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# SMART FARMING PRACTICES TO PROMOTE GROWTH AND PRODUCTIVITY OF ATRIPLEX (*Nummularia*) IN SALINE HABITATS

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**Abstract**

Salinity is one of the most serious environmental problems, since it is negatively affect agricultural production by limiting the growth and productivity of plants especially in arid and semi-arid regions of the world. Most developing countries suffer from a lack of cultivated area and fresh water supply due to the negative impact of climate changes. Therefore, growing non-traditional crops such as halophytes could be a proper solution to solve the problem of saline environments. For this purpose, two field experiments were carried out during 2014 seasons at the model farm of National Research Centre, El Tour, South Sinai to study the effect of addition of soil amendments ( Charcoal 5 kg/plant or Hydrogel 50 g/plant in addition to control treatment) and organic fertilizer [Chicken manure, Compost or mixture of composted *Sporopolus virginicus*, *Spartina patens* and *Leptochloa fusca* (1:1:1) + bio (yeast) 5 kg/ plant each in addition to control treatment as mineral fertilizers ] as well as their interaction effect on some growth characters and photosynthetic pigments content as well as some physiological aspects ( proline, soluble carbohydrates, succulence, sodium, potassium and K/Na ratio). Data showed that addition of 5kg chicken manure recorded the highest values of all the studies growth characters, photosynthetic pigments and potassium content as well as K/Na ratio and succulence as compared with other treatments. On the other hand the highest proline and sodium content recoded by addition of 5 kg compost, while the highest values of soluble carbohydrates were obtained by control treatment. However addition of soil amendments either charcoal or hydrogel positively affected all the studies growth and physiological characters with superiority to hydrogel. As for interaction effect, treating plants with 5 kg chicken manure in addition to hydrogel recorded the highest growth and photosynthetic characters as well as it improves all physiological aspects of Atriplex plant.

**Key words:** *Atriplex* - chicken manure - Compost – charcoal - Hydrogel – Saline habitat.

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## INTRODUCTION

Salinity is one of the most important environmental factors limiting crop production of marginal agricultural soils in many parts of the world. Salinity effects on plants include ion toxicity, osmotic stress, mineral deficiencies, physiological and biochemical perturbations, and combinations of these stresses (Munns et al., 2008, Ibrahim et al., 2011; Hussein et al., 2013). Salt ion toxicity has numerous deleterious effects on plants such as denaturing cytosolic enzymes. Salt stress affects many aspects of plant metabolism and, as a result, growth and yields are reduced. Excess salt in the soil solution may adversely affect plant growth either through osmotic inhibition of water uptake by roots or specific ion effects. High concentrations of salts have detrimental effects on plant growth (Ben Amor et al., 2005) and excessive concentrations kill growing plants. It is a well-known practice that grafting onto salt-tolerant rootstocks reduce crops sensitivity (Santa-Cruz et al., 2002) and growing media have an important influence on crops' resistance (Usanmaz et al., 2019).

Halophytes are distinguished from glycophytes by their tolerance of saline conditions. The use of halophytic plants in pasture and fodder production on saline soils is the only economically feasible solution available (Cabello and Ramas 2004). Halophytes are plants that grow naturally in saline environments, such as salt marshes, salt spans and salt deserts (Khan et al., 2005). Halophytic species differ widely in the extent to which they accumulate ions and their overall degree of salt tolerance (Ashraf, 2009).

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Atriplex species (saltbushes) are dominant in many arid and semi-arid regions of the world, particularly in habitats that combine relatively high soil salinity with aridity (Tawfik et al., 2010). Several species belonging to the genus Atriplex are well adapted to harsh environmental conditions and therefore constitute a useful material for the identification of physiological mechanisms and genes involved in biotic stress resistance. Atriplex is a halophyte saltbush species highly resistant to drought, salinity, and heavy-metal stress (Nedjimi et al., 2005).

