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Combined Effect of Potassium Fertiliser, Saline Irrigation Water and Humic Acids On Soil Acidity and Yield Components of Pepper (*Capsicum annuum L*)

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Abstract: A field experiment was conducted to adapt seedlings of sweet pepper, also called "California Wonder", to salinity and the role of humic acid and potassium fertiliser in reducing the effect of salinity on the plant.

A three-factorial field experiment was conducted according to the Complete Random Block Design, with three replications during the spring season of 2018 to study the humic acid and potassium fertiliser role in enhancing the salt tolerance of pepper plants**.** The first factor included four levels of saline water irrigation, namely 2, 4, 6 and 8 $dS.m^{-1}$. The second factor included a foliar application of three levels of humic acids i.e., 0, 25 and 50 $kg.h^{-1}$. The third factor represents the addition of three levels of potassium fertiliser (potassium sulphate of 50% K_2O according to the fertiliser recommendation of 0, 75 and 150 kg. h^{-1}. The considered plant and soil traits were branch per plant, stem diameter (mm), percentage of protein in the fruits and soil pH. The results obtained from the experiment can be summed up above the treatment of air conditioning at saline level 6 ds $m–^{1}$ in branch per plant with 12.3 and the most significant results obtained from the experiment can be summed up above the treatment of air conditioning at saline level 4 ds m^{-1} in stem diameter 2.03 mm. The results showed a decrease in branch per plant and stem diameter (mm) by increasing the salinity of irrigation water by 8 ds m^{-1} and the increase in the addition of humic acid and potassium fertiliser. The results showed a decrease in soil acidity (pH) increasing the salinity of irrigation and increasing fruit protein content by increasing the salinity.

Key words: Humic acids, potassium, saline irrigation water, pepper, humic acid and potassium interaction.

Introduction

Arab countries, and Iraq, in particular, are considered to be among the countries suffering from a serious and widespread salinity problem due to excess salt accumulation in large areas of fertile agricultural land, which renders them unsuitable for agricultural investment. The total geographical area of the Euphrates Basin River is 45 million hectares, of which 78% or 34 million hectares are not suitable for agriculture under current conditions. The total cultivated area is 6 million hectares, where 50% of the cultivated area is located in the north of Iraq and depends on rainfall, while the remaining area is irrigated for agriculture (FAO, 2012). Dealing with salinity is a challenging process, and it is essential to control soil salinity and coexist with it, so that it does not exceed permissible levels through integrated agricultural practices, including plowing, fertilisation, irrigation, and drainage. The high concentration of soluble salts in the soil makes

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the land unsuitable for the natural growth of plants, especially economic crops, which weakens or entirely impedes production (Al-Mursi et al., 2015). Due to population growth, in addition to freshwater scarcity, there has been an increased demand for food, leading to worsening salinity conditions due to the expansion of saline lands. Therefore, there has been a shift towards using saline water sources for irrigation purposes, which requires complex technical processes and management. Accordingly, research and studies have focussed on selecting methods and approaches to enhance plant salt tolerance and reduce its harmful effects, such as seed priming with proline acid (Ashraf and Foolad, 2007). Therefore, fertilisation is considered one of the effective methods to enhance plant resistance to soil salinity. Humic acid and potassium fertilisation has been used to improve and increase the salt tolerance of salt-sensitive pepper plants grown in saline soils and irrigated with water of varying salinity levels (Dantas et al., 2007). Additionally, potassium fertiliser has been found to increase plant resistance to water deficit (Heidari and Jamshidi, 2011). In addition to the potassium fertiliser has been found to moderate soil acidity. Which is considered a significant stress factor negatively affecting crop productivity and the development of plant roots (Miransari and Smith, 2007). This study aims to investigate the role of humic acid and potassium fertiliser in enhancing the salt tolerance of pepper plants and to explore the interactions between salinity, humic acid, and potassium in plant characteristics.

