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The effect of fertilization with urea and important sulfates on some growth characteristics of the Ares plant Myrtus communis L.growing under salt stress.

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Abstract
season in the woody canopy of 2023-2022 The study was conducted during the the College of Agriculture, University of Basra, to study the effect of treatment with urea and potassium sulfate on myrtle plants growing under salt stress and the interactions of the three was used as a source of nitrogen at concentrations of (0, 50, 100) mg. L treatments, where urea^{-1} and potassium sulfate as a source of potassium in concentrations of (0, 50, 100) mg. L^{-1}. For salty water, concentrations of (1, 3, 6) ds.m -1 were used.

ect of the three study factors showed the superiority of the salt stress The results of the eff treatment at a concentration of 6ds.m $^{-1}$ in the average characteristics of the fresh weight of the esh weight of shoot, the dry weight of the shoot, the percentage increase in plant growth, the fr the root system, the dry weight of the root system, and the carbohydrate content. It reached mg. 100 g g, 69.93 g, 56.70%, 66.70 g, 25.40 g, 177.10 111.00)$^{-1}$ respectively. The salt stress ,(treatment at a concentration of 3ds.m $^{-1}$ excelled in the rate of root length characteristic and proline µg g content, reaching (56.84 cm, 17.76^{-1} respectively ,(
As for urea, the 100 mg/L treatment was superior in terms of percentage increase in plant micrograms g content, reaching (53.2%, 17.59 growth, proline content, and carbohydrate^{-1} , 175.60 mg. 100 g^{-1} respectively. Urea at a concentration of 50 mg/L outperformed the average ,(characteristics of the fresh weight of the shoot and the dry weight of the shoot, reaching (119.10 .g), respectively g, 71.44
As for potassium sulfate, the treatment was superior to potassium sulfate at a concentration of mg/L in terms of the average percentage increase in plant growth, fresh weight of the root 100 ine content, which amounted to (49.40%, 63.31 g, system, dry weight of the root system, and prol micrograms). gm g, 18.07 24.61^{-1} respectively. As for the 50 mg/L treatment, it excelled in ,(the average characteristics of the fresh weight of the shoot and the dry weight of the shoot, which .o (120.90 g, 69.59 g) respectivelyamounted t
.way interactions in all traits were significant-and three -All two

INTRODUCTION

Myrtle plant*Myrtus communis* L. known aromatic ornamental plant belonging to -It is a well theMyrtaceae family) which includes approximately 100 genera and 3000 species ,Sumbule *et al.*, 2011).

It is a small shrub that grows throughout the Mediterranean regions. It often grows in hrubs shady, moist places, areas abundant with water, and on the banks of rivers. Myrtle s rise to two meters and have many branches filled with leaves that contain glands with a beautiful, pleasant smell. It is an evergreen plant, and its leaves They maintain their ify the air and glasses for a long time, and they secrete disinfectant substances that pur smelling perfumes are extracted from the -eliminate microorganisms. Many pleasant leaves, flowers, fruits, and bark of the myrtle plant. Myrtle fruits are also considered to m their fruits shows have nutritional and medicinal benefits, as the syrup extracted fro) nutritional and medicinal value and benefit. HighGradelie *et al* ., 2008).

Foliar nutrition is used to meet the plants' need for elements by spraying on the leaves. This is ng the elements to their consumption centers because their absorption by the roots and transporti takes a long time compared to spraying directly on the leaves. Foliar nutrition is involved in many biochemical and physiological processes that affect development and growth. The result is a plant
(Stojanova *et al* ., 2016).

Nitrogen is one of the most important elements necessary for plants, as the plant's nitrogen of dry weight. It occupies an important role in plant nutrition and %5-content ranges between 2 amino acids that form the structure of proteins, physiology, as it is included in the construction of enzymes, and cellular membranes. It is also involved in the construction of chlorophyll, nucleic .acids, and vitaminsWang *et al* .,2014).

issue and maintains cell Potassium contributes to regulating the moisture balance in plant t swelling. It also participates in many physiological processes in plants, including photosynthesis, enzyme activation, and plant sap transfer processes. A deficiency in potassium causes a decrease) ht, decay, and resistance to insect infestation and diseasein the plant's resistance to droug Rawat *et al* . *al* ,.2022).

