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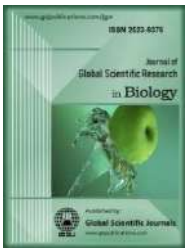

The Role of Vitamin C and Salt Stress and their Interactions in Some Characteristics of Wheat Yield

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ABSTRACT

One of the Baghdad governorate nurseries was selected during the growing season 2021-2022 to conduct a factorial experiment designed to design a complete randomized block type RCBD with three replicates and 27 experimental units. The aim of this study was to demonstrate the effect of spraying wheat leaves with the first factor (vitamin C) in three concentrations (0, 100 and 200) mg. L- and the effect of adding the second factor (sodium chloride) at three concentrations (0, 100, and 200) mM.L-1 and their interaction in some indicators of wheat plant yield (spike length, spike length with awn, spike weight, grain weight, 1000 grain weight, and spikelet number. The results showed the following: 1- Vitamin C spraying on the leaves caused a significant increase in the mean and values (spike length, spike length with awn, spike weight, grain weight, 1000 grain weight and spikelet number) compared with the control treatment. 2- The averages and values of the above mentioned yield growth indicators decreased significantly when sodium chloride was added at concentrations (100 and 200) mM.L-1. 3- The interaction effect between vitamin C and sodium chloride was significant in the aforementioned growth indicators and the treatment (200 mg.l^{1} of vitamin C and 0 mM.L of salt) was the best in giving it the best values for the studied traits and the concentration was (200 mg.l^{1}). Vitamin C is the best in reducing sodium chloride damage.

1. Introduction

Wheat is considered one of the most important food and strategic crops that guarantee food security at the global level. Global production of wheat has increased dramatically as a result of the increased demand for it, In 1961, wheat production was 218.5 million tons, and its production increased to 732 million tons in 2013 (Tadesse et al.,2016)

Abiotic environmental stresses include salt stress, which causes an increase in the formation of Reactive Oxygen Species (Free radical)ROS.(Reddy et al., 2004). And high levels of ROS negatively affect cellular functions to permanently disrupt metabolic processes, as they destroy DNA, proteins and lipids, and then lead to the death of the plant(Anjum et al., 2015). One of the means of tolerating high levels of ROS is to sweep it up by increasing the effectiveness of the enzymatic antioxidants CAT, POD, SOD and non-enzymatic ones, including Ascorbic acid (vitamin C)) Faize et

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al ., 2010(.Ascorbate (AA) and ascorbate (glutathione) cycle are the first line of defense from the group of non-enzymatic antioxidants that scavenge the ROS group, As AA converts HR2ROR2R into water with the help of the enzyme (Ascorb.Ascorbate Peroxidase (APX), Plants that contain high levels of antioxidants have a high tolerance for stress(Foyer and Shigeoka,2011), And that ascorbic acid contributes to the removal of the harmful effect of detoxification of types of Oxygen ROS, which is formed in the processes of photosynthesis and respirati (Smirnoff, 1996). Vitamin C, whose chemical code is CR6RHR8ROR6R, is the first line of defense among enzymatic non- antioxidants, For cell components such as chloroplast, mitochondria and peroxum as the inhibitory force for the oxidation of cell membranes (Quan et al., 2008), It has the ability to sweep ROS, as well as the reduction of hydrogen peroxide to water by Ascorbate Peroxidase Enzyme.(Noctor and Foyer, 1998). Vitamin C acts as a cofactor in the synthesis of many plant hormones(Salicylic acid SA Ethylene ET, Jasmonic acid) . As well as its effect on sending signals of genetic stimulation to plant hormones(Gibberellic acid GAR3R Abscissic acid ABA ،JA) under the influence of environmental stresses Khan et al., 2011. The use of foliar spraying with ascoric acid for wheat plants in increasing concentrations

It led to a significant increase in the characteristics of spike length and the number of spikes in plants exposed to water stress (Bakry et al.,2013).