Material and Methods

Soil samples were randomly collected and mixed to form one sample that represents all the selected samples. The resulting sample was air-dried for 48 hours, and preserved in a plastic bag to be transferred later to the laboratory. In the laboratory, the representative soil sample was crushed in a soil pulveriser to pass through a 2 mm mesh screen to determine the selected soil's chemical and physical properties. Soil pH was measured in a 1:5 soil-to-water suspension by using a pH meter. The total nitrogen was calculated as per method by Mulvaney et al. (1982). The available P was determined according to Olsen et al. (1982). Ca, Mg, Na and K were determined by using a flame photometer. The sulphates were estimated by precipitation with barium chloride and Arabic gum and measured by a colour spectrophotometer, and the chlorides were estimated in the extract using the colorimetric method (Table 1).

Table 1: Some chemical and physical properties of considered soil

Parameter		*Value*	*Unit*
Electrical Conductivity	EC(1:1)	10.34	dSm^{-1}
Potential of Hydrogen	pH(1:1)	7.44	
Soil Organic matter	SOM	8.2	g.kg $^{-1}$
Lime	CaCO3	274	
Cation Exchange Capacity	CEC	23.8	cmolc/kg
Bulk Density	BD	1.33	Mg m^{-3}
Ca++	Cations	20.62	
Mg++		12.92	
Na+		33.26	
K+		0.89	mML^{-1}
SO_4^{-2}	Anions	18.24	
Cl-		51.58	
HCO_3		16.09	
Available N		66	mg.kg $^{-1}$
Available P		7.8	
Available K		32	
Soil particles	Sand	331	g.kg $^{-1}$
	Silt	320	
	Clay	349	
Soil Texture	Clay loam		

Experimental Design and Cultivation

A field experiment was carried out during the spring season of 2018 in the field of the Faculty of Dentistry in Clay loam soil texture. A three-factorial experiment was conducted. The first factor included four levels of saline water irrigation symbolised as S_0, S_1, S_2, and S_3 with salts concentrations of 2, 4, 6 and 8 dS. m^{-1}, respectively. The second factor included a foliar application of three levels of humic acids symbolised as H_0, H_1 and H_2 with concentrations of 0, 25 and 50 kg. h^{-1} respectively that equals 0, 1.88 and 3.75 gram per bed. The third factor represents the addition of three levels of potassium fertiliser (potassium sulphate of 50% K_2O), symbolised as K_0, K_1 and K_2 according to the fertiliser recommendation of 0, 75 and 150 kg.h^{-1} , respectively, which meet 0, 11.25 and 22.5 gm. bed^{-1}. The study was carried out according to the (RCBD), with three replications. Then after, the experimental field was plowed to 0 – 0.3 m depth followed by harrowing and levelling. Raised beds with dimensions of 0.5 to 1.5

m width and length respectively were configured. The distance between each adjacent bed was 1 m. After the farm is prepared for cultivation, mono super phosphate fertiliser (P_2O_5 18.98%) was added at the rate of 160 kg P_2O_5 h^{-1} once before planting. The pepper seeds were planted in the nursery and placed in a shaded plastic greenhouse. At the germination stage, the seedlings were irrigated with freshwater. After 20 days from planting, the seedlings were fertilised with nitrogen (urea N46%). When the seedlings had developed five leaves, all seedlings were irrigated with saline water with an electrical conductivity of 2 dS m^{-1} for 15 days. After the adaptation, the seedlings were exposed to salinity using saline water with electrical conductivity of 2, 4, 6, and 8 dS m^{-1} for 15 days. The first factor included four levels of saline water irrigation symbolized as S_0, S_1, S_2, S_3 with salts concentrations of 2, 4, 6 and 8 dS. m^{-1} respectively as shown in Table 2.

Table 2: Some chemical properties of Irrigation water

Parameter		*Units*	S_0	S_1	S_2	S_3
EC		dSm^{-1}	2.00	4.00	6.00	8.00
pH			7.70	7.70	7.60	7.60
Ca^{+2}	Cations		3.40	9.32	11.97	16.00
Mg^{+2}			3.60	7.50	9.87	15.03
Na^{+}			3.70	8.76	14.40	15.20
K^{+}		$meqL^{-1}$	0.05	0.32	0.56	0.78
SO_4^{-2}	Anions		5.20	9.64	14.35	21.06
Cl^{-}			4.66	14.94	19.18	25.22
HCO_3^{-}			3.85	4.81	10.92	11.71

On March 27, 2018, the seedlings were transferred to the field according to the experiment criteria. Reed plants were selected as a source of organic matter. Where the reed plant residues were fermented for 90 days, completing the decomposition process, and Table 3 shows some chemical properties of the reed straw residues.