Atriplex spp. are among a group of halophytes that complete their life cycle at high salinity levels and have the ability to accumulate high concentrations of micronutrients much greater than the required minimum (Ortiz et al., 2005). Atriplex spp. has increased biomass production with salt increments in the growth medium ranging from 5 to 10 g 1-1NaCl.A similar promotion of growth has also been reported for other halophytic species. It is suggested that Atriplex spp. may be more suitable for revegetating very saline soils and also be a good source of productive feed (Koyro, 2006). These plants could be promising since Atriplex species have special bladders in the leaves that act as salt sinks for the removal of the excess of salt. In the arid zones and other drylands, halophytic plants often dominate because of their tolerance to drought and salinity. Atriplex spp. are among the most salt-tolerant higher plants. They have adapted to salinity by tolerating salts internally and/or by excreting salt. There are some researches showing that biochar can be used to improve soil fertility and sequester carbon for reduction of carbon mitigation to mitigate climate change (Lehmann et al., 2009) and (Sohi, 2010). Charcoal is the dark residue consisting of carbon, and the remaining ash, obtained by removing water and other volatile constituents from vegetation substances (Laird, 2008). Charcoal is usually produced by pyrolysis at temperatures from 300 to 600 °C (Rajkovich, et al., 2012). Charcoal has also been shown to change soil biological conditions in terms of the quality and quantity of soil microorganisms (Kim et al., 2004). These changes may well have effects on nutrient cycles and soil structure which in turn can lead to differences in plants growth and productivity. The possible connections between biochar properties and the soil biota and their implications for soil processes have not yet been systematically described.

Water deficit ranks among the most important abiotic factors limiting the growth and productivity of plants. Hydrophilic polymers are used in horticulture and agriculture praxis as water absorbents for better water support of plants with partial water deficiency (Rehman et al., 2011and Andry et al., 2009). Other authors recommend hydrophilic polymers for replanting to decrease water stress (Wroblewska et al., 2012and Ruthrof et al., 2010). (Kumaran et al., 2010) describes hydrophilic polymers as agents with the ability to absorb 100–300 times their weight in water. (Kazanskii and Dubrovskii, 1992) mention the ability of hydrophilic polymers to improve soil water retention. ( Abd EL-Rehim et al., 2006) specify the benefits of a superabsorbent in the soil for the improvement of physical properties, better aeration, improved seed germination, and root system creation in heavier soil, and for increasing water retention in lighter soils. The use of hydrophilic matters could limit the negative impact of water deficit in vegetable production; this is due to more negative water potential and the ability absorb a huge amount of water, which consequently reduces the impact of environmental stress on the plant.

A similar effect in regulating water potential is used for pre-sowing hydration treatment (priming, osmoconditioning), as reported by (Olszewski et al., 2012). The ecosystem and human life have become under intense threat due to over-dependence on chemical fertilizers. Gradual consistent and systematic depletion of soil micro-flora and fauna, as well as an increase in leaching and soil erosion, are some of the problems of over-dependence on chemical fertilizer.

Hence the renewed interest in the proper and effective use of organic manure to maintain soil fertility (Olatuji et al., 2012).Application of manure is the key to soil fertility because it has rich contents of nitrogen, phosphorus, potassium, and many other nutrients which increase the productivity of soil (Mayer et al., 2003). Moreover, organic matter improves physical and chemical conditions of the soil by serving as a storehouse or supply for plant nutrients and by the positive impact microorganisms which increase fertility of soil (Tawfik et al., 2015) Organic manure also helps to improve the physical condition of the soil and provides the required plant nutrients.

**MATERIALS AND METHODS**

A field experiment was carried out at the Model Farm of National Research Centre, El Tour, South Sinai to study the impact of interaction effect of some soil amendments and organic fertilizer on some growth characters, photosynthetic pigments content, and crude protein content of Atriplex nummularia. Main plot was assigned to three treatment of soil amendment (charcoal 5 kg/ plant and hydrogel 50 g/plant in addition to controlling treatment (soil without charcoal and hydrogal). While sub-plots contained fertilizer treatment (Chicken manure 5 kg/plant, Compost 5 kg/plant, mixture of composted Sporopolus virginicus, Spartina patens and Leptochloa fusca (1:1:1) 5 kg/plant bio (yeast) in addition to control treatment(mineral fertilizer). Atriplex nummularia were transplanted at 6th Feb 2014 and grown under drip irrigation system with saline water (EC: 8.7 dSm-1), water analysis of Abo Kalam Well are presented in(Table 1). Each experiment included 12 treatments,(1.5 x 2 m distance between plants) i.e. 1400 plants/fed., the mechanical and chemical analysis of the soil was carried out by using the standard method described by (Klute, 1986), (Table2). Three replicate from vegetative samples for each treatment were taken at 3rd Sep 2014 to determine some growth characters i.e., plant height, number of branches, number of leaves, dry weight of leaves dry weight of the whole plant and leaf area as well photosynthetic pigments content as described by (Moran, 1982). Then samples were washed, dried thoroughly, then dried at 70° C to constant weight in an aerated oven to determine, proline (µg/g) according to (Bates et al., 1973), values of succulence (ratio of fresh weight/dry weight) according to( Tiku 1975). Soluble carbohydrates content determined by the method described by (Dubois et al., 1956).

