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Effect of polyoxal and Seaweed Extract In soil salinity and yield of eggplant *Solanum melongena L.* Grown in plastic houses

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Abstract

This experiment was carried out in Al-Muthanna Governorate in one of the unheated greenhouses Dimensions (9 x 54 m) belonging to Experiment Station of agricultural research in Al-Bandar area on the side of the Euphrates River, belonging to the College of Agriculture / University of Al-Muthanna for the winter growing season (2021-2022), to study the effect of adding polixal 20-8 at four concentrations (0, 4, 8, 12 ml L^{-1}) and the effect of foliar spraying seaweed extract (Algaren) at four concentrations (0, 1.5, 3, 4.5 ml L^{-1}) in the readiness of Some nutrients and their concentration in the plant of growth yield of eggplant cv Barcelona. The treatments were assigned to experimental following a randomized completely block design (R.C.B.D.) with three replicates and means were compared according to L.S.D. test at the level 0.05. The results showed the significant superiority of adding a polixal (12 ml L^{-1}) on soil salinity and plant yield. The electrical conductivity when adding the transactions in the first batch amounted to 4.758 ds m^{-1} and the electrical conductivity when adding the transactions in the second batch amounted to 3.727 ds m^{-1}, and the electrical conductivity when adding the transactions in the third batch amounted to 2.653 ds m^{-1}. The total yield of the greenhouse was 566.37 kg dunums $^{-1}$.

Keywords: polixal 20-8, seaweed extract (Algaren), soil salinity, yield of eggplant *Solanum melongena L.*

Introduction

Altaie (1970) indicated that about (70-80%) of the land lies within the medium soils of central and southern Iraq to highly saline soils. Dry and semi-arid areas suffer from an increasing problem of soil salinization due to lack of rain, high temperatures and high evapotranspiration, which leads to the difficulty of soil and water management (Anwar *et al.* 2013). The most common dissolved salt is NaCl, and the soil is classified as saline when its ECe value reaches 4 ds m^{-1} (Munns and

Tester, 2008). The sodium ion Na is toxic to most plants, as is the chlorine ion Cl in high concentrations, and it is a growth inhibitor for many plants (Zhu, 2007). The concentration of sodium and chlorine ions in all parts of the plant can increase by increasing the salt stress in the soil, which leads to an ionic imbalance because of damage to the membranes of root cells and the accumulation of these two ions and affects the absorption of important ions for the plant such as calcium, potassium and magnesium (Hussain et al. 2014). For this reason, many countries of the world have been interested in the development of the agricultural sector by increasing the production unit per unit area of land to meet the increasing number of the population, which in turn led to the depletion of natural resources such as water, as well as the excessive use of chemical fertilizers and agricultural pesticides, which contributed significantly to pollution Water and soil (Bhat *et al.* 2009).

Seaweed Extract are one of the methods used to improve growth and yield. As these materials are used after drying or extracting them as a food source for the plant due to what they contain a large percentage of growth-encouraging substances, amino acids and vitamins (Abd El-motty *et al.* 2010). It was also found that it has a physiological role when sprayed on the plant or added to the soil, as it increases the plant's tolerance to salinity, drought and disease, and it is one of the organic sources used in the field of agricultural production). Spenelli, *et al.* 2009). The eggplant, *Solanum melongena* L., is one of the main summer vegetables. It is a vegetable crop of the Solanaceae family, which is one of the most important and important plant families that are grown all over the world. Its importance is represented in many aspects, including the use of its fruits as food in most countries of the world, including Iraq.

Material and methods:

The experiment was carried out in Al-Muthanna Governorate in one of the unheated greenhouses with dimensions (9 x 54 m) belonging to the Agricultural Research and Experiment Station - in the Al Bandar area located on the banks of the Euphrates River, belonging to the College of Agriculture / Al-Muthanna University during the winter growing season (2021-2022), to study Effect of adding polyxal 20-8 (A_0 control, A_1 4ml.L^{-1} ,A_2 8 ml.L^{-1} and A_3 12 ml.L^{-1}) and foliar spraying with seaweed extract (Algaren) (B_0 control, B_1 1.5ml.L^{-1} ,B_2 3 ml.L^{-1} and B3 4.5 ml.L^{-1}) on the growth and yield of eggplant, cv. Barcelona. The characteristics of vegetative growth and yield were studied. Randomized Completely Block Design (R.C.B.D) were used with three replicates. The means were compared according to L.S.D test at the level of 0.05. Nutrients in plants and soil and early yield were recorded as parameters.