Humic acid was isolated according to the method described by Schnitzer and Ghosh (1982). Irrigation was done by mixing the saline water taken from some drainage in the Al-Ramadi city with an electrical conductivity of 10 dS. m^{-1} a river water that has an electrical conductivity of 1.1 dS. m^{-1} to prepare four levels of saline water, which is used for plant watering. The seedlings were transferred to the farm on April 8, 2018, for planting in beds on one side, with an interval spacing of 25 cm between the adjacent plants. Urea fertiliser (N46%) was added at a rate of 150 kg $N.h^{-1}$ three times. The first dose was applied 14 days after planting, the second after 20 days, and the third 20 days after the second dose. Potassium sulfate (K_2O 50%) was supplied as a source of potassium fertiliser at a rate of 0, 50, and 150 kg $K_2O.h^{-1}$ which is equivalent to 0, 11.25, and 22.5 $kg.m^{-2}$ in two doses. The first dose was 15 days after planting, while the second was 30 days after the first dose, using a subsoil injection method. The foliar method was used for humic acid application. The solution of umic acid was sprayed three times per season, the first time was 15 days after planting, the second time was 30 days from planting and the third one was 45 days from planting. The measurements and analyses were conducted as follows:

1. The number of branches per plant was estimated after separating the plants from their point of contact with the soil.
2. The stem diameter (mm) of the plant was measured after cutting the plant's contact with the soil.
3. Measure the percentage of protein in the plant
4. Measuring the degree of soil interaction using a pH meter

Results and Discussion

Branch Per Plant

Table 4 illustrates the impact of seedlings' adaptation and the interaction between humic acid and potassium on the number of branches per plant. The results listed in the table, show that there are non-significant differences in the number of branches, but significant differences were observed under the effect of humic acid levels (H_0, H_1, and H_2). The number of branches reached 10.89,

Table 3: Some chemical properties of reed peat

C/N Ratio	*Potassium*	*Phosphorus*	*Total Nitrogen* (*$gm.Kg^{-1}$*)	*Organic Carbon*	*Organic Decomposition Status*
51.3	3.55	0.72	7.64	392	Before decomposition
18.41	2.7	4.52	20.1	370	After decomposition

11.92, and 13.39, with a percentage increase of 9.46% and 22.96% compared to the treatment H_0, respectively. In addition, the obtained results demonstrate a positive relationship between the number of branches per plant and the levels of potassium addition (K_0, K_1, and K_2) with significant differences. The number of branches reached 9.72, 12.42, and 14.06, with a percentage increase of 27.78% and 44.65% compared to treatment K_0 respectively. Regarding the interaction, the combined effect between salinity (S) and the addition of humic acid (H), shows that humic acid addition led to an increase in the number of branches per plant. In this respect, the treatment S_0 H_2 recorded the highest value reaching 13.78, while the lowest value was observed in the treatment S_1 H_0 at 10.22 with a percentage of increase 34.83% compared with the S_1 H_0 treatment.

Similarly, the interaction between (S) and (K), led to a significant increase in the number of branches per plant. Where potassium application at the treatment S_0 K_2 recorded the highest value of branches per plant achieved 14.44, while the lowest value was observed in treatment S_1 K_0 attained 9.56. The percentage increase was 51.05% compared to the S_1 K_0 treatment. Correspondingly, the table also reveals the triple interaction effect of (S), (H), and (K). In light of this, the results show that the highest value was achieved in the treatment S_2 K_2 H_1, up to 15.33, while the lowest value was observed in the treatment S_3 K_0 H_1 was 6.67, with a percentage increase of 129.84% compared to the S_3 K_0 H_1 treatment.

