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EFFECT OF ORGANIC FERTILIZER AND FOLIAR APPLICATION OF HUMIC AND SALICYLIC ACIDS ON REDUCING SALINITY STRESS OF IRRIGATION WATER ON VEGETATIVE GROWTH CHARACTERISTICS OF BROCCOLI (*BRASSICA OLERACEA* L.) PLANT

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Abstract

The experiment was carried out in one of the fields of College of Engineering Sciences of Agriculture - University of Baghdad in a mixture of alluvial soils to study the addition of organic fertilizer and foliar application of humic and salicylic acids to reducing saline stress of saline irrigation to study of vegetative growth characteristics of broccoli for the autumn season 2018-2019 The experiment included three levels of salin water (S_1) fresh water, (S_2) 2.5 and (S_3) 5 dSm^{-1} and two levels of organic fertilizer (O_0) No fertilizer added (O_1) Add fertilizer at the level of 20 tons. h^{-1} also included foliar application (F_0 water application, F_H humic acid level of 1 $g.L^{-1}$, F_C Salicylic acid at the level of 200 $mg.L^{-1}$, and three replicates. The results showed that F_H application treatments exceeded the rest of treatments in all vegetative growth characteristics. The treatment of organic fertilizer O_1 outweighed the treatment of application salicylic acid F_C in the dry weight of the total vegetative and root and in the number of leaves and the content of chlorophyll in the leaves. The interaction between humic acid and organic fertilizer O_1F_H exceeded all treatments and reduce the salinity levels in all growth characteristics.

Key words : Water salinity, organic fertilizer, humic acid, salicylic acid, broccoli.

Introduction

Soil salinity is one of the most important determinants of agricultural production, and irrigation with saline water affects the growth of plants through its influence on many plant metabolic processes. Many Studies show that 20% of cultivated soils and 33% of irrigated soils have turned into unproductive soils due to salinization (Rui and Richard, 2017).

Studies have shown that in 2050, 50% of the world's soils may turn into salt soils (Bartels, 2005), which will lead to a significant reduction in their productivity, especially vegetable crops of all parts (roots, stems and leaves) which are sensitive or less tolerant crops For soil salinity. Salinization of Soils is due to several factors, including the use of ground water for irrigation (especially near sea water), the influence of climate factor in arid and semi-arid areas, as well as the impact of rising ground water. The negative effect of soil salinity is shown to decrease soil productivity through its effect on ready water due to the high osmotecis pressure in the rhizosphere and its effect on some physical soil properties such as respiration, water and air movement, as well as the imbalance of nutrients and the accumulation and toxicity of some elements such as chlorine, sodium and boron. Researchers have sought ways to reduce salt stress, including the addition of organic fertilizer with soil, which is considered as a favorable material for salt soils, in wich to containing humic materials produced by nitrogenous compounds that constitute an important source for the formation of amino acids. It also stores for many micronutrients necessary for plant growth and increased leaf content of chlorophyll (Waleed and Iman, 2017).

Other studies have confirmed that foliar application of humic and salicylic acids for plants grown under abiotic stress conditions increases the effectiveness of non-Enzymatic Antioxidant enzymes such as catalase (CAT) and peroxidase (POD). Proline leaves, increased humic acid application result to increased leaf content of chlorophyll dye and nutrient concentrations such as N, K and Ca (Kaya *et al.,* 2018). The plant has a phenolic nature and its entry into the organization of many In addition to its important role in protecting plants from saline and non-vital stresses, such as stresses, water and thermal stresses as well as stresses resulting from heavy metals (Khoshbakht, 2015).

Broccoli is the crop which cultivated in January and March. Or temperatures drop more than cauliflower, as it withstands frost without causing noticeable damage.

Materials and Methods

The research was carried out in the field of the College of Agriculture - University of Baghdad in alluvial soils for the winter season 2019-2018 to study the efficiency of the use of organic fertilizer and foliar application humic and salicylic acids in reducing salt stress of irrigation water in the vegetative growth characteristics of broccoli plant.

Plowing and smoothing of the land was carried out, as the land was divided into three sectors, each sector contains seven lines between the line and another within the sector 0.8 m and the distance between the sector and another 1.5 m each line contains three replicates, where each line represents one treatment.