Soil samples were taken randomly, at a depth of (0-30 cm), and the samples were mixed well for the purpose of conducting some physical and chemical analyzes before carrying out the experiment. As shown in Table 1.

Table 1: Physical and chemical properties of the soil before planting

Soil Particulate	**Value**

Sand	**283 g kg^{-1}**
Silt	**334 g kg^{-1}**
Clay	**383 g kg^{-1}**
Soil texture	**Clay loam**
pH	**7.8**
ECe	**7.9 dS m^{-1}**
O.M	**13.2 g kg^{-1}**
$CaCO_3$	**38.07 %**
$CaSO_4$	**1.67 %**
Available of N	**17.81 mg kg^{-1}**
Available of P	**13.76 mg kg^{-1}**
Available of K	**164.11 mg kg^{-1}**
Ca^{+2}	**371.3 C mol kg^{-1}**
Mg^{+2}	**203.8 C mol kg^{-1}**
Na^{+1}	**224.6 C mol kg^{-1}**
Cl^{-1}	**4282.0 C mol kg^{-1}**
HCO_3^{-1}	**102.1 C mol kg^{-1}**
CO_3^{-2}	**Nill C mol kg^{-1}**
SO_4^{-2}	**153.6 C mol kg^{-1}**

Laboratory measurements:

EC Electrical conductivity

The soil Saturated paste was prepared and electrical conductivity was measured using an electrical conductivity meter as described by Page *et al*. (1982).

Indicator of the yield

Indicator of the total yield of the greenhouse (kg. dunums $^{-1}$)

According to the weight of the yield of the cumulative multiple pick of the experimental unit throughout the harvest season until the last pick at the end of the season and converted into an area of dunums.

Factors

The experiment examined the effect of two variables:

First: Adding a anti salt Polixal 20-8 (manufactured commercially from the Spanish company Artal) (Table 2), symbolized by A, and it included four levels:

1. Add water only for comparison and symbolizing it with A_0.

2. Adding polyoxal in concentrations of 4 ml L^{-1} and denoting it with A_1.

3. Adding polyoxal in concentrations of 8 ml L^{-1} and symbolizing it with A_2.

4. Adding polyoxal in concentrations of 12 ml L^{-1} and symbolizing it with A_3.

Second: Spraying with seaweed extract (Algaren), which is a local fertilizer produced by the Iraqi Al-Joud Company belonging to the Abbasid Shrine (B) (Table 3), symbolized by B, and it included four levels:

1. Spray plants with water only and denote them with B_0.

2. Spray with seaweed extract at a concentration of 1.5 ml L^{-1} and symbolized by B_1.

3. Spray with seaweed extract at a concentration of 3 ml L^{-1} and symbolized by B_2.

4. Spraying seaweed extract with a concentration of 4.5 ml L^{-1} and symbolized by B_3.

Table 2: Polixal 20-8 components and their concentrations according to the Spanish-producing company Artal.

Contents	**Concentration (%)**
Calcium Oxide (CaO)	10.6
Polihidroxicarboxilic organic acids	26.4
Total Nitrogen (N)	6.2

Table 3: Seaweed extract contents :

Contents	**Concentration**
Sea Weeds	90 %
Natural auxins	10 mg L^{-1}
Natural cytokinins	0.027 mg L^{-1}
Nitrogen	0.4 %
Vitamins of B group B1,B2	(0.7,0.065) mg L^{-1}
Ca,Mg,Fe,Mn	(650,165,11,7) mg L^{-1}

The polyxal was added to the ground at a rate of three batches according to the instructions of the producing company, the first batch one day before planting, the second batch after 4 weeks, and the third batch after 5 weeks, using a 20-liter backspray.

