | 6.56 |
| T 5 | 5.98 | 8.72 | 11.58 | 8.76 |
| T 6 | 5.9 | 7.44 | 9.56 | 7.63 |
| T 7 | 5.94 | 7.9 | 10.8 | 8.21 |
| T 8 | 5.0 | 7.4 | 10.3 | 7.57 |
| Average | 5.64 | 7.45 | 9.49 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 0.185 | 0.380 | | 0.219 |

## Soil pH

Table 8 shows A significant differences between salinity levels of irrigation water on the degree of soil reaction, There was a significant decrease in the degree of soil reaction with increasing salinity levels of irrigation water, The average values of the degree of soil reaction were (8.30, 7.97, 7.65) for salinity of irrigation water with electrical conductivity of (1.4, 3, 6 ds.m$^{-1}$), respectively, this is consistent with (Al-Zaidi, 2011; Halub, 2014). Table 8 shows too a significant differences between fertilizer treatments on the degree of soil reaction. A significant effect of fertilizer treatments was observed compared to the control treatment except for the Cattle manures treatment, which has reduced the degree of soil reaction but not significantly. Organic fertilization has significantly reduced the degree of soil reaction (7.97, 8.01) for (corn cobs compost, corn cobs compost + Cattle manures), respectively, compared with the control treatment 8.27. This may be because the decomposition of organic fertilizer leads to the release of some organic acids that

have an effective effect in reducing the degree of soil reaction and the decomposition of organic fertilizer will result in the release of hydrogen ions to the soil solution, which contributes to reduce the degree of soil reaction. This may be due to the release of $CO_2$ for oxidation the organic material, the carbonic acid reduced the Ph degree in soil. This results are agreed with (Al-Delfi, 2013; Halub, 2014) indicated to a low degree of soil reaction when adding organic fertilizer.

**Table 8 :** pH in soil

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 8.5 | 8.31 | 8.00 | 8.27 |
| T 2 | 8.1 | 8.1 | 7.7 | 7.97 |
| T 3 | 8.4 | 7.99 | 7.8 | 8.06 |
| T 4 | 8.42 | 8.03 | 7.59 | 8.01 |
| T 5 | 8.29 | 7.83 | 7.55 | 7.89 |
| T 6 | 8.21 | 7.81 | 7.53 | 7.85 |
| T 7 | 8.24 | 7.83 | 7.52 | 7.85 |
| T 8 | 8.25 | 7.82 | 7.50 | 7.85 |
| Average | 8.30 | 7.97 | 7.65 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 0.196 | N.S | | 0.232 |

**N P K in leaves (%)**

Table (9, 10 and 11) showed a significant drooping in the NPK contents of leaves with elevation of salinity levels of irrigation water, respectively. These reduction with increasing of the water salinity leads to reduction of root growth and hence its inability to absorb nutrient elements (Al-Delfi, 2013; Halub, 2014; Al-Taey, 2017), which indicated a reduction of NPK content in the dry Weight of the leaves with an increase Irrigation water salinity levels. From the same tables, there is a significant effect in increasing the concentration of NPK in the leaves for fertilizer treatments compared to the control treatment as the organic fertilization significantly contributed to increase the concentration of NPK in the leaves, compared to control treatment tables (9, 10 and 11), These results are consistent with both (Al-Delfi, 2013; Al-Taey *et al*., 2018). This may be due to the increase in the soil content of NPK availability when organic fertilizers are added. Cooper (2008) showed that the increased NPK absorption by the plant is a function of nitrogen availability in the soil. As for The effect of organic manures type, Table (9, 10 and 11) showed that, the concentration of NPK varies according to the type of organic manures. Cattle manure and corn cobs compost + Cattle manure, respectively. The corn cobs compost gave the lowest average of nitrogen and did not differ significantly from cattle manures fertilizer treatment, The fertilizer of T4 (corn cobs compost + Cattle manure) gave the highest average of NPK in dry substance of leaves and significantly excelled on the other treatments and this may be due to the different role of organic fertilizers in the supply of soil with nutrients ,These results are agreement with (Al-Fadhli, 2011; Al-Delfi, 2013; Hamad, 2010) that the difference of organic manures added to the soil resulted in different concentration of NPK contents in the leaves. Same tables showed that chemical fertilization treatments have significantly excelled in the increase in the concentration of NPK in the leaves. Also note, the chemical + organic fertilizer treatment was significantly excelled in the increase NPK contents in leaves, it is noted that the organic + chemical fertilizer treatments significantly excelled in the increase NPK contents compare with the chemical fertilizer treatment only and the addition of organic fertilizer with the chemical fertilizer lead to increased absorption of NPK and its availability to plant tables (9, 10 and 11).