The contents of sodium and potassium were determined in the digested material using Jenway flame photometer as described by (Eppendrof and Hing, 1970). K/Na ratio was also calculated for each treatment. crude protein (CP) was also calculated as described by (Chapman and Pratt, 1978) method by multiplying nitrogen contents by 6.25. The obtained data were subjected to statistical analysis of variance described by (Snedecore and Cochran, 1990).

**Table 1.** Water analysis of Abo Kalam well, El Tour. South Sinai.

| | | |
|---|---|---|
| PH | | 7.49 |
| $ECdS^{-1}$ | | 8.78 |
| Soluble Cations(Meg/L) | $K^+$ | 0.56 |
| | $Na^+$ | 69.26 |
| | $Mg^+$ | 11.94 |
| | $Ca^+$ | 21.64 |
| Soluble Anions(Meg/L) | $SO^-{}_4$ | 26.65 |
| | $CL^-$ | 74.27 |
| | $HCO^-{}_3$ | 2.43 |
| | $CO_{--}$ | - |

**Table 2.** Mechanical and chemical analysis of the soil.

| **Depth** | **Minerals** | **0-30 (cm)** | **30-60 (cm)** |
|---|---|---|---|
| Soil Texture | | Sandy Soil | Sandy Soil |
| PH | | 8.15 | 8.40 |
| EC(dsm-1) | | 15.12 | 4.52 |
| Soluble cations(meq/L) | $K^+$ | 0.40 | 0.24 |
| | $Na^+$ | 112.01 | 27.22 |
| | $Mg^{++}$ | 28.82 | 15.54 |
| | $Ca^{++}$ | 60.59 | 12.52 |
| Soluble anions(meq/L) | $SO^{--}{}_4$ | 61.57 | 10.64 |
| | $CL^-$ | 139.08 | 31.81 |
| | $HCO^-_3$ | 2.70 | 3.65 |
| | $CO^{--}$ | | - |

## RESULTS AND DISCUSSION

### Effect of some farming practices on growth of Atriplex

Data in (Table3) show that increases in growth characters were obtained by adding hydro gel as compared to the other treatments (control) and charcoal. Whereas hydro gel gave the highest value for all studied characters on growth (plant height (cm),number of (branches, leaves), dry weight of (leaves ,whole plant(g/plant) and leaf area ($cm^2$/plant). superabsorbent polymers caused improvement in crop growth by increasing water holding capacity in soil and delaying the duration to wilting point in drought stress (Boatright et al., 1997).When polymers are incorporated with soil, they retain large quantities of water and nutrients, which are released as required by the crop, crop growth could be improved with limited water and nutrient supply (Gehring and Lewis, 1980).Water conservation by hydrogel creates a buffered environment being effectiveness in short term drought tension and losses reduction in establishment phase. Proficiency in water consumption and dry matter production are positive crop reactions to superabsorbent (Woodhouse and Johnson, 1991). (Islam et al. 2011) reported that in arid and semiarid regions of northern China, plant height, stem diameter, leaf area, biomass accumulation and relative water content in maize increased significantly up to super absorbent polymer at high and very high doses, but optimum dose of super absorbent polymer for maize cultivation was 30 kg $ha^{-1}$. Lower rates (10 and 20 kg $ha^{-1}$) or higher (K 40 kg $ha^{-1}$) doses would neither be sufficient nor economical. Maize yield increased following superabsorbent polymer 15 kg $ha^{-1}$ with half the amount (150 kg $ha^{-1}$) of fertilizer by 11.2% under low, 18.8% under medium and 29.2% under high dose as compared to control receiving conventional fertilizer dose (300 kg ha-1). Addition of polymer to peat soil decreased water stress and increased the time to wilt (Karimi et al., 2009). Use of hydrophilic polymers as carrier and regulator of nutrient release was helpful in reducing fertilizer losses, while sustaining vigorous crop growth. Also observed in (Table3)the addition of chicken manure to the soil has been shown to significantly increase the growth characteristics under study as compared to the other treatments(control (mineral),compost and halophytic manure. These effects of chicken manure on plant growth may be related to the important role of nitrogen, phosphorus and potassium in plant tissues which reflects its vegetative growth. They play a vital role in photosynthesis, carbohydrate transport, protein formation, control of ionic balance, regulation of plant stomata and water use activation of plant enzymes and other processes (El-Tantawy et al., 2009 and El-Dissoky, 2008)**.** Results in (Table3) also indicated that, interaction between charcoal + chicken manure gave the best results for growth traits under study compared to other charcoal with organic fertilizer the explanation for this is due to charcoal can significantly improve both the physical and chemical properties of soil, the high surface area gives the charcoal ability to absorb large amounts of water to increase the water holding capacity of the soil and can help prevent the leaching of nutrients and reduce the need for costly fertilizer application (Khalifa and Yousef, 2015; Lehmann et.al., 2011; and Schmidt, 2012) and the positive functions of charcoal in the soil with addition of chicken manure with provides important elements to plant growth which help to increase photosynthesis leads to increased of plant growth rates. The superiority of the interaction between hyrogel + chicken manure as other compared interaction gave the highest rate of results for all studied traits on growth, hydrogel and had an impact on soil moisture content and provided water to plants with addition of chicken manure fertilizer increases the ability of soil to analyze the micro and macro elements to help the plant to grow (Chen et.al. 2010 and Landis, 2012)