Stem Diameter

Table 5 indicates the effect of seedlings adaptation and the interaction between humic acid and potassium on the stem diameter of pepper plants (in millimeters). The evidence observed from the table shows that there are significant differences in stem diameter at salinity levels S_0, S_1, and S_2, with stem diameters of 1.91, 2.03, and 2.01 mm, compared to the salinity level S_3, where the stem diameter was 1.87 mm. With percentage increase of 3.00%, 9.00%, and 8.00% compared with S_3 treatment. Furthermore, it can be observed that there is an increase in stem diameter associated with the addition of humic acid levels (H_0, H_1, and H_2), and these differences are statistically significant. In that vein, the stem diameter reached 1.76, 1.99, and 2.12 mm, with percentage increases of 13.00% and 21.00% compared to the S_0 treatment. The evidence also shows an increase

Table 4: Effect of seedling adaptation and the interaction between humic acid and potassium on the number of branches

Irrigation water salinity	*H_0*			*H_1*			*H_2*			
	K_0	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*Average*
S_0	7.67	10.00	14.00	10.67	12.67	14.00	12.00	14.00	15.33	12.26
S_1	7.33	10.67	12.67	9.33	11.67	13.00	12.00	14.67	14.67	11.78
S_2	7.67	11.33	12.33	10.67	13.33	15.33	11.67	13.67	14.67	12.3
S_3	10.00	12.67	14.67	6.67	11.67	14.00	11.00	12.67	14.33	11.93
Average of Humic	10.89			11.92			13.39			
Average of Potassium	9.72			12.42			14.06			
L.S.D	SKHA= 2.99			HA= 0.86			K= 0.86		S= 0.99	
Salinity * Humic		S_0		S_1		S_2		S_3		L.S.D
	H_0	10.56		10.22		10.44		12.33		1.73
	H_1	12.44		11.33		13.11		10.7		
	H_2	13.78		13.78		13.33		12.67		
Salinity * Potassium	K_0	10.11		9.56		10		9.22		1.73
	K_1	12.22		12.33		12.78		12.33		
	K_2	14.44		13.44		14.11		14.22		
Humic * Potassium		H_0		H_1		H_2				
	K_0	8.17		9.33		11.67				1.5
	K_1	11.17		12.33		13.75				
	K_2	13.33		14.00		14.75				

Table 5: Effect of seedling adaptation and interaction between humic acid and potassium on stem diameter

Irrigation water salinity	*H_0*			*H_1*			*H_2*			
	K_0	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*Average*
S_0	1.57	1.73	1.93	1.83	1.93	1.9	1.9	2.1	2.3	1.91
S_1	1.7	1.87	1.9	1.9	2.07	2	2.2	2.33	2.33	2.03
S_2	1.45	1.9	1.97	2.13	2.1	2.27	2	2.07	2.17	2.01
S_3	1.57	1.73	1.8	1.77	1.93	2	1.97	2.05	2.07	1.87
Average of Humic	1.76			1.99			2.12			
Average of Potassium	1.83			1.98			2.05			
L.S.D	SKHA= 0.36			HA= 0.10			K= 0.10		S= 0.12	
Salinity * Humic		S_0		S_1		S_2		S_3		L.S.D
	H_0	1.74		1.82		1.78		1.7		0.21
	H_1	1.89		1.99		2.17		1.9		
	H_2	2.1		2.29		2.08		2.02		
Salinity * Potassium	K_0	1.77		1.93		1.87		1.77		0.21
	K_1	1.92		2.09		2.02		1.9		
	K_2	2.04		2.08		2.13		1.96		
Humic * Potassium		H_0		H_1		H_2				
	K_0	1.58		1.91		2.02				0.18
	K_1	1.81		2.01		2.13				
	K_2	1.9		2.04		2.23				

in stem diameter linked with the potassium addition (K_0, K_1, and K_2), and these differences are statistically significant. Based on this, the stem diameter reached 1.83, 1.98, and 2.05 mm, respectively, with percentage increases of 8.19% and 12.02% compared to the K_0 treatment, respectively.

Regarding the interaction between (S) and (H) the findings show that humic acid addition led to a significant increase in stem diameter. The treatment S_1 H_2 recorded the highest value of stem diameter reaching 2.29 mm, while the lowest value was observed in the treatment S_0 H_0 which achieved 1.74 mm, with a percentage increase of 31.61% compared to the S_0 H_0 treatment. Concerning the interaction between (H) and (K), the revealed results show that combining both substances resulted in a significant increase in stem diameter. Regarding the triple interaction between (S), (H), and (K). The observed results show that the highest value of stem diameter was achieved in the treatment S_1 K_2 H_2, which gave the stem a diameter of 2.33 mm. The lowest value was observed in the treatment S_2 K_0 H_0, with a stem diameter of 1.45 mm, with a percentage increase of 60.69%, compared to the treatment S_2 K_0 H_0.

