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Effect of polyoxal and Seaweed Extract on some ions in soil, leaves and the early yield of eggplant Solanum melongena L. under protected cultivation

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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) affiliated to experiment station of agricultural research in Al-Bandar area on the side of the Euphrates River, affiliated to the College of Agriculture / University of Al-Muthanna for the winter agricultural season (2021-2022), to study the effect of adding polixal 20-8 at four concentrations (0, 4, 8, 12 ml L^{-1}) and spraying seaweed extract (Algaren) at four concentrations (0, 1.5, 3, 4.5 ml L^{-1}) on some ions in soil, leaves and the early yield of eggplant cv. Barcelona, The treatments were assigned to experimental following a randomized completely block design (R.C.B.D.). The results showed the significant superiority of adding a polixal (12 ml L^{-1}) on the concentration of calcium, sodium and chloride ions in soil and plant, the calcium ion concentration in the soil was 431.8 PPM, the sodium ion concentration was 150.37 PPM, and the chlorine ion concentration was 1869 PPM, while the calcium ion concentration in the leave was 966.1 PPM, the sodium ion concentration was 443.2 PPM, and the chlorine ion concentration was 241.92 PPM, and the early yield is 1.38 kg house $^{-1}$ Significant differences were also recorded for the results of spraying seaweed extract with a concentration of 4.5 ml L^{-1} on all studied traits, increasing the calcium concentration, and decreasing the sodium and chloride ions in the soil and plant as the calcium ion concentration in the soil was 395.3 PPM, the sodium ion concentration was 149.29 PPM and the chlorine ion concentration was PPM 2961, while the calcium ion concentration in the plant was PPM 948.4 and the calcium ion concentration in the plant was PPM 948.4. Sodium 431.9 PPM and chlorine ion concentration 241.92 PPM, and the early yield is 1.05 kg house -1.**Keywords: polixal 20-8, seaweed extract (Algaren), calcium, sodium, chloride ions, yield Early *Solanum melongena L***

Introduction

Dry and semi-arid areas suffer from an increasing problem of soil salinization due to the lack of rain, high temperatures and high evaporation-transpiration, which leads to the difficulty of managing soil and water (Anwar 2013). The most common dissolved salt is NaCl, and the soil is classified as saline when the ECe value reaches 4 dSi m^{-1} (Tester and Munns 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 can increase in all parts of the plant by increasing the salt stress in the soil, which leads to an ionic imbalance as a result of damage to the membranes of roots 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), The importance of the polyxal compound (Polixal 20-8) is not only on the soil, but also because it contains calcium, which has a key role in the formation of the cell wall and determining the degree of its permeability, in addition to its important role in seed germination and activation of enzymes in the process of division, elongation of cells and formation Proteins and carbohydrates and their transport, as well as plant protection from heavy metal toxicity (Al-Arabi, 2007). Marine algae extracts contain a wide range of vegetative growth promoters such as auxins, cytokinins, vitamins, organic and amino acids (Spinelli et al. 2009). It also contains polysaccharides, which have a wide range of effects on the vital activity of the plant (Osama et al. 2010). It has a role in many different enzymatic activities such as glutathione reductase and Superoxide dismutase. These extracts increase the content of chlorophyll in leaves as a result of the availability of Betaine, which contributes to preventing the decomposition of chlorophyll in addition to its great role as an antioxidant (Zodape et al., 2010). These extracts contain It contains nutrients necessary for the plant, including a group of major nutrients N, P, K and micro nutrients such as Fe, B, Mg, Zn, as well as plant hormone analogues, which are necessary to build protein and support the plant cell (Abdul Hafez, 2008). *Solanum melongena* L is one of the main summer vegetables and it is a vegetable crop of the Solanaceae family, which is one of the most important and important plant families grown all over the world.

The experiment was carried out in Al-Muthanna Governorate in one of the unheated greenhouses with dimensions (9 x 54 m) affiliated to the Agricultural Research and Experiment Station - in the Al Bandar area located on the banks of the Euphrates River, affiliated to the College of Agriculture / University of Al-Muthanna for the winter agricultural 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 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 calcium, sodium and chlorine ions in soil and plant leaves, in addition to the early of eggplant. 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:

1. Calcium Ca^{+2}

The soluble calcium ions were estimated by 1:1 extract by scaling method with Versenate according to what was mentioned in (1958, Jackson).