Field soil samples were taken from different areas before the start of the experiment at a depth of 0 - 30 cm (root spread area) and then air dried and milled and passed through a sieve diameter of 2 mm holes and analyzed to study some chemical and physical properties of the soil soil, table 1 shows some physical and chemical properties of soil field of experiment before planting.

The recommendation was 20 tonnes. h^{-1} and then the added amount of fertilizer for the experimental unit. table 3 shows the chemical properties of organic fertilizer.

Humic acid was applicated as $g.L^{-1}$, salicylic 200 $mg.L^{-1}$ and in two batches between the first and second application was 10 days.

Studied plant qualities

Random plants were selected from each treatment to study plant characteristics:

Number of leaves (leaf)

The total number of leaves for each of the selected plants was calculated and then adjusted.

Dry Weight of Vegetative and Root Total ($gm.plant^{-1}$)

Four plants were taken from each experimental unit.

Leaves content of chlorophyll (mg. g^{-1} plant)

Chlorophyll index A, chlorophyll b and total chlorophyll were estimated by extraction method. Dyes were extracted from the leaves using acetone (80%). The optical absorption of the sample was read by Spectrophotometer along the wavelength of 663 nm and 645 nm. Mentioned by Lichtenthaler (1987).

Table 1: Some Physical and Chemical Properties of Field Study Soil.

Standard unit	Value	Adjective
....	7.80	pH
$dS.m^{-1}$	1.70	EC
%	48.8	Carbonate minerals
$g.kg^{-1}$	16.0	Organic matter
$meq.L^{-1}$	9.00	Ca^{+2}
	5.99	Mg^{+2}
	0.94	K^{+1}
	3.36	Na^{+1}
	Nil	CO_3^{--}
	7.63	HCO_3^{-}
	5.74	Cl^{-}
	2.63	SO_4^{--}
$mg.kg^{-1}$	42.00	available Nitrogen
	10.00	available phosphorus
	176.00	available Potassium
$g.kg^{-1}$	200.0	sand
	644.0	Silt
	156.1	Clay
	siltyloam	Class of texture

The experiment was carried out according to split plot design, where the salinity levels of irrigation water represented the main treatments, the organic fertilizer treatments and the foliar application treatments were the secondary factor. The number of treatments was 18, as shown in Table 2.

Results and Discussion

Number of leaves ($leaf.plant^{-1}$)

The results of table 4 showed a significant effect of saline water to decreasing the number of leaves by increasing the level of saline water when the salinity level increased as the number of leaves decreased from 36.66 leaves. Plant $^{-1}$ at the first salinity level S_1 to 29.89 leaves. While the number of leaves increased significantly when adding organic fertilizer compared with the treatment of (O_1) was (35.85 leaves) than it is when the treatment of non-addition of fertilizer (O_0) reached (30.14 leaves. $Plant^{-1}$). Humic acid (F_H) (37.11 Leaves. $plant^{-1}$) followed by (F_C) salicylic acid treatment (31.80 $leaves.plant^{-1}$), (F_0) and (30.09 $leaves.plant^{-1}$). While the interaction treatment ($S_1O_1F_H$) recorded the highest value in the number of leaves compared to the rest of the transactions, reaching

Table 2: Symbols of Transactions, Concentrations of Added Fertilizers and Quality of Irrigation water.

Explanation	Treatment
Comparative treatment (no salts added)	S_1
EC 2.5 dSm-1 saline	S_2
EC 5 dSm-1 salt water	S_3
Compared treatment non-organic	O_0
Add organic fertilizer at the level of 20 tons	O_1
Treatment compared to fresh water application	F_0
Application with humic acid at the level of 1 g	F_h
Application with salicylic acid at the level of 200 mg	F_c

Table 3: Chemical Characteristics of Sheep Residues.

Unit	Value	Qualities
dSm^{-1}	4.2	Ec
......	6.86	pH
%	23.3	Organic carbon
	1.09	Total nitrogen
	1.56	Total potassium
	0.35	Total phosphorus
......	21.46	C/N

(43.67 leaves.plant^{-1}).