**Table 3.** Effect of some farming practices on growth of Atriplex

| Soil amendment | Organic treatment | Plant height (cm) | Number of branches | Number of leaves | Dry weight of leaves/ plant(g) | Dry weight of whole/ plant(g) | Leaf area whole plant($cm^2$) |
|---|---|---|---|---|---|---|---|
| Control (without) | Control(mineral) | 89.0 | 34.3 | 390.2 | 74.8 | 662.2 | 2953.3 |
| | Compost | 80.3 | 32.5 | 353.5 | 71.7 | 636.4 | 2567.7 |
| | Chicken manure | 90.2 | 36.1 | 441.5 | 82.6 | 712.3 | 3051.5 |
| | Halophytic | 86.4 | 35.1 | 407.7 | 79.9 | 691.7 | 2973.2 |
| Charcoal | Control(mineral) | 104.3 | 40.4 | 442.2 | 85.9 | 799.2 | 3319.4 |
| | Compost | 94.7 | 35.5 | 431.6 | 83.6 | 710.4 | 3050.7 |
| | Chicken manure | 108.2 | 42.5 | 460.6 | 89.0 | 862.8 | 3319.8 |
| | Halophytic | 103.0 | 40.9 | 455.1 | 88.0 | 830.9 | 3274.2 |
| Hydrogel | Control(mineral) | 105.8 | 42 | 467.9 | 93.8 | 832.9 | 3168.0 |
| | Compost | 96.6 | 39.1 | 425.6 | 90.3 | 766.1 | 3091.3 |
| | Chicken manure | 108.6 | 43.5 | 482.0 | 99.5 | 857.5 | 3357.2 |
| | Halophytic | 104.0 | 42.3 | 444.7 | 96.3 | 860.1 | 3196.2 |
| Soil amendment mean | Control(without) | 86.5 | 34.5 | 398.2 | 77.3 | 675.6 | 2886.4 |
| | Charcoal | 102.5 | 39.8 | 447.4 | 86.7 | 800.8 | 3241.0 |
| | Hydrogel | 103.8 | 41.7 | 455.1 | 95 | 829.2 | 3203.2 |
| Organic Treatment mean | Control | 99.7 | 38.9 | 433.4 | 84.8 | 764.8 | 3146.9 |
| | Compost | 90.5 | 35.7 | 403.6 | 81.9 | 704.3 | 2903.2 |
| | Chicken manure | 102.3 | 40.6 | 461.4 | 90.4 | 810.8 | 3242.8 |
| | Halophytic | 97.8 | 39.5 | 435.9 | 88.1 | 794.3 | 3147.9 |
| L.S.D 5% | Soil amendment | 5.25 | 2.35 | NS | 4.36 | 35.69 | NS |
| | Organic treatment | 7.45 | 3.54 | 20.12 | 5.68 | 41.36 | NS |
| | Interaction SA*OT | 9.36 | 4.58 | 32.25 | 7.58 | 62.35 | NS |

