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Effect of Salicylic Acid Spraying on Salt Tolerability of Cucumber (*Cucumis sativus L.*)

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Abstract

This study was conducted during seasons 2022/2023 in aprivate farms in Thi Qar governorate / Al-Fadliya area with the aim of improving the salinity tolerance of the cucumber Cucumis sativus L by foliar application of salicylic acid. The study included three concentrations of salicylic acid (0, 100, 200)% and three salt concentrations (2.5, 5, 10) $dS \cdot m^{-1}$ on the cucumber hybrid 'Rami. The design of the Randomized Complete Block Design (R.C.B.D) was used in afactorial experiment with two factors and three replicates. The results were analyzed using analysis of variance and treatment means were compared using the least significant differences (LSD) at 0.05. The referred treatments were studied as irrigation salt water levels 5% and 10% led to a moral decrease in all the indicators of the studied qualities, but the treatment External with salicylic acid with both concentrations 100, 200% led to a significant decrease/increase in all the qualities mentioned above, but the overlaps between the treatments used in the experiment gave the treatment 2.5 dS M^{-1} salinity treatment with 200% salicylic acid, the highest height of the plant, the largest dry weight, the most content of chlorophyll and carbohydrates, with values reaching 72.1 cm, 17.3 g, 23 mg . 100 gm^{1-} , 1.383 mg. gm^{1-} respectively.

Keywords: Salicylic Acid, *Cucumis sativus L.* , Environmental stress , Salinity, Al-Fadliya area

Introduction

Cucumber plant *Cucumis sativus L*. It is and the world. It is grown in the fields during the one of the plants of the Cucurbetaceae family, summer and spring. It is one of the important which includes 117 genera and 825 species. It is summer crops known to man since ancient also one of the most important vegetables in Iraq

times.China, Central Africa and India are its original habitat, [1].

The salinity of irrigation water is one of the main problems that hinder agriculture globally, especially in dry and semi-arid areas [2].The problem of salinity in Iraq has increased recently, due to the lack of rainfall and water sources, the deterioration of their quality, poor management, the lack of sanitation and global warming and high groundwater levels, which led to an increase in the salinity of the soil in the irrigated areas in central and southern Iraq [3];[4]. Therefore, it has become necessary to use some alternative technologies at present in order to improve the salt tolerability of the cucumber plant, and one of these techniques is the use of Salicylic acid is not a mineral element, but rather an organic phenolic compound [5]. Among the different compounds which have been used to reduce the harmful effects of salinity is acid. Salicylic acid has an important role in the plant's tolerance to Osmotic Stress, Salt Stress, Heat Stress, and the many physiological roles of salicylic acid in plant growth, development and detection [6], and given its role in reducing the effect of salt tension, and the frequent use of cucumber crop in daily consumption, and to work to increase the quotient of cucumbers and improve its quality, and given the lack of previous studies on the use of salicylic and its effect on the quotient of cucumbers grown in unheated greenhouses, so this study aims to evaluate the response of the cucumber plant to the RAMI hybrid under Plastic house conditions to the effect of spraying with salicylic to improve plant growth.

Literature Review:

Salt stress:

Since most of the world's water contains about 30 grams of sodium chloride per liter, the globe is the planet planet Salty [2], and because most plants, especially vegetable crops, cannot grow in high salt concentrations, as only salt plants are the ones that can grow, which is called Halophytes in solutions of sodium chloride higher than 40 dS M^{-1} [7], so salinity is a continuous threat that affects food production globally, as excessive salinity in the soil may result from natural processes or from crop irrigation processes with salty irrigation water the preposition "with" makes the sentence unclear and disjointed. mainly in arid and semi-arid areas of the world, where plant growth inhibits and greatly reduces the occur rent, and salt stress affects the growth and development of the plant in many respects and that salt stress is one of the types of environmental tension (biotic) A biotic or environmental stress, which occurs when the concentration of salts in the soil solution increases from (1500) parts per million (2.5 dS M^{-1}), which is the ideal concentration of salts necessary for the growth of a Typical crop [8].