Dry weight of total vegetative (gm.plant^{-1})

The results of table 5 showed significant differences in the dry total weight of vegetative when fertilizer and foliar application treatments under saline stress conditions. (280.0 gm.plant^{-1}) when adding organic fertilizer O_1. The dry weight increased significantly with foliar application treatment of humic acid (F_H) over the other treatments (272.07 gm. plant^{-1}) followed by salicylic acid (F_C) (239.47 gm. plant^{-1}). While the dry weight decreased significantly by increasing salt stress, the dry weight reached (286.20 gm.plant^{-1}), at the first level (S_1) and the value decreased at the third level (S_3) to (179.20 gm.plant^{-1}). The highest dry weight value for ($S_1O_1F_H$) was (396.34 g.plant^{-1}).

Dry weight of total roots (g. Plant^{-1})

The results of table 6 showed a significant decrease in the dry weight of root when salinity levels increased. The treatment of the saline level (S_1) exceeded the rest of the treatments, where the dry weight value was (29.61 g. Plant$^{-1)}$ and this value decreased at salt level (S_3) reaching (26.76 g. Plant^{-1}). While the value of the root weight was significantly higher when treated with addition of organic fertilizer (O_1) (29.95 g. Plant^{-1}) The dry weight increased in foliar application treatments, where humic acid foliar application (F_H) exceeded the rest of the foliar application treatments, reaching (30.80 g. Plant^{-1}) followed by salicylic acid foliar application treatment (F_C) (27.77 g. Plant^{-1}) and the lowest value when treated with water foliar application (F_0) (25.83 g. Plant^{-1}). In treatment factors also had a significant effect on the dry weight of the root total. The highest dry weight value was (34.80 g. Plant^{-1}), while the lowest value was (23.51 g. Plant^{-1}) ($S_3O_0F_0$).

The results of Tables 4, 5, 6 show that increasing the salinity level reduces the dry weight of the root of crop vegetative total and the number of leaves. Lead to nutritional imbalance that harms the growth of plant Petal *et al.*, (2000), The role of organic fertilization reducing the plant damage that occurs in the plant directly and indirectly, indirectly by reducing the negative impact of salt stress by improving soil construction and increasing salt washing Rauber *et al.*, (2018), her effect is directly influenced by hormone secretion It also provides nutrients NPK table 3 continuously and increase its readiness in the soil and absorption by the plant and this leads to increase and improve the growth of vegetative and root in addition to increasing water absorption. The process of photosynthesis and synthesis of proteins and carbohydrates this is found by Odeh *et al.*, (2011), Gama *et al.*, (2018).

The increasing in dry weight of the root total vegetative total and the number of leaves increased significantly when foliar application of humic acid, which affects the processes of respiration photosynthesis the manufacture of proteins and increased enzymatic reactions, which in turn increase the absorption of nutrients and increase the manufactured materials and accumulation in the plant, which increases the number of leaves and dry weight of the total vegetative In addition to its role in the improvement and growth of the root, which leads to increase the ramification and branching of the roots and increase the size of the root and thus increase the dry weight of the root Karaman *et al.*, (2017).

The increase in dry weight of root and vegetative total in salicylic acid treatment is attributed to its role in increasing root growth of Hegazil and El-shraiy (2007), in addition to increasing the effectiveness of photosynthesis and absorption of nutrients, which leads to increased plant growth and increase its dry weight. And its role in increasing the number of leaves by increasing the absorption of carbon dioxide, which contributes to the process of photosynthesis, which is reflected on the growth of the plant and increase the number of leaves Obeidi (2013). The dry weight of the roots decreases with increasing salinity because of the presence of salts in the soil, which reduces the density and growth of the roots. And decreases its ability to absorb water and decreases the growth rate, while interfering with organic fertilizer and acids reduces the effect of

Table 4: Effect of Organic Fertilizer and foliar application of Humic and Salicylic Acids on Reducing Salinity Stress of Irrigation Water on broccoli leaves (leaf-plant^{-1}).