**Effect of some farming practices on photosynthetic pigments of Atriplex**

Results in (Table 4) and (Figure1) clearly show that the soil amendment (hydrogel) had a significant effect in chlorophyll (a,b), carotenoids and total pigment. The use of halophyte matters could limit the negative impact of water deficit in vegetable growth this is due to more negative water potential and ability absorb a huge amount of water which consequently reduces the impact of environmental stress on plant physiology (Katerina and Martin, 2013). These increases might be due to the increased rate of quenching of chlorophyll fluorescence, which markedly increased plant biomass and this steady state was greater than the other soil amendment. Concerning the effect of the organic amendment, (chicken manure and halophytic manure) treatments on Atriplex comparing to the other treatments data in (Table4) and (Figure1) gave the greatest values of most studied characters over the other treatment. These results are in agreement with the obtained by (EL-Tantawy et.al., 2009; and Mohamed and Nermeen, 2017) the positive effect of organic fertilizers on chlorophyll a+b could be due to enhancement of photochemical efficiency of leaf since organic fertilizers alleviate salt stress with maintenance of cell form through improving permeability of plasma membranes due to the increase of ant oxidative enzymes . Data presented in (Table 4) and (Figure2) show the interaction effect between soil amendment (hydrogel) and addition chicken manure give the highest values on chlorophyll (a&b), carotenoids and total pigments. Soil amended hydrogel increase field capacity and reduces the impact of environmental stress with the addition of chicken manure increased the leaf area due to sufficient nitrogen availability and there for an increase on photosynthetic pigments which in turn improve the vegetative growth. These findings are also confirmed by (Shah et al., 2016; and Taufiq et al., 2017). Who found a greater leaf area with the application of poultry manure.

**Table 4.** Effect of some farming practices on photosynthetic pigments content of Atriplex

| Soil amendment | Organic treatment | Chlorophyll a mg/g fresh weight | Chlorophyll b mg/g fresh weight | Carotenoids mg/g fresh weight | Total pigment mg/g fresh weight |
|---|---|---|---|---|---|
| Control (without) | Control(mineral) | 1.22 | 0.69 | 0.38 | 2.29 |
| | Compost | 1.15 | 0.65 | 0.36 | 2.16 |
| | Chicken manure | 1.25 | 0.72 | 0.39 | 2.36 |
| | Halophytic | 1.26 | 0.73 | 0.40 | 2.39 |
| Charcoal | Control(mineral) | 1.36 | 0.83 | 0.47 | 2.65 |
| | Compost | 1.30 | 0.77 | 0.44 | 2.51 |
| | Chicken manure | 1.44 | 0.87 | 0.49 | 2.80 |
| | Halophytic | 1.42 | 0.85 | 0.48 | 2.75 |
| Hydrogel | Control(mineral) | 1.42 | 0.91 | 0.49 | 2.83 |
| | Compost | 1.34 | 0.86 | 0.47 | 2.67 |
| | Chicken manure | 1.49 | 0.92 | 0.51 | 2.92 |
| | Halophytic | 1.46 | 0.90 | 0.50 | 2.87 |
| Soil amendment mean | Control(without) | 1.22 | 0.70 | 0.38 | 2.30 |
| | Charcoal | 1.38 | 0.83 | 0.47 | 2.68 |
| | Hydrogel | 1.43 | 0.90 | 0.49 | 2.82 |
| Organic Treatment mean | Control | 1.33 | 0.81 | 0.45 | 2.59 |
| | Compost | 1.26 | 0.76 | 0.42 | 2.44 |
| | Chicken manure | 1.39 | 0.84 | 0.47 | 2.70 |
| | Halophytic | 1.38 | 0.83 | 0.46 | 2.67 |
| L.S.D 5% | Soil amendment | NS | 0.038 | NS | 0.09 |
| | Organic treatment | NS | NS | NS | NS |
| | Interaction SA*OT | NS | NS | 0.035 | 0.18 |