Percentage of Protein in the Fruits (%)

Table 6 demonstrates the effect of seedling adaptation and the interaction between humic acid and potassium on the percentage of protein in the fruits. The table shows significant differences in protein percentages, which are observed at salinity levels S_0, S_1, S_2, and S_3, with protein percentages reaching 105.37, 107.81, 107.91, and 111.12%, respectively. The percentage increases were 2.32%, 2.41%, and 5.46%, compared with the control treatment S_0. Additionally, an increase in the protein percentage was observed with the addition of humic acid levels (H_0, H_1, and H_2), and these differences were statistically significant. The protein percentages reached 102.31, 107.74, and 114.11%. The percentage of increase was 5.31% and 11.53%, compared with the control treatment (H_0). Similarly, the results show an increase in protein percentage with the addition of potassium levels (K_0, K_1, and K_2), and these differences were statistically significant. The protein percentages reached 103.54, 108.12, and 112.50%, with percentage increases of 4.42% and 8.65% compared to the K_0 treatment. Regarding the interaction between salinity and potassium, potassium addition resulted in a significant increase in protein percentage. In

Table 6: Effect of seedling adaptation and interaction between humic acid and potassium on fruit protein content

Irrigation water salinity	*H_0*			*H_1*			*H_2*			
	K_0	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*Average*
S_0	95.93	100.23	101.70	99.40	106.27	109.17	107.93	111.70	116.67	105.37
S_1	99.80	103.53	105.43	104.20	108.17	112.50	107.93	111.27	117.50	107.81
S_2	99.40	102.33	105.23	102.50	107.7	112.30	109.37	113.77	118.57	107.91
S_3	101.87	105.63	107.33	105.63	109.37	115.63	109.17	117.53	127.93	111.12
Average of Humic		102.31			107.74			114.11		
Average of Potassium		103.54			108.12			103.54		
L.S.D		SKHA= 1.99			HA= 0.57		K=0.57			S= 0.66
Salinity * Humic		S_0			S_1		S_2		S_3	L.S.D
	H_0	99.06			102.92		102.32		104.94	1.15
	H_1	104.94			108.29		107.50		110.21	
	H_2	112.10			112.23		113.90		118.21	
Salinity * Potassium	K_0	100.86			103.98		103.76		105.56	1.15
	K_1	106.07			107.66		107.93		110.84	
	K_2	109.18			111.81		112.03		116.97	
Humic * Potassium		H_0			H_1		H_2			
	K0	99.07			102.93		108.60			0.99
	K1	102.93			107.87		113.57			
	K2	104.92			112.40		120.17			

this context, the treatment S_3 K_2 recorded the highest protein percentage at 116.97%, while the lowest value was observed in the treatment S_0 K_0 at 100.86%, with a percentage increase of 15.97% compared to the S_0 K_0 treatment. Similarly, the results show an increase in protein percentage linked with humic acid (H_0, H_1, and H_2) and potassium addition (K_0, K_1, and K_2), and these differences were statistically significant. The protein percentages measured 102.31, 107.74, and 114.11 for H_0, H_1, and H_2, respectively, with percentage increases of 5.31% and 11.53% compared with the H_0 treatment, respectively. The results also show the effect of the triple interaction between S, H, and K. Thus, the highest value was observed in the S_3 K_2 H_2 treatment, reached 127.93%, while the lowest value was recorded in the S_0 K_0 H_0 treatment, at 95.23%, with a percentage increase of 34.34% compared with the S_0 K_0 H_0 treatment.

These results are consistent with Al-Rawi (2018), who indicated that increasing the salinity levels of irrigation water led to an increase in the protein content in the fruits. Relating to the addition of humic acid, it led to an increase in the protein content in the fruits. This is in line with Esho (2017) who pointed out that the addition of humus fertilisers increases the plant protein content. It assists in separating newly formed proteins from ribosomes, allowing the opportunity for the formation of new proteins (Abdel-Latif et al., 2011).