2. Materials and Methods

In one of the nurseries of Baghdad governorate, an experiment was conducted with plastic pots during the growing season 2021-2022, The plastic pots have a capacity of 5 kg. Soil. The soil was taken from the nursery after grinding and softening it. The experiment was designed according to a complete randomized block design as a 4x3 factorial experiment with three replications. The seeds of the plant were planted and each pot had 15 seeds on 11/17/2021, On the basis of 50% of the field capacity, it was irrigated with water, and the plants were reduced after 14 days from the date of planting the seeds to 8 plants per pot, with the necessary agricultural operations such as removing the bush and watering according to the weight loss. On 18/1/2021 it was treated with saline solutions, as it was irrigated with concentrations (0, 100 and 200) mmol of saline solutions. vitamin C. The plant was harvested after it had become completely dry, on 3/4/2021, and some components of the yield were measured, which are the length of the spike (cm), the length spike with awn (cm) using a ruler. The sensitive scale was used to calculate the weight of the spike (grams) and the weight of 1000 grains (gram). The number of spikelets was calculated for each spike. The statistical process was carried out on the results according to the design of the experiment and by the method [24] and at the probability level of 0.05 the averages were compared using the least significant difference.

3. Results and Discussion

The results of the study tables (1, 2, 3, 4, 5 and 6) indicated that raising the concentration of sodium chloride from zero to 200 mmol / liter reduced the rates of yield characteristics of the wheat plant that were studied in this experiment (the length of the spike, the length of the spike with the awn, the weight of the spike, the weight of the grain, the weight of a thousand grains, and the number of spikes) significantly from (8.23, 9.89, 1.55, 0.061, 60.81, and 26.33) to (5.40, 5.74, 0.96, 0.038, 37.48, and 18.66), respectively. The results of the tables indicated the positive effect of adding vitamin C in increasing the rates of these traits, when the concentration was raised from zero to 200 mg. L-1: There was a significant increase in the traits' scores from (6.30, 6.53, 1.03, 0.043, 43.59, and 19.33) to (7.33, 8.65, 1.51, 0.052, 53.72, and 23.33), respectively, compared with zero concentration of vitamin C. The effect of the binary interaction between the two factors of the experiment, which are sodium chloride and vitamin C, It was significant in the values of those characteristics (the length of the spike, the length of the spike with the tip, the weight of the spike, the weight of a grain, the weight of a thousand grains, and the number of spikelets) in the plant. At two concentrations, 200 mg. L-1 of vitamin C and a concentration of 200 mmol/L sodium chloride, the values were (6.10, 6.34, 1.10, 0.041, 41.58, and 20.00) compared to (5.25, 5.03, 0.80, 0.035, 34.17, and 17.00) at a concentration of zero vitamin C and a concentration 200 mmol/L of sodium chloride, respectively.

The concentration excelled 200 milligrams. L-1 vitamin C with a concentration of 0 mmol/L sodium chloride and it gave the highest values for the traits (spike length, spike length with awn, spike weight, grain weight, 1000 grains weight, and spike number), which reached (8.90, 11.59, 1.95, 0.068, 69.11 and 29). .00) respectively.

Compared with other concentrations of vitamin and other concentrations of salt, and the results of the above tables indicated that the lowest values for the studied traits were at concentration 0 of vitamin C and concentration of 200 sodium chloride, which amounted to (5.20, 5.03, 0.80, 0.035, 34.17 and 17.00) respectively, compared with (7.30, 10.21, 1.20, 0.052, 53.10 and 23.00) respectively, at the zero concentration for each of vitamin C and sodium chloride and compared with (6.10, 8.34, 1.10, 0.041, 41.58 and 20.00), respectively, at the concentration of 200 mg. 1 liter of vitamin C and a concentration of 200 mmol / liter of sodium chloride. The rates and values for the yield traits of wheat plant (spike length, spike length with awn, spike weight, grain weight, 1000 grain weight, and spikelet count), especially at high concentrations of sodium chloride, were confirmed by the results in the above tables as a result of the harmful osmotic or oxidative effects of sodium chloride. On plant metabolism processes(Chinnusamy et al 2005). And vitamin C raised the rates and values of characteristics of the yield of wheat plant (spike length, spike length with awn, spike weight, grain weight, weight of a thousand grains, and spikelet count) for its positive role in the growth and development of the plant. It works to reduce the effect of salt stress on the plant by increasing the mineral content. In plant cells important in metabolic processes and increases the process of ionic balance and the ratio between potassium and sodium and stimulates the formation of bundles of special proteins that help the plant to withstand salt stress, while vitamin C works to reduce the content of toxic elements such as sodium (Hasan et al. 2020).