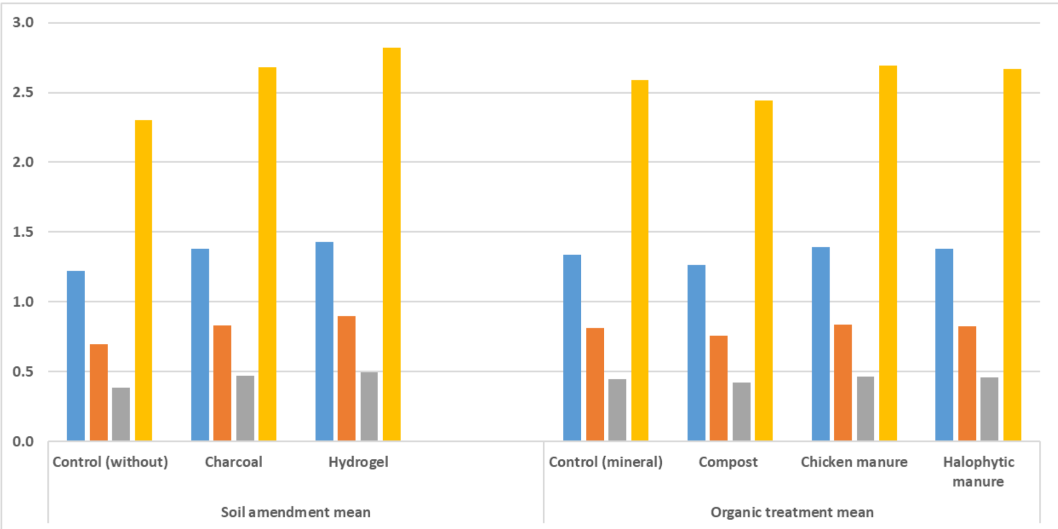


**Figure1.** Effect of some farming practices on photosynthetic pigments content of Atriplex (LSD 5%)

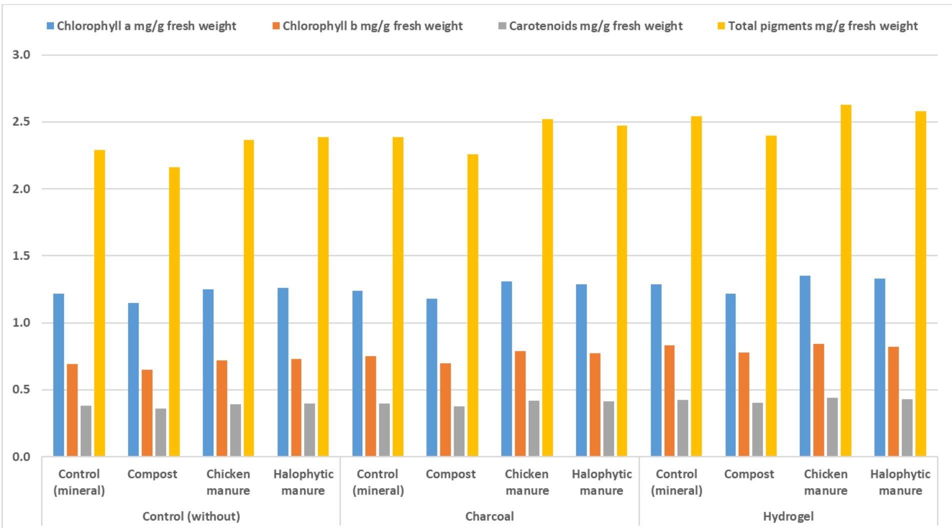


**Figure 2.** Interaction effect of some farming practices on photosynthetic pigments content of Atriplex (LSD 5%)

**Effect of some farming practices on some physiological aspects of Atriplex**

Data in (Table5) and (Figure 3)clear that all treatments significantly affected all the studied characters. It is also clear from the Table that the highest values for succulence, potassium content of leaves, K/N ratio and crude protein recorded in soil amendment (hydrogel) as compared with the other treatments. On the other hand, the highest values for proline, soluble carbohydrate and sodium content of leaves were recorded in soil amendment (control). (Table5) It also shows the effect of organic treatment on some physiological aspects of Atriplex. It is clear that all treatments significantly all the studied characters the highest values for succulence, the potassium content of leaves, K/N ratio and crude protein were recorded in plants fertilized with chicken manure as compared with the other treatments. On the other hand, the highest values for proline, the sodium content of leaves were recorded in plants fertilized with compost but the highest value of soluble carbohydrate was recorded in plants fertilized with mineral. Similar results were obtained by (Webb et.al., 2010; Rezk et.al.,2016; and Tawfik et.al., 2017) who stated that organic substances such as farmyard manure, animal manures, and composts can be used as amendments to increase and sustain the overall soil fertility. The same amendments could likely be considered for soil remediation in the salt-affected areas due to their high content of organic matter. The organic matter has several positive impacts on agricultural products such as the slow release of nutrients, improvement of soil structure and the production of soil against erosion. Results in (Table 5) and(Figure4)also indicated that interaction between soil amendment and organic fertilizers. It is clear that all treatment significantly affected all the studied characters the highest values for succulence, K/N ratio and crude protein were recorded in soil amendment (hydrogel)and chicken manure fertilizer as compared with other treatments. On the other hand, the highest value in potassium content of leaves was recorded in soil amended (hydrogel) and mineral fertilizer. On the other hand, the highest values for the proline and sodium content of leaves were recorded in control and compost fertilizer. Similar results were obtained by (EL-Tantawy et.al., 2009) who proved that organic manure improved the physical condition of the soil and provides the required plant nutrients and enhances cation exchange capacity and acts as a buffering agent against undesirable soil pH fluctuations