Mean of O×S	foliar application			Organic fertilizer level	Salinity level
	F_C	Fh	F_0		
33.50	29.67	41.40	29.44	O_0	S_1
39.81	38.33	43.67	37.44	O_1	
29.59	29.56	34.00	25.22	O_0	S_2
35.30	33.56	38.11	34.22	O_1	
27.33	28.11	31.78	22.10	O_0	S_3
32.45	31.56	33.67	32.56	O_1	
M.S	F_C	Fh	F_0	foliar application / Salinity level	
36.66 a	34.00	42.54	28.16	S_1	
32.45 b	31.56	36.06	30.78	S_2	
29.89 c	29.84	32.73	31.33	S_3	
** **	31.80 b	37.11 a	30.09 c	F	
M.O	F_C	Fh	F_0	foliar application / Salinity level	
30.14 b	29.11	35.73	25.59	O_0	
35.85 a	34.48	38.48	34.59	O_1	
** **	31.80 b	37.11 a	30.09 c	F	

S×O×F	O×F	S×F	S×O	F	O	S	L.S.D 0.05
1.40	0.81	0.99	0.81	0.57	0.47	0.57	

The different characters within one column or row indicate significant differences between the averages of the coefficients at the probability level P d" 0.05 according to L.S.D 0.05 test.

** Significant effect of coefficients at P d" 0.01 in variance analysis table.

salinity and salt concentration and this is consistent with the dairy (2014).

Total chlorophyll content (mg. 100 g^{-1} plant)

Table 7 indicates that the increase in total chlorophyll content in leaves was significant by addition of organic fertilizer. The chlorophyll content increased from (512.27 mg.100g^{-1}plant) when no organic fertilizer (O_0) was added to (520.40 mg.100g^{-1}plant) when organic fertilizer (O_1) was added. Foliar application with humic and salicylic acid (F_H) and (Fc) significantly increased the chlorophyll content compared to (F_0) water foliar application, reaching (522.74 mg.100g^{-1}plant, 516.10 mg.100g^{-1}plant) when treated with water foliar application. While the chlorophyll content in the leaves decreased with increasing salt levels, the treatment of low saline level (S_1) recorded a value of (529.64 mg.100g^{-1}plant) while the chlorophyll content in the saline level (S_2) and (S_3) was (513.63 mg.100g^{-1}plant) and (505.72mg.100g^{-1}plant) Sequentially. The interaction between salt level and the addition of organic fertilizer and foliar application with humic acid ($S_1O_1F_H$) exceeded the total chlorophyll content in the

Table 5: Effect of Organic Fertilizer and foliar application of Humic and Salicylic Acids on Reducing Salinity Stress of Irrigation Water on dry weight of broccoli vegetative total (gm.plant^{-1}).

Mean of O×S	foliar application			Organic fertilizer level	Salinity level
	F_C	Fh	F_0		
231.59	238.59	254.40	201.79	O_0	S_1
340.81	355.99	396.34	270.11	O_1	
168.59	166.59	198.75	140.44	O_0	S_2
276.67	298.90	310.76	220.34	O_1	
135.66	130.96	172.64	103.39	O_0	S_3
222.53	245.80	299.51	122.28	O_1	
M.S	F_C	Fh	F_0	foliar application / Salinity level	
286.20 a	297.29	325.37	235.95	S_1	
222.63 b	232.75	254.76	180.39	S_2	
179.20 c	188.38	236.08	112.84	S_3	
** **	239.47 b	272.07 a	176.39 c	F	
M.O	F_C	Fh	F_0	foliar application / Salinity level	
178.62 b	178.71	208.60	148.54	O_0	
280.00 a	300.23	335.54	204.24	O_1	
** **	239.47 b	272.07 a	176.39 c	F	

S×O×F	O×F	S×F	S×O	F	O	S	L.S.D 0.05
37.50	21.65	26.51	21.65	15.31	12.50	15.31	

The different characters within one column or row indicate significant differences between the averages of the coefficients at the probability level P d" 0.05 according to L.S.D 0.05 test.

** Significant effect of coefficients at P d" 0.01 in variance analysis table.

leaves (540.80 mg.100g^{-1}plant) Chlorophyll content was (498.30 mg.100g^{-1}plant).

The role of salinity in reducing chlorophyll due to the accumulation of ions in the leaves, especially the ions that enter the structure of chlorophyll such as magnesium and inhibition in the paper Ali and others (2004). In addition to increasing the enzymes of chlorophyll demolition due to the increase of salts addition to salt stress increases the proportion of proline in the leaves, which in turn withdrawn nitrogen necessary to build chlorophyll Cha-um and Kirdmanee (2009).