2. Sodium Na^{+1}

The measurement was made using a flame photometer, as described by Page *et al.* (1982).

3. Chloride Cl^{-1}

It was determined by grinding with a solution of (AgNO3 - N - 0.005) as described (1954, Richards).

Early Yield (kg $house^{-1}$)

The early yield represents the yield of the first three pounds.

Factors

The experiment examined the effect of two variables:

First: Adding a salt processor 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 denote it with A_0.

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

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

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

Second: Spraying with marine algae extract (Algaren), which is a local fertilizer produced by the Iraqi Al-Joud Company affiliated 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: Marine algae 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 house 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 plastic house 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 Merz and Merz (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 so there are 48 experimental units.

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) = 2.8 m^2

Results and discussion

Calcium soluble in the soil

The results of Table 4 showed that the ground addition of the saline treatment significantly affected the increase in the concentration of calcium in the soil, as it gave the rate of treatments A_1, A_2 and A_3 amounted to (338.2, 393.1, 431.8 PPM) sequentially with an increase of (9.80, 27.62, 40.19 %), respectively compared to With the comparison treatment A_0, it recorded the lowest rate of 308.0 PPM, noting that the treatment of A_3 was the most significant increase in this way than the rest of the treatments. While the spraying of seaweed extract had a significant effect on all treatments, as it recorded the highest rate of calcium concentration in soil B_3 (4.5 ml L^{-1}) amounting to 395.3 PPM and an increase of 18.49% compared to the comparison treatment B_0, which gave the lowest rate of 333.6 PPM.

As for the combination treatment between the ground addition of the saline treatment and spraying with marine algae extract, it showed significant differences on the concentration of calcium in the soil, as the highest rate of the A_3B_3 synthesis was recorded, amounting to 472.3 PPM, with an increase of 56.23% compared to the comparison treatment A_0B_0, which recorded the lowest rate of interaction amounting to 302.3 PPM. The significant increase of calcium in the soil may be attributed to the role of the saline processor in increasing the solubility of calcium-containing minerals, in addition to the

calcium originally present in the saline processor.

Tab.4: Effect of polixal and seaweed extract in the concentration of calcium in the soil.

polyxal			seaweed extract		
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	302.3	306.3	303.7	319.7	308.0
A_1	315.3	325.0	351.3	361.3	338.2
A_2	333.7	391.3	419.3	428.0	393.1
A_3	383.0	426.3	445.7	472.3	431.8
Mean	333.6	362.2	380.0	395.3	
$L.S.D._{0.05}$	**A=14.31**	**B=14.31**	**A*B=28.62**		

Sodium soluble in the soil

The results of Table 5 indicated that the polyoxal addition factor had a significant effect on the concentration of sodium in the soil, as it recorded a significant decrease for treatment A_3 (12 ml L^{-1}) amounting to 150.37 PPM compared to the comparison treatment A_0, which recorded the highest rate of 185.07 PPM and a decrease of 18.74%. The reason is attributed to the role of the calcium ion in the installation of the polyoxal salt processor, as it works to separate the sodium ion element and wash it away from the radical total. While it appeared in the same table that the spraying factor of marine algae extract also had a significant effect on the content of sodium concentration in the soil, as it recorded the lowest average of 149.29 PPM for treatment B3 (4.5 ml l^{-1}) with a decrease of 24.16% respectively compared to the control treatment, which was recorded The highest rate was 196.86 PPM.

With regard to the combination between the ground application of polyoxal and spraying with marine algae extract, the results indicated that there was a significant effect between the treatments on the character of sodium concentration in the soil, as the lowest rate of the interaction treatment was A_3B_3 recorded 133.53 PPM compared to the comparison treatment, which gave the highest rate of the combination amounted to 216.77 ppm with a percentage of a decrease of 38.40%. It may be attributed to the positive effect of the combination between the two factors on the concentration of sodium in the soil and the increase in the leaching of the soil.