**Table 5.** Effect of some farming practices on some physiological aspects of Atriplex

| Soil amendment | Organic treatment | Proline content mg/g dry weight | Soluble carbohydrates % | Succulence | Sodium content of the leaves mg/g dry weight | Potassium content of the leaves mg/g dry weight | K/Na ratio |
|---|---|---|---|---|---|---|---|
| Control (without) | Control(mineral) | 352.79 | 48.33 | 3.52 | 20.23 | 10.58 | 0.52 |
| | Compost | 365.08 | 44.25 | 3.43 | 20.64 | 10.35 | 0.50 |
| | Chicken manure | 323.88 | 44.37 | 3.84 | 18.60 | 10.78 | 0.58 |
| | Halophytic | 338.28 | 46.87 | 3.67 | 19.44 | 10.68 | 0.55 |
| Charcoal | Control(mineral) | 329.52 | 45.56 | 3.77 | 18.94 | 11.55 | 0.61 |
| | Compost | 337.28 | 41.25 | 3.74 | 19.11 | 11.02 | 0.58 |
| | Chicken manure | 303.43 | 42.84 | 4.06 | 17.52 | 11.68 | 0.67 |
| | Halophytic | 314.71 | 43.26 | 3.94 | 18.10 | 11.47 | 0.63 |
| Hydrogel | Control(mineral) | 314.81 | 44.02 | 3.93 | 18.14 | 12.35 | 0.68 |
| | Compost | 329.92 | 40.23 | 3.82 | 18.70 | 11.87 | 0.63 |
| | Chicken manure | 290.74 | 41.56 | 4.20 | 16.82 | 12.23 | 0.73 |
| | Halophytic | 299.50 | 42.14 | 4.11 | 17.29 | 12.09 | 0.70 |
| Soil amendment mean | Control(without) | 345.01 | 45.95 | 3.62 | 19.73 | 10.60 | 0.54 |
| | Charcoal | 321.23 | 43.23 | 3.88 | 18.42 | 11.43 | 0.62 |
| | Hydrogel | 308.74 | 41.99 | 4.02 | 17.74 | 12.14 | 0.69 |
| Organic treatment mean | Control | 332.37 | 45.97 | 3.74 | 19.10 | 11.49 | 0.60 |
| | Compost | 344.09 | 41.91 | 3.67 | 19.48 | 11.08 | 0.57 |
| | Chicken manure | 306.01 | 42.92 | 4.03 | 17.65 | 11.56 | 0.66 |
| | Halophytic | 317.50 | 44.09 | 3.91 | 18.27 | 11.41 | 0.63 |
| L.S.D 5% | Soil amendment | 15.88 | 2.87 | NS | 1.12 | 0.61 | NS |
| | Organic treatment | 21.36 | 3.32 | NS | NS | 0.75 | NS |
| | Interaction SA*OT | 29.54 | 4.21 | NS | 2.01 | 1.1 | 0.055 |