The role of salicylic acid in increasing the plant's resistance to salt stress :

Salicylic acid is considered one of the phenols that play a major role in regulating the process of growth and detection in plants, as it was found that salicylic and similar compounds affect the plant in many physiological aspects. Salicylic acid also has an important role in biotic stress to which plants are exposed. Salicylic acid also has a role in encouraging the process of biosynthesis of Tuberonic acid or jasmonic acid, which leads to the formation of tubers in potatoes [9]. It was also found that salicylic acid plays an important role in the plant's tolerance of Osmotic Stress, Salt Stress and Heat Stress and given For the many physiological roles of salicylic acid in plant growth, development and detection, this compound has been added to the list of known plant hormones such as auxins, cytocanins and gibberelins, and no ways it is considered a natural plant hormone [6]. It turned out that the external treatment of salicylic acid is very effective in reducing the damage of salinity on the barley plant [10]. and it got the same result in the corn plant by [11], and that the addition of 0.1 µm salicylic acid encouraged the growth of plants under salty conditions in the

sunflower plant [12], and that soaking the seeds in different concentrations 10-6, 10-4, 10-2 mg/l of salicylic acid led to an increase in the leaf area and the content of the leaves of clophyl, especially at the concentration (10-2 mg/l). The treatment of wheat gestures at a concentration of 100 mg/l of salicylic has led to a significant reduction in salinity damage by a degree [13]. Treatment with salicylic acid has also led to increased levels of calcium ions in the cytoplasm and the increase in calcium levels in the cytoplasm, which is considered the second messenger, in many physiological processes, including the stimulation of the gene expression process that helps plants adapt to salt stress conditions [14].

Materials and Methods:

The research was carried out in one of the civil orchards in the Al-Fadhlia area in Thi Qar Governorate for the period from 15/7/2022 AD to 15/9/2022 to find out the effect of spraying with salicylic acid on the plant's ability to withstand the salt of the RAMI hybrid plant.

Preparing it in the middle of agriculture:

A soil of special nurseries was used and in sufficient quantities, and cleaning and washing operations were carried out before use, and random samples were taken for the purpose of analysis, and then the soil was distributed on polyethylene bags with a capacity of 5 kg and equally, and then it was irrigated to the field capacity before planting the seeds in it.

Levels of salinity:

Three levels of irrigation water salinity were applied (2. 5 , 5 , and 10) ds M^{-1}, and the control was (2) ds M^{-1}. As for the other salt levels, they were prepared by dissolving sodium chloride in distilled water according to the required concentrations and calculated using the electrical conduction device. E.C. The plants were irrigated with distilled water at the beginning of the experiment until treatment at saline levels three weeks after seed cultivation.

Salicylic Acid treatment :

A solution of salicylic acid was taken from the company (Fluka.AG. Chemische Fabric) and three concentrations were prepared (zero, 100 mg/l and 200 mg/l) with the addition of the diffuser (Tween-20 0.01%). Salicylic acid was sprayed on the leaves until completely wet. The plants were sprayed every seven days until the end of the experiment, and the spraying began three weeks after planting the seeds.

Experimental design and treatments :

The experiment was conducted with two factors workers according to the design of the complete random sectors (R.C.B.D.) Randomized Complete Block Design with three repetitions. The experiment included two factors, the first factor is spraying with salicylic acid (3) and salinity levels of irrigation water (4) using the design of the complete random sectors C.R.B.D. At the rate of three repeaters per transaction, the results were analyzed using the statistical analysis program t dec-2008)-31 Genstat and then compared the differences between the averages using the lowest moral difference R.L.S.D. And at the level of probability of 5% the narrator and the successor of God [15].

Table (1) Some chemical and physical properties.

Parameters	Unit	Valu
pH	—	6.3
E.C		0.3
N	($gm.kg^{-1}$)	0.92
P	($gm.kg^{-1}$)	3.6
K	($gm.kg^{-1}$)	11.5
$CaCO_3$	($gm.kg^{-1}$)	099.1
O.M	(gm.kg-1-)	0.2
CO_3	Meq/L	0.111
HCO_3	Meq/L	0. 512
Sand	%	44
Clay		19
Silt		37
Texture		Sandy clay loam

Experimental measurements:

1- Plant height (cm)
2- Dry weiht of shoot system (gm)
3- Estimating the total content of chlorophyll in leaves (mg . 100 gm^{1-})
4- Estimating the total content of carbohydrate in leaves (mg. gm^{1-})

Result and discussion :

The results in Table (2) indicate that salicylic levels (100 and 200 mg/l) caused a significant increase in the height of the plant compared to untreated plants and with increases of (19.07 and 10.84%) respectively, and there are no significant differences between salicylic concentrations. The results showed that the concentrations of salinity (5,10) led to a moral decrease in the height of the plant compared to the concentration (2.5(The treatment of interference between salicylic and salinity showed a moral effect on the height of plants, as the treatment gave (200) salicylic with the treatment of (2.5) the highest height of the plant of (72.1) while the increase in the concentration of irrigation salinity greatly affected the height of the plant if the concentration (10) was given the lowest height of the plant of (39.9).