Tab.5: effect of polixal and seaweed extract in the concentration of sodium in the soil.

polyxal			seaweed extract		
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	216.77	182.17	174.20	167.13	185.07

A_1	211.47	179.53	165.33	158.13	178.62
A_2	195.27	174.63	156.33	138.37	166.15
A_3	163.93	164.50	139.53	133.53	150.37
Mean	196.86	175.21	158.85	149.29	
L.S.D.$_{0.05}$	**A=3.736**	**B=3.736**	**A*B=7.471**		

chlorine soluble in the soil

The results of Table 6 showed that the polyoxal addition factor had a significant effect on the chlorine concentration in the soil, as the lowest rate of treatment A_3 (12 ml L^{-1}) was 1869 PPM, significantly lower than the rest of the treatments, including the comparison treatment A_0, which recorded the highest rate of 4274 PPM and a decrease Its amount is 56.27%. This decrease can be attributed to the role of calcium in the composition of the polyoxal salt processor in the property of hydroxyl and carboxylate, as they separate the sodium element from the soil and close it so that it does not stick to it or any other particles (McCauley *et al*. 2017). While the same table indicated that the spraying agent with marine algae extract also had a significant effect on the chlorine concentration in the soil, as the lowest average of 2961 PPM was recorded for B_3 treatment (4.5 ml L^{-1}) significantly lower than the rest of the treatments with a decrease of 16.68 % compared to the control treatment, which recorded the highest rate of 3554PPM, while no significant differences were recorded for treatment B_1 (1.5 ml L^{-1}) with B0 (control).

As for the combination treatment between the two mixtures of ground addition of the saline treatment and spraying with marine algae extract, significant differences were found between them on the character of the concentration of chlorine in the soil, as the lowest rate of the combination A_3B_3 was recorded, amounting to 1829PPM, with a decrease of 59.20% compared to the comparison treatment A_0B_0, which recorded the highest rate of combination reached 4483PPM, the reason may be due to the positive combination between two parameters and consequently the low concentration of chlorine in the soil through the processes of ion exchange of elements in the soil solution and dissolution and washing of chlorine.

Tab.6: effect of polixal and seaweed extract in the availability of chlorine in the soil

polyxal			seaweed extract		
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	4483	4406	4224	3983	4274
A_1	4286	4225	3800	3176	3872
A_2	3554	3626	3085	2857	3281
A_3	1891	1914	1842	1829	1869

Mean	3554	3543	3238	2961
L.S.D.$_{0.05}$	**A=120.300**	**B=120.300**	**A*B=240.500**	

Calcium concentration in leaves

The results of Table 7 showed that adding saline treatment to the soil had a significant effect on the calcium concentration in the leaves, as it gave the highest rates for treatments A1, A2 and A3 amounting to (840.20, 879.10, 966.10) PPM sequentially with an increase of 6.84, 11.78, 22.85%, respectively, compared to the comparison treatment. A0 recorded the lowest rate of 786.40PPM, knowing that the treatment of A3 was significantly lower in this way than the rest of the treatments. The increase in the proportion of calcium in the leaves can be attributed to the increase in the calcium concentration in the nutritional solution resulting from the addition of the ground to polyxal containing a percentage of calcium in its composition. As well as the solubility of calcium minerals in the soil (table 2). While the spraying of seaweed extract had a significant effect on all treatments, as it recorded the highest rate of calcium content of leaves B_3 (4.5 ml L^{-1}) amounting to 948.40 PPM and an increase of 20.24% compared to the control treatment B_0, which gave the lowest rate of 788.70PPM. Note that the treatment of B3 was significantly lower in this way than the rest of the treatments. The reason may be attributed to the content of the marine algae extract within its composition of calcium element for ready and absorbable by the leaves of the plant as well as the increase of plant activity and its ability to absorb more nutrients (Table 3). As for the combination treatment between the addition of the saline treatment to the soil and spraying with seaweed extract, there were significant differences between them on the characteristic of the concentration of calcium element from the leaves, as the highest rate of the combination A_3B_3 was recorded, which amounted to 1063.70 PPM, with an increase of 45.25% than the comparison treatment A_0B_0, which recorded the lowest rate of combination amounted to 732.30 PPM (Table 7). As a result of the positive effect of the combination between two treatments, it led to a noticeable increase in the calcium ion concentration in the leaves by increasing the leaf and root uptake of the plant.