**Table 9 :** Nitrogen %

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 2.27 | 2.12 | 2.03 | 2.14 |
| T 2 | 2.36 | 2.20 | 2.11 | 2.22 |
| T 3 | 2.54 | 2.21 | 2.14 | 2.30 |
| T 4 | 2.63 | 2.41 | 2.35 | 2.46 |
| T 5 | 2.95 | 2.62 | 2.56 | 2.71 |
| T 6 | 3.01 | 2.73 | 2.63 | 2.79 |
| T 7 | 3.16 | 2.82 | 2.74 | 2.91 |
| T 8 | 3.32 | 2.87 | 2.83 | 3.01 |
| Average | 2.78 | 2.51 | 2.42 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 0.063 | N.S | | 0.075 |

**Table 10 :** Phosphorus %

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 0.132 | 0.112 | 0.052 | 0.098 |
| T 2 | 0.147 | 0.132 | 0.098 | 0.125 |
| T 3 | 0.166 | 0.135 | 0.113 | 0.138 |
| T 4 | 0.184 | 0.167 | 0.121 | 0.157 |
| T 5 | 0.211 | 0.198 | 0.138 | 0.182 |
| T 6 | 0.233 | 0.201 | 0.152 | 0.195 |
| T 7 | 0.251 | 0.221 | 0.156 | 0.209 |
| T 8 | 0.264 | 0.232 | 0.181 | 0.225 |
| Average | 0.198 | 0.175 | 0.126 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 0.004 | 0.008 | | 0.005 |

**Table 11 :** Potassium %

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 2.24 | 2.01 | 1.44 | 1.90 |
| T 2 | 2.50 | 2.28 | 1.50 | 2.09 |
| T 3 | 2.46 | 2.32 | 1.56 | 2.11 |
| T 4 | 2.66 | 2.36 | 1.72 | 2.25 |
| T 5 | 2.33 | 2.07 | 1.50 | 1.97 |
| T 6 | 2.73 | 2.39 | 1.81 | 2.31 |
| T 7 | 2.82 | 2.46 | 1.93 | 2.40 |
| T 8 | 2.99 | 2.50 | 2.10 | 2.53 |
| Average | 2.59 | 2.30 | 1.70 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 0.086 | N.S | | 0.102 |