Potassium is one of the reasons for increasing the plant's efficiency in absorbing nutrients, the nsuring the plant's most important of which are phosphorus and nitrogen, which leads to e nutritional balance, which leads to improving plant growth, improving its quality, and increasing production. Potassium helps speed up plant growth and improves the plant's resistance to pests Better and stronger, giving potassium fertilizer at the .and drought, which leads to plants growing) right time and quantity ensures good growth and enhanced productionGonçalves *et al* , 2022).

Salt stress is one of the most influential types of stress on plant growth and development, as exposure to this type of stress leads to exposure of the plant to another type of stress, which is b water, and there are differences in water stress, as salinity reduces the plant's ability to absor sensitive plants, moderately -the level of tolerance to salt stress, as Plants are divided into salt .(Najjar et al., 2020-tolerant plants (Al-sensitive plants, and salt-salt

The conclusion ofAcosta-Motos *et al.* Salinity is one of the most important environmental 2017 challenges that reduces plant productivity. In the short term, the effect of salt stress is observed first through the root system, as it affects the osmotic pressure in the roots, which causes a in water absorption and its availability to the plant. However, in the long term, salt decrease stress leads to Ion poisoning occurs due to an imbalance of nutrients in the cellular juice present e continued absorption of in the cell vacuoles. Plants with a strong root system can ensure th water and nutrients from the soil under salt stress. In general, salt stress leads to a decrease in the production of the vegetative parts of the plant. Stress causes the production of Ethylene, which loss is considered one of the mechanisms for resisting salt stress, by leads to leaf fall, and this reducing the water lost through transpiration. Another mechanism for resisting salt stress is n absorb increasing the proportion of roots to the shoot. The large root system under salt stress ca toxic ions and break them down. And its accumulation in it, and this is one of the important mechanisms for resisting soil salinity and is used to maintain the osmotic pressure inside the .plant and continue water absorption

siological roles, some of which are directly harmful to plants, namely toxic Salinity has many phy effects or indirect effects, such as osmotic or ion effects, which weaken the plant's ability to me chemical carry out its vital activities, which can cause a reduction in the synthesis of so compounds in the plant, in addition to reducing the absorption of some elements. The nutrients that the plant needs to build some compounds, and these compounds include carbohydrates and teins and some plant hormones (Abdel amino acids, which are the basis for the synthesis of pro .(Wahed, 2012

:Working methods

The experiment was carried out in the wooden canopy of the Department of Horticulture and for the agricultural -University of Basra -College of Agriculture -Landscape Engineering on on some vegetative season 2022/2023, with the aim of knowing the effect of foliar fertilizati) traits of the myrtle plant***Mtytus communism L.)*** .growing under salt stress
The plants were prepared from a nursery in Basra and transferred to plastic pots with a diameter d filled with a growth medium of 24 cm and a height of 22 cm, with a capacity of 7 kg, an .consisting of seed and peat moss in a ratio of 1:2

The experiment was designed according to aRandomized Complete Block Design (RCBD as a (factorialexperiment lications for which included 27 factorial treatments, 3*3*3, with three rep , each treatment. Thus, the number of experimental units is 81 experimental units, and the Rawi and -experimental unit includes 3 plants, so the total number of plants is 243. plants . (Al .(Khalaf Allah, 2000

e taken on the experimental plants one month after the last All measurements studied wer :spraying and included the following characteristics

1- :(Fresh weight of shoots (g

The fresh weight of the shoot was calculated by separating the shoot from the root, and the .using a balance weight was measured