Tab.7: effect of polixal and seaweed extract on calcium concentration in leaves.

polyxal	seaweed extract				
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	732.30	761.00	802.00	850.30	786.40
A_1	772.70	815.00	866.00	907.00	840.20
A_2	794.30	844.00	905.30	972.70	879.10
A_3	855.30	937.30	1008.00	1063.70	966.10

Mean	788.70	839.30	895.30	948.40
L.S.D.$_{0.05}$	**A=9.980**	**B=9.980**	**A*B=19.960**	

The concentration of sodium in the leaves

The results of Table 8 showed that the addition factor Polyoxal had a significant effect on the sodium concentration of plant leaves, as the lowest rate was recorded for treatment A_3 (12 ml L^{-1}) amounted to 443.20 PPM compared to comparison treatment A_0, which recorded the highest rate of 453.80 PPM and a decrease of 2.39 %, while there was no significant decrease between factor A_1 (4 ml l^{-1}) amounting to 453.40 PPM compared to control treatment A_0, which amounted to 453.80 PPM and A_2 448.80 ppm. The decrease in sodium ion can be attributed to the role of the polyoxal salt processor in the process of replacing calcium instead of sodium in the soil solution and its dimensions from the root zone (AL-Masoudi, 2021).

While the same table indicated that the agent sprayed with marine algae extract also had a significant effect on the sodium concentration characteristic of plant leaves, as it recorded the lowest averages of 400.80 and 431.90 PPM for the two treatments B_2 (3 ml L^{-1}) and B_3 (4.5 ml L^{-1}) sequentially and with a percentage a decrease of 6.05 and 7.61%, respectively, compared to the control treatment, which recorded the highest rate of 467.50 PPM. The reason for the decrease can also be attributed to the role of marine algae extract treatments in reducing the effect of sodium, which helped the plant to create mechanisms of adaptation to salinity by sequestering sodium ions and reactivating the absorption of nutrients and thus reducing its concentration in the leaves of the plant. Regarding the combination between the addition of polyoxal and spraying with marine algae extract, the results indicated that there was no significant effect between the treatments on the characteristic of sodium concentration content of plant leaves.

Tab.8: effect of polixal and seaweed extract on sodium concentration in leaves.

polyxal			seaweed extract		
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	470.00	468.00	437.00	440.00	453.80
A_1	474.30	460.00	447.30	432.00	453.40
A_2	464.70	457.70	442.30	430.30	448.80
A_3	461.00	450.00	436.30	425.30	443.20
Mean	467.50	458.90	440.80	431.90	
L.S.D.$_{0.05}$	**A=8.230**	**B=8.230**	**A*B= N.S**		

The concentration of chlorine in the leaves

The results of Table 9 indicated that the polyoxal addition factor had a significant effect on the chlorine concentration content of plant leaves, as the lowest rate of treatment A_3 (12 ml l^{-1}) was 241.92 PPM, significantly lower than the rest of the treatments, including the comparison treatment A_0, which recorded the highest rate of 263.33 PPM With a decrease of 8.13 %, while there was no significant decrease between factor A_1 (4 ml L^{-1}) which amounted to 259.17 PPM compared to treatment A_2 (8 ml L^{-1}) which amounted to 255.25 PPM. The reason for the decrease in the chlorine component in the soil may be attributed to the role of the polyoxal salt processor by breaking the bonding of the sodium ion and replacing the calcium ion, which facilitates the process of washing the chlorine ion and keeping it away from the radical total. Thus, the percentage of chlorine ion in the leaves decreases. While the results indicated in the same table that the spraying agent with marine algae extract also had a significant effect on the chlorine concentration of plant leaves, as the lowest averages were 257.75, 252.33, 241.92 PPM for treatments B1 (1.5 ml L^{-1}), B_2 (3 ml L^{-1}), B3 (4.5 ml l^{-1}) sequentially with a decrease of 3.84, 5.73, 9.62%, respectively, compared to the control treatment, which recorded the highest rate of 267.67 PPM. The reason for the decrease can also be attributed to the role of seaweed extract treatments in reducing the effect of chlorine, which is a poisonous ion for the plant. As for the combination treatment between the addition of the floor to the saline treatment and spraying with marine algae extract, there were significant differences between them on the content of the chlorine element content of the plant leaves, as the lowest rate of the combination of A_3B_3 was recorded at 220.00 PPM and with a decrease of 20.09% compared to the comparison treatment A_0B_0, which recorded the highest rate of combination. It reached 275.33 PPM. The reason may be attributed to the positive effect of the combination between the two factors on the role of the plant's vital processes, which led to a significant decrease in the concentration of chlorine in the plant leaves.