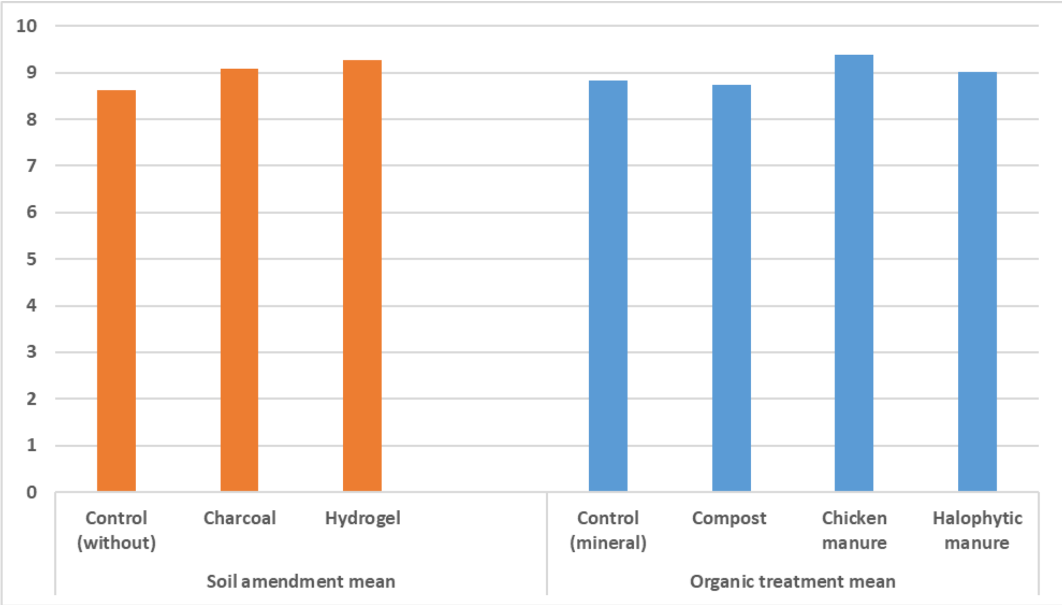


**Figure3.** Effect of some farming practices on crude protein % of Atriplex (LSD 5% : NS ).

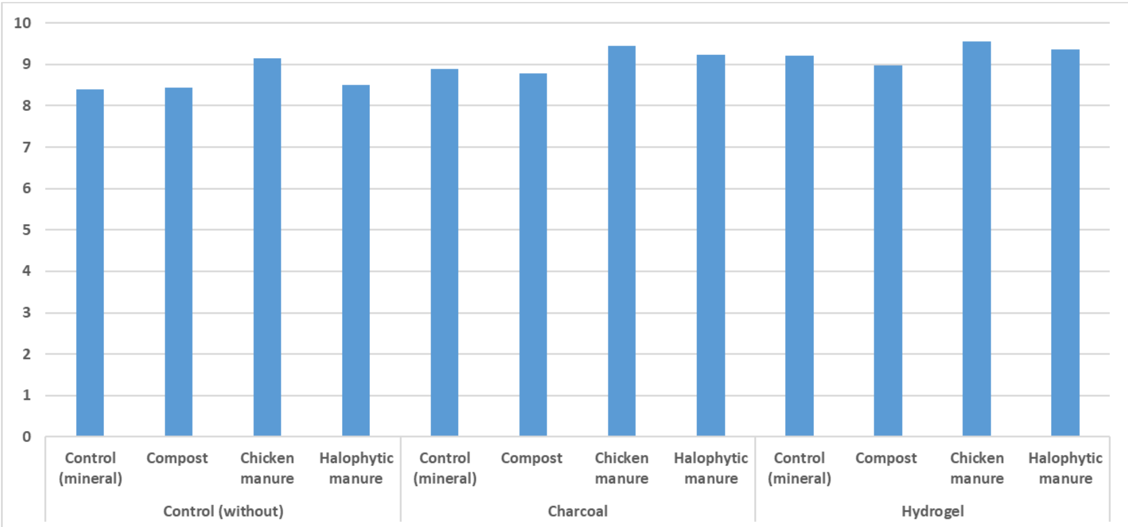


**Figure4.** Interaction effect of some farming practices on crude protein % of Atriplex (LSD 5%)

## CONCLUSION

This study proved the importance of application of organic fertilization, especially in new reclaimed salt-affected sandy soil. It is important to properly select organic materials, taking into consideration nutrients content timing and method of application. As a matter of fact, organic fertilization in saline and sodic soils fulfils the sustainability of resources use being able to recycle wastes locally stored thus contributing to solving the disposal problem of different agro-industrial wastes. This study also shows the positive impact of both hydrogel and charcoal improving yield and many agronomic physiological and chemical traits of Atriplex grown in salt-affected sandy soil. According it can be recommended the application chicken manure(5 kg/plant)in addition to hydrogel (50 g/plant)under saline sandy soil conditions.

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