Table (2) The effect of salt tension and spraying salicylic acid and interfering between them on plant height.

salicylic acid salinity levels	0	100	200	Average salinity levels
2.5	60.4	62.5	72.1	65
5	49.1	55.7	57.8	55.2
10	39.9	47.4	48.1	45.3
average salicylic acid	49.8	55.2	59.3	
L.S.D $P \leq 0.05$				
Salicylic * salinity	salinity			Salicylic
6.16	4.80			4.80

The results in Table (3) showed that salicylic levels (100 and 200 mg/l) to a significant increase in dry weight compared to untreated plants and with increases of (23.52 and 16.80%) respectively, and there are no moral differences between salicylic concentrations.

The results showed that the concentrations of salinity (5,10) led to a moral decrease in dry weight compared to the concentration of (2.5)

The interference treatment between salicylic and salinity showed a moral effect in the dry weight, as the treatment gave (200) salicylic with the treatment of (2.5) the largest weight of (17.3) while the increase in the concentration of irrigation salinity greatly affected the dry weight if the weight in concentration reaches (10) the lowest amount of (9.4).

Table (3) The effect of salt tension and spraying salicylic acid and interfering between them on Dry weight (gm)

salicylic acid salinity	0	100	200	Average salinity levels

levels				
2.5	14.1	16.6	17.3	16
5	12.2	13.4	15.5	13.7
10	9.4	11.7	11.5	13.5
average salicylic acid	11.9	13.9	14.7	
L.S.D P ≤ 0.05				
Salicylic * salinity			salinity	Salicylic
2.50			1.60	1.60

The results of Table No. (4) indicated that the concentrations of salicylic (100 and 200 mg/l) achieved a significant increase in the chlorophyll content of the leaves compared to untreated plants and with increases of (14.28 and 18.83%) respectively, and there are no moral differences between salicylic concentrations.

The results indicated that saltiness concentrations (5, 10) led to a moral decrease in the chlorophyll content of the leaves compared to the concentration (2.5) .

Also, the interaction treatment between salicylic and salinity showed a moral effect in the contents of the leaves of chlorophyll, as the treatment gave (200) salicylic with a treatment of (2.5) more content of chlorophyll of (23), while the increase in the concentration of irrigation salinity greatly affected the content of the leaves of chlorophyll if the content of chlorophyll in the concentration reaches salty 10 and not treated with salicylic is less amount of (15.2).

Table (4) The effect of salt tension and spraying salicylic acid and interfering between them on the total content of chlorophyll in leaves (mg . 100 gm^{1-})

salicylic acid salinity levels	0	100	200	Average salinity levels

2.5	21.2	22.9	23	24.4
5	17.5	20.5	20.7	19.6
10	15.9	19	18.9	17.9
average salicylic acid	18.2	20.8	20.9	
L.S.D P ≤ 0.05				
Salicylic * salinity			salinity	Salicylic
2.19			1.09	1.09

The results in Table (5) showed that salicylic levels (100 and 200 mg/l) led to a significant increase in this trait and increased by (60.57 and 93.59%) respectively, and there are no moral differences between salicylic concentrations.

The results showed that the concentrations of salinity (5,10) led to a significant decrease in the mentioned quality compared to the concentration (2.5).

The treatment of interference between salicylic and salinity showed a moral impact in this trait, as the treatment gave (200) salicylic with a treatment of (2.5) the largest carbohydrate content in the leaves of (1.383), while the increase in the irrigation salinity concentration greatly affected if the content of carbohydrates in concentration (10) reaches the lowest amount of (0.591).

Table (5) The effect of salt tension and spraying salicylic acid and interfering between them on the total content of carbohydrate in leaves (mg . gm^{1-})

salicylic acid / salinity levels	0	100	200	Average salinity levels
2.5	0.814	1.136	1.383	1.111
5	0.551	0.749	0.696	0.665
10	0.409	0.590	0.768	0.589
average salicylic acid	0.591	0.825	0.949	
L.S.D P ≤ 0.05				
Salicylic * salinity			salinity	Salicylic
0.158			0.079	0.079

It is observed through the previous tables that irrigation at salt levels (5, 10)) ds M^{-1} It led to a clear decrease in all the studied qualities compared to irrigation with salty water (2.5)) ds M^{-1} As the decrease in growth indicators came as a result of salt tension, as it works to reduce water effort and ionization by inhibiting the absorption of nutrients such as potassium and calcium and the accumulation of sodium, which leads to toxic levels within the plant, as it is reflected on plant growth. Nutritional imbalance also affects the efficiency of light construction, which is reflected in vital activities. These results are consistent with many studies in this research , such as [10] ; [12] ; [6] ; [4].

As for the role of treatment of salicylic acid, it has shown a positive role in all the studied qualities, perhaps due to its role in reducing salinity damage, which enhances plant growth, and given the many physiological roles of salicylic acid in plant growth, development and revelation, this has helped in the positive role that has been developed, which matched the results Agree with [13].

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