It was sprayed with seaweed extract at a rate of 4 batches, The first batch after 10 days, the second batch after 3 weeks, the third batch after 4 weeks, and the fourth batch after 5 weeks, using a 20-liter hand sprayer to spray the plant until complete wetness.

agricultural Processes

The soil of the greenhouse was plowed twice in an orthogonal way and it was smoothed and leveled, and nitrogen, phosphorous and potassium fertilizers were added according to the recommended fertilizer recommendation: urea at 6 g plant^{-1}, triple superphosphate at 6 g plant^{-1} and potassium sulfate by 6 g plant^{-1} (half the fertilizer recommendation)) and in two batches, the first one month after planting and the second two weeks after adding the first batch (Al-Shahmani, 2014). The greenhouse is divided into three sectors. Each sector contains (16) experimental units, the dimensions of each of them are (2 m * 1.3 m), and between each experimental unit and another within each sector, and another isolation distance (90 cm) and the distance between one plant and another (50 cm) and between two ridges (70 cm).

Experiment design and statistical analysis

A factorial experiment was carried out on 384 seedlings of homogeneous vegetative growth using the randomized complete block design (R.C.B.D) and with three replicates, and they were randomly distributed, with (16) experimental units for each replicate and with two factors, so the number of experimental units is as follows:

48 = 4 * 4 * 3

(experimental unit) (factor two) (factor one) (replicators)

The data was statistically analyzed using the statistical program Genstsat after collecting the data from the field and tabulating it in the Excel program, then the arithmetic averages were compared using the L.S.D test under a probability level less than 0.05.

The agricultural area of the experimental unit = (the distance between one plant and another 0.5 * the number of plants for both plants is 8) + (the distance between the two plants (0.70)) = 3.1 m^2

Results and discussion

1. Electrical conductivity ECe

1-1. Electrical conductivity when adding transactions in the first batch

Table 4 shows the results of the electrical conductivity when polyoxal and seaweed extract treatments were added. The electrical conductivity rates ECe decreased significantly with an increase in the ground levels of polyoxal saline treatment, as it gave its value at the level A_3 of 4.758 dsm^{-1}, significantly lower than the rest of the treatments, with a decrease of 33.93 % compared to the comparison treatment A_0, which was 7.202 dsm^{-1}. The results showed that the seaweed extract had a significant effect for all foliar spraying rates and for the levels of B_1, B_2 and B_3 with rates of 6.681, 5.810, 4.958 dsm^{-1}, respectively, with a decrease of 7.88, 19.89, 31.64%, respectively, in relation to the comparison treatment B_0, which gave the highest rate. For the electrical conductivity, which amounted to 7.253 dsm^{-1}, note that the B_3 treatment was significantly lower in this way than the rest of the treatments (Table 4).

It was also observed that the combination between an additive agent for the polyoxal salt treatment and a spraying agent with seaweed extract significantly affected this trait, as the interaction combination A_3B_3 gave the lowest value for the electrical conductivity rate of 3.107 dsm^{-1} and a decrease of 62.23% compared to the

comparison combination A_0B_0, which reached a value of 3.107 Its electrical conductivity is 8.227 ds m^{-1}

Tab.4: effect of polixal and seaweed extract on the electrical conductivity of the soil at the first batch.

polyxal			**seaweed extract**		
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	8.23	7.21	7.17	6.20	7.20
A_1	7.85	6.74	5.95	6.13	6.67
A_2	7.11	7.49	5.30	4.40	6.07
A_3	5.83	5.28	4.82	3.11	4.76
Mean	7.25	6.68	5.81	4.96	
L.S.D.$_{0.05}$	**A= 0.367**	**B= 0.367**	**A*B= 0.735**		

1-2. Electrical conductivity when adding transactions in the second batch

The results of Table 5 showed that adding the saline treatment four weeks after the first addition had a significant effect on the electrical conductivity values, as the lowest electrical conductivity was recorded when treatment A_3 amounted to 3.73 ds m^{-1}, while the comparison treatment gave the highest rate of 5.89 ds m^{-1} and a decrease of its amount 36.69%.

While the levels of foliar spraying with seaweed extract recorded a significant decrease in the electrical conductivity values, as the spraying levels B_1, B_2 and B_3 gave rates of 4.89, 4.15, 3.55 dsm^{-1}, respectively, and significantly lower than the comparison treatment, which gave the highest value of the electrical conductivity rate of 5.75 ds m^{-1}. With decreases of 14.94, 27.77, and 38.15%, respectively.

The above table indicates that there was no significant effect between the combination treatments adding polyxal and spraying seaweed extract in this capacity.