Tab [1] the role of vitamin C and salt stress and their interactions in spike length of wheat yield

Salt concentration (NaCl) $mM.L^{-1}$	(Vitamin C concentration ($mg.L^{-1}$)			Effect average salt(NaCl)
	0	100	200	
0	7.30	8.50	8.90	8.23
100	6.50	6.90	7.00	6.80
200	4.20	5.90	6.10	5.40
Effect aavrage vitamin C	6.30	7.10	7.33	
LSD (.0.05.)	vitamin C =0.021 salt NaCl =0.022 the interaction=0.041			

Tab [2] the role of vitamin C and salt stress and their interactions in spike with awn wheat yield				
Salt concentration (NaCl) mM.L^{-1}	(Vitamin C concentration (mg.L^{-1})			Effect average salt(NaCl)
	0	100	200	
0	8.21	9.89	11.59	9.89
100	6.35	7.41	8.03	7.26
200	5.03	5.85	6.34	5.74
Effect aavrage vitamin C	6.53	7.71	8.65	
LSD (.0.05.)	vitamin C =0.36 salt NaCl =0.54 the interaction=1.07			

Tab [3] the role of vitamin C and salt stress and their interactions in spike weight of wheat				
Salt concentration (NaCl) mM.L^{-1}	(Vitamin C concentration (mg.L^{-1})			Effect average salt(NaCl)
	0	100	200	
0	1.20	1.50	1.95	1.55
100	1.10	1.25	1.48	1.27
200	0.80	1.00	1.10	0.96
Effect aavrage vitamin C	1.03	1.25	1.51	
LSD (.0.05.)	vitamin C =0.014 salt NaCl =0.022 the interaction=0.038			

Tab [4] the role of vitamin C and salt stress and their interactions in weight grain of wheat				
Salt concentration (NaCl) mM.L^{-1}	(Vitamin C concentration (mg.L^{-1})			Effect average salt(NaCl)
	0	100	200	
0	0.052	0.063	0.068	0.061
100	0.043	0.045	0.049	0.045
200	0.035	0.040	0.041	0.038
Effect aavrage vitamin C	0.043	0.049	0.052	
LSD (.0.05.)	vitamin C =0.002 salt NaCl =0.005 the interaction=0.006			

Tab [5] the role of vitamin C and salt stress and their interactions in 1000 grian of wheat yield				
Salt concentration (NaCl) mM.L^{-1}	(Vitamin C concentration (mg.L^{-1})			Effect average salt(NaCl)
	0	100	200	
0	53.10	60.24	69.11	60.81
100	43.52	46.45	50.47	46.81
200	34.17	36.71	41.58	37.48
Effect aavrage vitamin C	43.59	47.80	53.72	
LSD (.0.05.)	vitamin C =2.25 salt NaCl =3.17 the interaction=6.11			

Tab [6] the role of vitamin C and salt stress and their interactions in spikelet number of wheat				
Salt concentration (NaCl) mM.L^{-1}	(Vitamin C concentration (mg.L^{-1})			Effect average salt(NaCl)
	0	100	200	
0	23.00	27.00	29.00	26.33
100	18.00	20.00	21.00	19.66
200	17.00	19.00	20.00	18.66
Effect aavrage vitamin C	19.33	22.00	23.33	
LSD (.0.05.)	vitamin C =0.10 salt NaCl =1.50 the interaction=1.88			

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