Organic fertilizer increases the percentage of chlorophyll in the leaf because the decomposition of organic fertilizer in soil results in an increase in the proportion of nitrogen in the soil, which turns into ammonium and nitrate by The mineralization process carried out by some microorganisms and transforms them into a ready-to-absorbed form favored by the plant, which increases their absorption into the plant and thus increases the activity of cells and increase protein and

Table 6: Effect of Organic Fertilizer and foliar application of Humic and Salicylic Acids on Reducing Salinity Stress of Irrigation Water on dry weight of broccoli root total (gm.plant^{-1}).

Mean of O×S	foliar application			Organic fertilizer level	Salinity level
	F_C	Fh	F_0		
27.48	27.30	29.20	25.15	O_0	S_1
31.73	31.65	34.80	28.74	O_1	
26.29	26.32	28.48	24.08	O_0	S_2
29.77	28.99	33.08	27.24	O_1	
25.17	24.22	27.77	23.51	O_0	S_3
28.35	28.13	30.65	26.28	O_1	
M.S	F_C	Fh	F_0	foliar application / Salinity level	
29.61 [a]	29.48	32.40	26.94	S_1	
28.03 [b]	27.66	30.78	25.66	S_2	
26.76 [c]	26.18	29.21	24.90	S_3	
** **	27.77 [b]	30.80 [a]	25.83 [c]	F	
M.O	F_C	Fh	F_0	foliar application / Salinity level	
26.31 [b]	25.95	28.75	24.25	O_0	
29.95 [a]	29.59	32.84	27.42	O_1	
** **	27.77 [b]	30.80 [a]	25.83 [c]	F	

S×O×F	O×F	S×F	S×O	F	O	S	L.S.D $_{0.05}$
1.75	1.01	1.23	1.01	0.71	0.60	0.71	

The different characters within one column or row indicate significant differences between the averages of the coefficients at the probability level P d" 0.05 according to L.S.D 0.05 test.
** Significant effect of coefficients at P d" 0.01 in variance analysis table.

Table 7: Effect of Organic Fertilizer and foliar application of Humic and Salicylic Acids on Reducing Salinity Stress of Irrigation on total chlorophyll of broccoli plant (mg. 100 g^{-1}plant).

Mean of O×S	foliar application			Organic fertilizer level	Salinity level
	F_C	Fh	F_0		
525.47	527.83	532.67	515.90	O_0	S_1
533.82	534.87	540.80	525.80	O_1	
508.80	509.60	512.10	504.70	O_0	S_2
518.47	519.30	523.10	513.10	O_1	
502.53	499.50	509.80	498.30	O_0	S_3
508.90	505.50	518.00	503.20	O_1	
M.S	F_C	Fh	F_0	foliar application / Salinity level	
529.64 [a]	531.35	536.73	520.85	S_1	
513.63 [b]	514.45	517.60	508.85	S_2	
505.72 [b]	502.50	513.90	500.75	S_3	
** *	516.10 [ab]	522.74 [a]	510.15 [b]	F	
M.O	F_C	Fh	F_0	foliar application / Salinity level	
512.27	512.31	518.19	506.30	O_0	
520.40	519.89	527.30	514.00	O_1	
N.S. *	516.10 [ab]	522.74 [a]	510.15 [b]	F	

S×O×F	O×F	S×F	S×O	F	O	S	L.S.D $_{0.05}$
27.41	15.82	19.38	15.82	11.19	9.14	11.19	

The different characters within one column or row indicate significant differences between the averages of the coefficients at the probability level P d" 0.05 according to L.S.D 0.05 test.
** Significant effect of coefficients at P d" 0.01 in variance analysis table.

carbohydrates in the leaves, which results in an increase of the formula Chlorophyll Channal (2013). Humic acid also directly affects breathing and building processes.

References

Abu Rayan, A.M. (2010). Organic agriculture (specifications and importance in human health) Department of Horticulture and Crops. faculty of Agriculture. University of Jordan. First Edition. Wael Publishing House. Oman. Jordan, 322.

Akaba, A.J.S. and M.H.S. Al-Asadi (2017). Effect of cultivation and spraying with humic acid on growth and productivity of yellow corn calories and their content of some effective compounds for two picking dates. *Karbala Journal of Agricultural Sciences*, **4(4):** 19-30.