## Yield

Table (12) shows a significant reduction in the total yield of Cabbage plants with increasing salinity levels of irrigation water with values of (60.72, 45.18, 36.06 tons.h$^{-1}$) for levels salinity of irrigation water with Ec (1.4, 3 and 6 ds.m$^{-1}$) On the other hand, the decrease in salinity of irrigation water can be attributed to increased salinity concentration in soils and increased osmotic pressure resulting in reduced absorption of water and nutrient elements. These results agree with (Mondel, 1983; Al-Taey and Saadoon, 2012, Al-Taey, 2018). The table (12) shows that there a significant effect of fertilizer treatments in the total yield compared to the control treatment, As organic fertilizer significantly contributed to increase the total yield of the plant (36.48, 42.10, 45.63 tons.h$^{-1}$) for (corn cobs compost, cattle manures, corn cobs compost + cattle manures), respectively, compared to the control treatment. This is due to the role of organic fertilizers in reducing the values of electrical conductivity of soil as shown in table (7) and increasing the nutrient availability (nitrogen, phosphorus and potassium) in the soil as shown in tables (4, 5, 6) in addition to improving soil properties. All this is reflected in the increase in the yield, these results are consistent with (Lakhdar *et al*., 2010; Al-Taey *et al*., 2017). Table (12) shows that the addition of chemical fertilizer alone or mixed with organic fertilizer has contributed to increasing the total yield of plant was significantly compared to the control treatment, may be due to the role of chemical fertilizers in increasing the nitrogen and phosphorus concentration in the plant, and low sodium concentration in the dry weight of leaves. In addition, the increase of phosphorus in the soil as shown in table (5) has led to the formation of a strong root system and thus leads to increased absorption of nutrient elements. The treatment of corn cobs compost + cattle manures + chemical fertilizer has given the highest average of the total yield of the plant (60.92 ton.h$^{-1}$) with significant difference from the rest of the treatments, As well as the superior of treatment of organic fertilizer + chemical on the rest of the treatments. As for the effect of the type of organic manures, Table (12) shows a significant difference in the total yield of the plant according to the type of organic manures. The total yield of the plant was (36.48, 42.10, 45.63 tons.h$^{-1}$) for (corn cobs compost, cattle manures, corn cobs compost + cattle manures), respectively, the fertilizer was given the highest rate of the total yield of the maize calves. The corn cobs compost gave the lowest average of the total yield of plant. This may be due to the difference in the effect of these fertilizers on the soil characteristics and the difference in their effect on salt washing and reducing the effect of salinity of irrigation water. In addition to the difference in the content of nutrients as shown in Table (2) and its role in increasing the readiness of nutrients and their content within the plant, These results agree with (Jablonska-Ceglarek and Rosa, 2003; Uddin *et al*., 2009; Pardossi, 2009). The organic and chemical fertilizer treatments, which gave an average of yield reached (55.57, 56.96, 60.92 tons.h$^{-1}$), these treatments were significantly excelled in the total yield of plant on the chemical fertilizer treatment only, this results agree with (Costa *et al*., 1991) that the presence of organic fertilizer with chemical fertilizer increases soil susceptibility to water retention and thus reduces nutrient elements loss and their availability increases for plant.From the same table, there is a significant effect of the interaction between salinity of irrigation water and organic and chemical fertilizer in the average of total yield of the plant and the highest value was (74.23 tons.h$^{-1}$) when irrigated with irrigation water at Ec of (1.4 ds.m$^{-1}$) and addition of corn cobs compost + cattle manures + chemical fertilizer, the lowest value was (18.88 tons.h$^{-1}$) when using irrigation water with an Ec of (6 ds.m$^{-1}$) and not add fertilizer. This refers to the role of organic and chemical fertilizers in increasing the occurrence and reducing the harmful effect of the high salinity of irrigation water on the plant. Fuchs *et al*. (1970) indicated to that the elements come from the mineral fertilizer increase the length of the roots and penetration of the soil and the formation of primary leaves, while the elements that are derived from organic fertilizer improve production

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**Table 12 :** Yield (ton/h)

| Fertilizers | Water quality | | | Average |
|---|---|---|---|---|
| | W1 | W2 | W3 | |
| T 1 | 104.3 | 107.72 | 110.32 | 107.45 |
| T 2 | 109.3 | 110.6 | 119.3 | 113.06 |
| T 3 | 112.0 | 118.3 | 127.3 | 119.2 |
| T 4 | 111.3 | 118.1 | 126.7 | 118.7 |
| T 5 | 85.42 | 93.23 | 100.6 | 93.08 |
| T 6 | 94.78 | 103.6 | 110.8 | 103.06 |
| T 7 | 97.82 | 109.2 | 118.6 | 108.54 |
| T 8 | 96.7 | 106.9 | 117.2 | 106.93 |
| Average | 101.45 | 108.46 | 116.35 | |
| L.S.D (0.05) | W.Q | Interaction | | Fertilizers |
| | W | W X T | | T |
| | 2.668 | N.S | | 3.167 |

## Conclusions

- The elevation of electrical conductivity in soil had a negative effect on reducing the plant growth and yield. While adding the organic and chemical fertilizers and their combination with chemical fertilizers have a positive effect in alleviation the harmful effect of the salt stress.
- The organic composted have achieved significant effect in reduce soil salinity and reduce the adverse effect of water salinity, while cattle manures have excelled in nutrients availability in soil.

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