Tab.5: effect of polixal and seaweed extract on the electrical conductivity of the soil at the second batch.

polyxal			**seaweed extract**		

	B_0	B_1	B_2	B_3	Mean
A_0	7.02	6.15	5.42	4.95	5.89
A_1	6.03	4.85	4.20	3.32	4.60
A_2	5.07	4.94	3.45	3.04	4.13
A_3	4.87	3.61	3.53	2.90	3.73
Mean	5.75	4.89	4.15	3.55	
L.S.D.$_{0.05}$	**A=0.426**	**B=0.426**	**A*B= N.S**		

1-3. Electrical conductivity when adding transactions in the third batch

The results of Table 6 showed that the addition of the polyoxal anti - salt at the third batch had a significant decrease in the electrical conductivity by increasing the treatment levels. The electrical conductivity rate was 4.59 dSm^{-1}, with a decrease of 25.85, 33.76, 42.7 % compared to the comparison treatment, noting that the A3 treatment was the most significant decrease in this capacity than the rest of the treatments.

While all treatments of seaweed extract foliar spraying recorded significant differences for treatments B_1, B_2 and B_3, where the averages were 3.55, 3.01 and 2.73 dSm^{-1}, respectively, compared to the control treatment B0, which gave the highest value of electrical conductivity amounted to 4.40 dSm^{-1}, with a decrease in its amount 19.33, 31.55, 37.85%. Note that the treatment of B_3 was significantly lower in this way than the rest of the treatments. The above table indicates that there was no significant effect between the interaction treatments between the treatments of polyoxal addition and foliar spraying with seaweed extract in this way.

Tab.6: effect of polixal and seaweed extract in the electrical conductivity of the soil at the third batch .

polyxal			**seaweed extract**		
	B_0	B_1	B_2	B_3	Mean
A_0	5.92	4.80	4.10	3.53	4.59
A_1	4.23	3.39	3.11	2.88	3.40
A_2	3.91	3.05	2.70	2.50	3.04
A_3	3.52	2.94	2.13	2.02	2.65
Mean	4.40	3.55	3.01	2.73	
L.S.D.$_{0.05}$	**A=0.311**	**B=0.311**	**A*B= N.S**		

The decrease in values in the results of the above tables 4, 5 and 6 can be attributed to the role of the ground addition of the polyoxal anti salt in reducing soil salinity through the speed of washing or removing the sodium ion, i.e. breaking the bonding of the sodium ion to the soil and replacing the calcium ion (which is present in the polyoxal compound and as It is shown in Table 2) instead, which facilitates the process of washing the sodium element to the lower layers and away from the root system of the plant. The soil and this is positively reflected in the readiness of nutrients and their absorption by the roots (McCauley, 2017). The decrease in these values for the same tables is also attributed to the contents of seaweed extracts in their composition on organic and amino substances and a group of growth-promoting substances, as well as nitrogen ready for absorption by the plant, which increases the vegetative and root growth of the plant, and that the increase in biological activities helps the plant to tolerate salt stress. And the increase in the amount of salt absorbed, which leads to a decrease in the electrical conductivity values in the soil.

2. Total greenhouse yield per hectare (kg dunums $^{-1}$)

The results of Table 7 showed a significant superiority of the rates of polyoxal treatments A_1, A_2 and A_3 434.57, 547.47, 614.98 kg dunum^{-1}, respectively, with the comparison treatment A_0, which recorded the lowest average of 342.38 kg dunums $^{-1}$ for the characteristic of the total yield of the greenhouse, as the percentage of increase appeared Amounts of 26.92, 59.90 and 79.76% respectively, and there were no significant differences between treatments A_3 and A_2 with this trait. The reason for the increase in the total yield of the plant may be attributed to the role of the polyoxal anti salt to reduce the effect of salts and increase the vegetative growth of the plant resulting from the increase in the amount of carbohydrates and the percentage of chlorophyll and proteins manufactured in the leaves, which led to an increase in the rate of flower knots and the number of Fruit set plant and thus increase the indicators of the total yield of plants (Al-Thafi, 2015).