Ali, Y., Z. Aslam, M. A. Ashraf and G.R. Tahir (2004). Effect of salinity on chlorophyll, leaf area, yield and yield component of rice genotype grown under saline conditions. *Inter. J. Environ. Sci and Technol.*, **1(3):** 221-225.

Bartels, D. and R. Sunkar (2005). Drought and salt tolerance in plants. *Crit. Rev. plant Sci.*, **24:** 23-58

Channal, B.K. (2013). Effect of organic and inorganic sources of nutrientsion soil fertility and productivity of maize, Master Thesis, College of Agriculture, University of Dharwad.

Cha-um, S. and C. Kirdmanee (2009). Effect of salt stress on proline accumulation, photosynthetic ability and growth characters in two maize cultivars. *Pak. J. Bot.*, **41:** 87-98.

Halob, I.A. (2014). The Effect of Interference between Salinity of Irrigation Water and Organic Fertilizer on Some Soil Chemical Characteristics and Insulation. Soil Science and Water Resources Faculty of Agriculture. Baghdad University.

Obeidi, Z.H.H. (2013). Effect of salicylic acid and growth-inducing bacteria on enzymatic and non-enzymatic antioxidant activity on growth and yield of maize under saline stress. Doctoral dissertation. faculty of Agriculture. Baghdad University.

Odeh, M. and I. Mohammed and H. Hassan (2011). Effect of Organic Fertilization and Mycorrhization in Pollution on Efficiency of Phosphorus Maize Absorption and Dry Material Production. *Arab Journal of Arid Environments*, **5 (1):** 89-101.

Gama, D.P. and B. Prasetya and Soemarno (2018). Application Of Organic Matter On Entisol-Soil Affected Soil Moisture Capacity And Growth Of Maize (*Zea mays* L.). I*nternational Journal of Research-Granthaalayah*, Issn-2350-0530 (O), Issn- 2394-3629.

Hegazi, A.M. and A.M. EL-Shraiy (2007). Impact of salicylic uo acid and paclobutrazol exogenous application the growth, Yield and nodule formation of common bean. *Aust. J. Bas. Appl. Sci*., **1(4):** 834-840.

Karaman, M.R., M.T. Ayhan Horuz, M. Sefik Tufenkei and A. Adiloglu (2017). Interactive effects of Bonn and humic acid on the growth and nutrient status of muize piam (*Zea mays* L.). *Int. J. of plant and soil Sci.*, **19(2):** 1-9.

Kaya, C., N.A. Akram, M. Ashraf and O. Sonmez (2018). Exogenous application of humic acid mitigates salinity stress in maize (*zea mays* L.) plants by improving some key physic-biochemical attributes published online, E. mail: nuderataauaf @ yahoo. com.

Khoshbakht and M.R. Asgharei (2015). in fluence of foliar-applied Salicylic acid on growth, gas-exchange characteristic and Chlorophyll fluorescence in Citrus under Saline conditions. *Photosynthetica*, **53(3):** 410-418.

Lichtenthaler, H.K. (1987). Chlorophylls and carotenoids: Pigments of photosynthetic biomembranes. *Methods Enzymol.*, **148:** 350-382.

Petal, R.M, S.O. Prasher and R.B. Bonnel (2000). Effect of waterable depth, irrigation water salinity, and fertilizer application on root zone salt buildup. *Canadian Agricultural Engineering*, **42:** 111-115.

Rauber, L.P. A.F., A.L. Mafra, D.B.M.G. Darosa., M.S.H. Mafra and J.C. Correa (2018). Soil physical indicators of management systems in traditional agricultural areas under manure application. *Sci. Agri.*, **75(4):** 354-359.

Rui, M.A. and P. Richard (2017). Soil Salinity: Effect on vegetable crop growth-management, practices to prevent and mitigate soil salinization. *Horticulturae*, **3:** 30.

Tamimi, A.J.H. (2015). Effect of salicylic acid and proline under saline stress conditions on growth, yield and quality of sunflower. PhD thesis. Department of Soil Science and Water Resources. faculty of Agriculture. Baghdad University.

Waleed, F.H. and Q.M. Iman (2017). Effect of bio-Organic fertilization in some nutrients availability, growth and yield of cucumber (*Cucumis sativus* L.). *Journal of agriculture and veterinary science*, **10:**13-17.