Tab.9: effect of polixal and seaweed extract on chlorine concentration in leaves.

polyxal			seaweed extract		
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	275.33	264.33	260.33	253.33	263.33
A_1	265.67	260.00	260.67	250.33	259.17
A_2	268.67	257.00	250.00	244.00	255.25
A_3	260.00	249.67	238.00	220.00	241.92
Mean	267.67	257.75	252.33	241.92	
$L.S.D._{0.05}$	**A=4.473**	**B=4.473**	**A*B=8.945**		

Early yield kg house^{-1}

The results of Table 10 showed that the polyoxal addition factor had a significant effect on the characteristics of the early yield of the plant, as it recorded the highest rate of treatment A_3 (12 ml L^{-1}) amounting to 1.38 kg $plant^{-1}$, significantly superior compared to the rest of the treatments, including control treatment A_0, where the yield reached 0.45 kg $Plant^{-1}$ with an increase of 205.30%. While there was no significant difference between factor A_1 (4 ml L^{-1}), which amounted to 0.53 kg $plant^{-1}$, compared to control treatment A_0, which amounted to 0.45 kg $plant^{-1}$. The reason for the increase in the total yield of the plant may be attributed to the role of the polyoxal saline processor to reduce salt stress and increase the vegetative and root system of the plant, which will help increase the manufactured amount of carbohydrates and proteins inside the plant and photosynthesis, which led to an increase in the rate of flower knots and the number of fruits per plant and thus increase the indicators of The early yield of the plant and this agrees with (Al-Tahafi, 2015).

While the results indicated that the spraying factor of marine algae extract also had a significant effect on the characteristics of the early yield of the plant, as it recorded the highest mean of 1.05 kg $plant^{-1}$ for B_3 treatment and an increase of 65.04% compared to the control treatment, which amounted to 0.64 kg $plant^{-1}$. While there was no significant effect of treatments B_1 and B_2 at rates of 0.68 and 0.85 kg $plant^{-1}$ respectively, compared to the control treatment, which amounted to 0.64 kg $plant^{-1}$. Vegetative growth and increase of biological processes and the manufacture of carbohydrates to meet the requirements of the plant and raise the rate of fruit set, and then increase the indicators of early yield of the plant (Hassan, 2010) and Althafi, *et al.* (2016) or it may also be attributed to the genetic nature of the Barcelona variety, whose plants are characterized by strength, hardness of fruits and density of vegetative growth Which increases the number of flower groups and thus increase the quantitative characteristics of the fruit, which was reflected in the increase in early yield (Kumar and Ram, 1987).

As for the combination between the two studied factors, namely the addition of polyoxal and spraying with marine algae extract, the results indicated that there was no significant effect between the treatments.

Tab.10: effect of polixal and seaweed extract on the early yield kg house $^{-1}$.

polyxal	seaweed extract				
	B_0	**B_1**	**B_2**	**B_3**	**Mean**
A_0	0.41	0.41	0.45	0.54	0.45
A_1	0.51	0.41	0.47	0.74	0.53
A_2	0.57	0.71	1.03	1.13	0.86
A_3	1.07	1.18	1.46	1.80	1.38
Mean	0.64	0.68	0.85	1.05	

L.S.D.$_{0.05}$	**A= 0.247**	**B= 0.247**	**A*B= N.S**

Conclusion : The treatment adding 12 ml. L-1 of polyxal with spraying 4.5 ml.L-1 of seaweed extract (Algaren) is the best treatment is recommended to increase yield and reduce salt ions.

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