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EFFECT OF ADDITION OF ROCK PHOSPHATE IN TOMATO PLANT (*LYCOPERSICON ESCULENTUM* MILL.) EXHIBITION TO SALT STRESS

Suad Abd Said Aljalaly*, Amel Abd Said Aljalaly and May Saadi Fadel Al-Hadithy

Ministry of Education, directorate of Education, Rusafa, Iraq

Abstract

An experiment was conducted in green house of Biology Department, College of Education for Pure Science– Ibn AL–Haitham, Baghdad University. for the growth season 2017-2018, To study the effect of adding phosphate rock fertilizer, level of addition and not added, It is a control transaction, and three concentrations of sodium chloride (50, 100, 150) $mM.L^{-1}$, as well as the treatment of control and their overlapping, in some qualities of tomato plant (Chlorophyll content, carbohydrate ratio, protein ratio, concentration of some minor elements (iron, zinc, boron), in the shoot. The results showed that the addition of sodium chloride caused a significant decrease in the qualities mentioned above, compared with control treatment, in contrast, the addition of manure resulted in a significant increase and decrease the effect of sodium chloride in the average of the above qualities compared with the treatment of non-addition.

Key words: Plant; *Lycopersicon esculentum* Mill.; rock phosphate.

Introduction

The salinity is a problem environment . Salt stress of sodium chloride in plants influences some plant metabolic processes such as, photosynthesis, protein synthesis, and energy and lipid metabolism (Parida, *et al*. 2005). Salt stress also causes oxidative damage, thereby affecting cellular membrane integrity, enzyme activities, and functioning of plant photosynthetic apparatus (Parida, *et al*., 2005). Tomato human for (*Lycospersicon esculentum* Mill) fruit is an essential component of diet the supply of vitamins, minerals and certain types of hormones precursors in addition to protein and energy (Kallo, 1993). The provision of mineral nutrients is a key factor in plant growth, phosphorus is one of the major constituents in energy metabolism and biosynthesis of nucleic acids and cell membranes and it has an important role in regulation of a number of enzymes (Richardson *et al*., 2009). Being a critical macronutrient for plant growth and development, phosphorus is limiting for crop production and it has been estimated that the world resources of inexpensive rock phosphate (Vance *et al*., 2003). Phosphate rock contains 11-16% P. the Akashat rocks in Iraq are high in phosphorus content, up to 30% P_2O_5 (Yousbaki, 2004). This study aimed to show the effect of the rock phosphate reduce the impact of negative sodium chloride on tomato plant.

***Author for correspondence :** E-mail : suadaljalali@yahoo.com

Materials and Methods

A plastic experiment (5 kg. Soil) was conducted at the green house of the Department of Life Sciences, College of Education for Pure Sciences - Ibn Al-Haytham, Baghdad University. The soil was dried, crushed and sifted with a sieve, diameter of openings 2 millimeters, the soil was weighed and packed in the pots, and weighing 5 kg per pot. The experiment is designed according to the design of sectors for full randomisation (RCBD) and three replications, the ($3 \times 4 \times 2$), including two factors, they are three concentrations of sodium chloride (50, 100 and 150) $mM.L^{-1}$, in addition to the treatment of control, and addition of 5 gm of phosphate rock F26 (PO_4) Ca10 (concentration of 12% P.), and not added, and three replicates and so be (24) experimental unit. Seeds of tomatoes were planted (10) seeds per pot, on 23/3/2017. Water was irrigated to reach 50% of the field capacity, agricultural operations were followed up such as irrigation and removal of bushes, the seedlings were reduced to two seedlings. On 13/5/2017 they were irrigated with pre-prepared salt concentrations, prepare a stock solution of sodium chloride at 1 M concentration (Dissolve a molecular weight in a liter of distilled water), the required

concentrations of sodium chloride (50, 100 and 150) $mM.L^{-1}$ were then prepared from the stock solution, According to the mitigation law, On 25/4/2017 the chlorophyll content was measured by a spad device, by averaging four readings of four leaves randomly from each transaction. On 1/6/2017 one plant cut each experimental unit, The shoot was dried in an electric dryer, at a temperature of 65-70°C, for 72 hours, and until proven weight, according to (Agiza *et al*., 1960). Method was used (Herbert *et al*., 1971) which is called the method (phenol sulfuric acid) to estimate the proportion of carbohydrate dissolved in the shoot, the percentage of protein in the shoot was estimated according to the following law:

% Protein = Percentage of Nitrogen × 6.25

According to (Schaffelen and Vanschauwenbury (1960**)** [8].

First, the concentration of nitrogen was estimated by (Chapman and Pratt 1961). using the microcalde. The elements (iron, zinc, manganese and boron) were estimated in the acid extract of plant samples previously digested by a device Atomic Absorption spectrophotometer according to (Allan, 1961). The results were statistically analyzed by The experiment was designed Randomized Completely Block Design (RCBD) and three replicates and method (19) and the averages were compared at a probability level of 0.05.