Soil Acidity (pH)

Table 7 shows the effect of seedling adaptation and the interaction between humic acid and potassium on soil pH after cultivation. It is clear from the table that there is a significant decrease in soil pH at salinity levels S_0, S_1, S_2, and S_3. The soil pH values were 7.41, 7.37, 7.33, and 7.28, respectively, with a percentage decrease of 0.54%, 1.08%, and 1.75% as compared with the treatment S_0, respectively. Also, it can observed that there is a significant decrease in soil pH with the addition of humic acid levels H_0, H_1, and H_2. The soil pH values were 7.37, 7.35, and 7.33, respectively, with a percentage decrease of 0.27% and 0.54% compared to treatment H_0, respectively. However, no significant differences were observed in soil pH under the effect of potassium level addition (K_0, K_1, and K_2). The soil pH values were 7.35, 7.75, and 7.35, respectively, with no percentage decrease compared with treatment S_0. The table also shows a significant decrease in soil pH with the addition of both salinity and humic acid.

Table 7: Effect of seedling adaptation and the interaction between humic acid and potassium on soil pH

Irrigation water salinity	*H_0*			*H_1*			*H_2*			
	K_0	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*K_0*	*K_1*	*K_2*	*Average*
S_0	7.46	7.44	7.44	7.42	7.40	7.40	7.39	7.39	7.38	7.41
S_1	7.38	7.38	7.39	7.37	7.37	7.36	7.36	7.36	7.36	7.37
S_2	7.34	7.34	7.35	7.34	7.33	7.34	7.33	7.33	7.31	7.33
S_3	7.29	7.3	7.29	7.29	7.25	7.28	7.27	7.28	7.27	7.28
Averageof Humic		7.37			7.35			7.33		
Averageof Potassium		7.35			7.35			7.35		
L.S.D		SKHA= 0.021			HA= 0.006			K=0.006		S= 0.007

Salanity * Humic		S_0	S_1	S_2	S_3	L.S.D
	H_0	7.45	7.38	7.34	7.29	0.001
	H_1	7.41	7.37	7.33	7.27	
	H_2	7.39	7.36	7.32	7.27	
Salanity * Potassium	K_0	7.42	7.37	7.34	7.28	0.001
	K_1	7.41	7.37	7.33	7.28	
	K_2	7.41	7.37	7.33	7.28	
Humic * Potassium		H0	H1	H2		
	K_0	7.37	7.36	7.34		1.011
	K_1	7.37	7.34	7.34		
	K_2	7.37	7.34	7.33		

The highest soil pH value was recorded at treatment S_0 H_0, which gave 7.45, while the lowest value was observed at treatment S_3 H_2, which gave 7.27, with a percentage decrease of 6.44% compared to the S_0 H_0 treatment. Regarding the interaction between salinity and potassium, the addition of potassium resulted in a significant decrease in soil pH. The highest soil pH value was recorded at treatment S_0 K_0, which gave 7.42, while the lowest value was observed at treatment S_3 K_2, which was 7.28, with a percentage decrease of 1.89% compared to S_0 K_0 treatment. Similarly, the interaction between humic acid and potassium resulted in a significant decrease in soil pH. Where the highest soil pH value was recorded at treatment K_0 H_0, which gave 7.37, while the lowest value was observed at treatment K_2 H_2, which gave 7.33, with a percentage decrease of 0.54%.The table also demonstrates the impact of the triple interaction between salinity, humic acid, and potassium. In this regard, the highest soil pH value was recorded at treatment S_0 K_0 H_0, which was 7.46, while the lowest value was observed at treatment S_3K_1 H_1, which reached 7.25, with a percentage decrease of 2.81% compared with the S_0 K_0 H_0 treatment. Increasing the salinity of irrigation water leads to the accumulation of neutral salts in the soil, which, in turn, reduces the soil pH towards neutrality.

Conclusion

The current study indicated that using the combination of humic acids, potassium fertiliser and saline irrigation water reduced the harmful effect of salinity on pepper plant growth. Where under the effect of study factors combination (humic acids, potassium fertiliser and saline irrigation water), all the considered plant traits had increased. Also, the study findings show that the study factors combination enhances the pepper plant's ability to adapt to irrigation water salinity. Moreover, the combination of study factors resulted in a significant decrease in soil pH. Consequently, increases the nutrition availability, which thereby leads to an increase in the plant traits under study

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