As for foliar spraying seaweed extract treatment, it had a significant effect on the overall yield of the greenhouse, as the B_3 foliar spraying treatment gave the highest rate of 566.37 kg dunum^{-1}, with an increase of 33.39% over the control treatment, which recorded the lowest average of 424.07 kg dunum^{-1}, while No significant differences were recorded between the rate of treatment B_1 and B_2 432.54, and 516.41 kg dunum^{-1} respectively with the comparison treatment B_0. These results may be attributed to the role of seaweed extract, which contains many nutrients, because of the organic matter and nutrients that seaweed extracts contain, which positively affects the increase in root and vegetative growth, and consequently the number and weight of fruits, and then the total yield of the plant (Khan *et al.* 2012).

Regarding the combination between the treatments of ground addition of polyoxal and spraying with seaweed extract, the results indicate that there is no significant effect between the interaction treatments.

Tab.7: effect of polixal and seaweed extract on the total yield of the greenhouse kg

dunums $^{-1}$.					
polyxal			**seaweed extract**		
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	325.17	349.27	311.73	383.33	342.38
A_1	313.02	386.45	498.92	539.90	434.57
A_2	509.85	480.41	564.25	635.36	547.47
A_3	548.25	514.03	690.77	706.89	614.99
Mean	424.07	432.54	516.41	566.37	
L.S.D.$_{0.05}$	**A= 95.521**	**B= 95.521**	**A*B= N.S**		

References :

Abd El-Motty, E. Z., M. M. Shahin, M. H. Elshiekh and M. M. Abd-Migeed. (2010). Effect of algae Extract and yeast application on growth Nutritional status, yield and fruit quality of Keitte mango trees. Agric. Biol. J. N. Amer. 1(3): 421– 429.

Al-Shahmani, R. W. S. (2014). The effect of planting pattern and magnetic treatment of irrigation water and spraying with aminoalexin fertilizer on the growth and yield of *Cucumis sativus L*. eggplant (*Solanum melongena L.)* in protected cultivation. Master Thesis. Department of Plant Production - College of Agriculture - University of Al-Muthanna.

Al-Tahafi, S. A. A. , Hussain, A. S. , Habib, H. A. and Azab, N. A. (2015). Response of the yield of Gujarat plant (*Hibiscuss abdarffa L.)* to the addition of a salinity treatment (Clean salt) and spraying with organic fertilizer (Humic Aljohara) in high salinity soil. Kufa Journal of Agricultural Sciences, 7 (1) pp. 73-93.

Altaie, F. (1970) . Salt affected and water logged soils of Iraq. Report to siminar on methods of amelioration of saline and water logged soils. Baghdad state organization for soil and land reclamation Baghdad, Iraq.

Bhat N.R. , Suleiman M.K. and Abdal M.(2009) . Selection of crops for sustainable utilization of Land and Water resources in Kuwait. World J. of Agric , Sci . , 5 (2) : 201 – 206.

Khan, A. S. , Ahmad, B. , Jaskani, M. J. , Ahmad, R. and Malik, A. U. (2012). Foliar application of mixture of amino acids and seaweed (*Ascophylum nodosum*) extract improve growth and physico-chemical properties of grapes. Int. J. Agric. Biol. 14(3): 383-388.

McCauley, A. , Jones, C. , Olson-Rutz, K. (2017). Soil pH and organic matter. Nutrient Management Module No. 8, 4449-8. Montana State University/ Extension.

Muhammad, D. & Khattak, R. A. (2011). Wheat yield and chemical composition as influenced by integrated use of gypsum, pressmud

and FYM in saline-sodic soil. J. Chem. Soc. Pak., 33:82-86.

Page, A. L. , Miller, R. H. and Keeney , D. R. (1982). Methods of soil analysis . Part2 . chemical and Microbiological Properties . 2nd . ed. . am. Soc. Agron. , Inc., Soil Sci. Soc. Am. , Inc. Madison , Wisconsin. U.S.A.

Rana, C. H. and Raman, S. (1999). Water management related constraints of crop production in Gujrat (Western India). Irrigation under water scarcity . Vol 1 G – 17th ICID. Intl. Cong. On Irrigation and Drainage Granada, Spain. P. 161 – 170

Spinelli, F. , Fiori, G. , noferini, M. , Sprocatti, M. and Costa, G. (2009). Perspectives on the use of a seaweed extract to moderate the negative effects of alternate bearing in apple trees. J.of Hort.Sci. & Biotech. Special Issue 131-137.