Results and Discussion

Show the results of table (1) to raise the concentration of sodium chloride reason to reduce the content of chlorophyll, a ratio of decline 44.82%. The results indicated to effect add rock phosphate in increase average chlorophyll content.

The results of table 1 indicated that raising of sodium chloride from (0) to (150 $mM.L^{-1}$) caused an average reduction of chlorophyll content and a decrease of 44.83%, the results of the table also confirmed the effect of the addition of phosphate rock in increasing the average total chlorophyll content, adding phosphate rock caused a significant increase in the average chlorophyll content to 41.71 compared to 35.92 spad when not added. The effect of the binary interaction between the two factors of the experiment was significant in the studied character, the results of the table above confirmed the positive effect of fertilization in reducing the harmful effect of sodium chloride, at the fertilization and the higher concentration of sodium chloride is 150 $mM.L^{-1}$ the total chlorophyll content increased to 32.33 compared to 22.00 at the level of zero of the fertilizer and the same concentration of sodium chloride.

Table 1: Effect addition the rock phosphate and Sodium chloride in chlorophyll tomato plant exhibition to salt stress.

Effect the average rock phosphate	**Sodium chloride concentrations ($mM.L^{-1}$)**				**Rock phosphate (gm)**
	150	100	50	0	
35.92	22.00	34.66	40.00	47.00	
41.71	32.33	38.00	45.00	51.50	
	27.17	36.33	42.50	49.25	Effect the average sodium chloride
	Sodium chloride =4.00 rock phosphate =5.11 The interaction =8.28				LSD (0.05)

Carbohydrate ratio

The results of table 2 showed a significant decrease in the average carbohydrate percentage (%) simultaneously increase the concentration sodium chloride in central growth, with a concentration of 150 $mM.L^{-1}$. The average carbohydrate ratio decreased by 41.49% compared with the comparison treatment (zero salt), the results of the table also showed a significant increase in the average percentage of carbohydrates when adding fertilizer to 3.25 compared with 2.84 when not added,, and the effect of the overlap between fertilization and concentration of sodium chloride was significant, fertilizer has a role in reducing the negative effect of sodium chloride, when added the level of 5 gm with high concentration (150 $mM.L^{-1}$) of sodium chloride was the value of carbohydrate ratio 2.45 compared with 2.10 when not added and the same concentration of sodium chloride above.

Protein

The results of table 3 confirmed that sodium chloride concentration negatively affected the rate of protein ratio,

Table 2. : Effect addition the rock phosphate and Sodium chloride in charbohydrate tomato plant exhibition to salt stress.

Effect the average rock phosphate	**Sodium chloride concentrations ($mM.L^{-1}$)**				**Rock phosphate (gm)**
	150	100	50	0	
2.84	2.10	2.66	3.00	3.60	
3.25	2.45	2.86	3.54	4.17	
	2.27	2.76	3.27	3.88	Effect the average sodium chloride
	Sodium chloride =0.07 rock phosphate =0.05 The interaction =0.12				LSD (0.05)

and gave significant differences when lifting the concentration from 0 to 150 mM.L^{-1} decreased the rate of protein ratio decreased by 36.98%. Table results confirmed that the fertilization gave a significant increase in the rate of protein ratio, when fertilizing, the average protein ratio was 10.65 compared to 9.87 when not fertilizing.

Table 3. : Effect addition the rock phosphate and Sodium chloride in protein tomato plant exhibition to salt stress.

Effect the average rock phosphate	Sodium chloride concentrations (mM.L^{-1})				Rock phosphate (gm)
	150	100	50	0	
9.87	7.55	9.16	11.00	11.78	5
10.65	8.00	9.80	11.92	12.88	0
	7.77	9.48	11.46	12.33	Effect the average sodium chloride
	Sodium chloride =0.21 rock phosphate =0.23 The interaction =0.45				LSD (0.05)

The results of table 6 showed that there were significant differences in this effect by the interaction of the two factors of the study, and the role of addition of phosphate rock in reducing the harmful effect of salt, when the addition of fertilizer level 5 gm and concentration 150 mM.L^{-1} of sodium chloride increased the value of protein ratio to 8.00 compared to 7.55 when not added to the fertilizer and the same concentration of sodium chloride, ي

Iron

The results of table 4 confirmed that the average concentration of iron in tomato plant was affected by the presence of sodium chloride in the center of growth, when the concentration increased from 0 to 150 mM.L^{-1} The average iron concentration was significantly reduced from 0.30 to 0.03 and by 90% reduction, the results of the table also showed a significant increase in the mean iron when adding phosphate rock level of 5 g iron was 0.13 compared with 0.09 when not added, The effect of the binary interaction between the two factors of the study was significant in the value of iron concentration, it was noted from the results of the table that the addition of phosphate rock fertilizer has a clear effect in reducing the harmful effect of sodium chloride in the concentration of iron in the vegetative part of the tomato plant, at the level of 5 g of fertilizer and concentrate 150 mM.L^{-1} the concentration value of the element was 0.04 compared to 0.02 at zero fertilizer level and the concentration of sodium chloride above.

Table 4. : Effect addition the rock phosphate and Sodium chloride in Fe% tomato plant exhibition to salt stress.

Effect the average rock phosphate	Sodium chloride concentrations (mM.L^{-1})				Rock phosphate (gm)
	150	100	50	0	
0.09	0.02	0.03	0.04	0.27	0
0.13	0.04	0.06	0.12	0.33	5
	0.03	0.04	0.08	0.30	Effect the average sodium chloride
	Sodium chloride =0.012 rock phosphate =0.010 The interaction =0.020				LSD (0.05)

Zinc

The results of Table 5 showed a significant decrease in the mean concentration of zinc by increasing the concentration of sodium chloride at a concentration of 150 mM.L^{-1} The zinc average decreased by 33.72% compared to the comparison treatment.

The results of the table also showed a significant increase in the average concentration of zinc by addition of phosphatic rock. In addition, the mean increase was increased by 10.29% compared to the non-addition of fertilizer. The effect of the overlap between the addition of phosphate rock and sodium chloride concentration was significant

The value of the character at fertilization and concentration was 150 mM.L^{-1} sodium chloride is 61.00 compared with 53.00 at non-fertilization and under high concentration of sodium chloride.

Boron

The results of Table 6 showed a significant decrease in the average concentration of boron concentration by increasing the concentration of sodium chloride. As the concentration was increased from 0 to 150 mM.L^{-1} the

Table 5. : Effect addition the rock phosphate and Sodium chloride in Fe% tomato plant exhibition to salt stress.

Effect the average rock phosphate	Sodium chloride concentrations (mM.L^{-1})				Rock phosphate (gm)
	150	100	50	0	
68	53	67	73	82	
75	61	71	80	91	
	57	69	76	86	Effect the average sodium chloride
	Sodium chloride =4.25 rock phosphate =1.22 The interaction =6.44				LSD (0.05)

average level decreased by 32.46%. The results of the table also showed a significant increase in the average concentration of boron when adding phosphate rock. At the level of 5 g of fertilizer, the average grade increased from 62 to 67.

Table 6. : Effect addition the rock phosphate and Sodium chloride in Boron tomato plant exhibition to salt stress.

Effect the average rock phosphate	Sodium chloride concentrations ($mM.L^{-1}$)				Rock phosphate (gm)
	100	50	25	0	
62	50	60	66	75	
67	55	63	70	80	
	52	61	68	77	Effect the average sodium chloride
	Sodium chloride rock phosphate The interaction				LSD (0.05)

As for the effect of overlap between the two factors of the experiment, the results of the table also indicated that it is significant in the value of the element of boron in the vegetative part of the plant when fertilization and concentration zero sodium chloride was the highest value of the value of 80.00, stressing the role of phosphate rock in improving the growth of non-exposed plant to stress sodium chloride. The lowest value of the content of the characteristic when non-fertilization and concentration 150 $mM.L^{-1}$, sodium chloride reached 50.00. The results of the table above showed the positive phosphate rock role in reducing the damage of sodium chloride when it was added to the concentration treatment 150 $mM.L^{-1}$ sodium chloride. The value of the substance increased to 55.00 compared with 50.00 when not fertilizing and at the same concentration of sodium chloride.

Discussion

Salt stress (NaCl) has both osmotic (cell dehydration) and toxic (ion accumulation) effects on plant cells, impairing growth, ion homeostasis. Salt stress (NaCl) has both osmotic (cell dehydration) and toxic (ion accumulation) effects on plant cells, impairing growth, ion homeostasis, photosynthesis and nitrogen fixation among other key physiological processes (Parida, *et al*., 2005). This is why the averages of the studied characteristics are lower in accordance with the results of the tables (6, 1, 2, 3, 4, 5). The increase in mean values in the tables above is due to the role of fertilizer in increasing vegetative growth, the increase in metabolic activity increases the consumption of nutrients and then increases the absorption, Phosphorus influences the growth and development of the plant through its role in metabolic processes Phosphorus is second only to nitrogen in terms of quantity for its involvement in several functions within the plant. It enters the structure of phospholipids (Havlin *et al*., 1999). Phosphorus is associated with nitrogen in the construction of cellular membranes and in the synthesis of energy compounds such as ATP and enzymatic accomplices such as NADH2 and NADPH2 and is involved in the formation of esters with the hydroxyl groups of sugars and alcohols (Taiz and Zeiger, 2002) . Which reflected positively on the qualities studied.

Conclusion

Based on this, we conclude that fertilization with a concentration of 5 g of phosphate rock contributed to the increase in the studied traits and reduced the negative effect of sodium chloride in the average of these qualities.

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