:(Dry weight of shoots (g -2

The dry weight of the shoots was measured at the end of the experiment. The shoots were separated to be dried and placed in paper bags and placed in an electric oven for 72 hours at a .until the weight stabilized. Then the dry weight of the shoots was measured temperature of 65°C

3 - :(%) Percentage increase in plant growth rate

The growth speed of Elias seedlings was measured based on the estimated increase in the height od of six months. The percentage of growth speed was calculated of the plant seedlings for a peri :according to the following equation

first height –Final height
Percentage rate of increase in plant growth = 100
First height

4- :(Root length (cm

.their rates were recorded Root length measurements were taken and

5- :(Fresh weight of the root system (g

The fresh weight of the root system of the seedlings was measured at the end of the experiment with by uprooting the plants, separating the shoot from the root system, washing the root system water to remove dust, cleaning it well, drying it airily to get rid of the washing water, then weighing it with a sensitive balance, and the weight of the root system of one plant was .measured

:(Dry weight of the root system (g - 6

the root system of the seedlings was measured after uprooting the seedlings at The dry weight of the end of the experiment and separating the root system from the shoot. The root system of each then the dry dried until the weight of the samples was constant, and-seedling was dried air .weight of the plant was measured using a sensor balance

the amino acid proline (µg g Leaves' content of -7^{-1}):

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Proline was determined according to the method ofTroll and Lindslay by taking 0.2 (1955) grams of dried and crushed leaves and adding 5 ml of 95% ethyl alcohol. Then the centrifugation ,process was carried out in a centrifugeand then the clear part was taken and evaporated until distilled water to the remaining part after dry, after which 2 grams were added. ml of evaporation, then the centrifugation process was carried out again, and 1 ml of the clear part was taken and its absorbance was read at a wavelength of 520 nm with a spectrophotometer, and the concentration oline in the leaves was estimated based on a standard curve for the amino acid of pr : .proline according to the following equation

Reading from the standard curve
Proline concentration (µg g^{-1} dilution * ____ = (
Sample weight

8- mg. 100 gm) Leaves' content of total soluble carbohydrates^{-1} (dry weight**:**

sulphric acid-It was estimated using the modified phenolcolorimetric method prepared by Dobois *et* al . (1956 apex and This was done by collecting the fourth leaf from the growing .(after cleaning it well, it was placed in an electric oven at a temperature of 70°C until the weight :was constant, and then I ground it with an electric grinder and then followed the following steps or each experimental unit and place it in a test Take 0.5 grams of dry plant sample (leaves) f -1 .tube

ml of distilled water was added to it, then the tube was closed and heated in a water bath at 75 - 2 .boiling point for an hour, then cooled to room temperature

per and take a volume of 5 ml of the filtrate and add 25 ml Filter the solution through filter pa -3 of distilled water to it, then take 1 ml of it and add 1 ml of phenol to it with 5 ml of concentrated .sulfuric acid quickly and cool to room temperature

ngth of 490 nm with aThe absorbance was measured at a wavele -4spectrophotometer

.The amount of total soluble carbohydrates was estimated using the glucose standard curve

: Results

:(Fresh weight of shoots (g -1

Table No. 1 shows the significant effect of the three study factors and their interactions on the fresh weight of the shoots. If the plants treated with salt stress at a concentration of 6ds.m $^{-1}$ excelled in the average fresh weight of the shoots in the experimental season, which amounted to .g, while the treatment with salt stress at a concentration of 3 was recorded 111.00ds.m $^{-1}$ .decreased in rate, reaching 101.60 g

the effect of plants treated with urea on the average fresh The same table also showed weight of the shoots, as the urea treatment was given at a concentration of 50 mg. L^{-1} had the highest rate of 119.10 g, while the urea treatment recorded a concentration of 100 mg. Liter^{-1} .ease in the average fresh weight of the vegetative plant, reaching 101.60 gdecr

As for the effect of spraying with potassium sulfate, the results of the same table showed

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ven the effect on the average fresh weight of the vegetative plant, as the treatment was gi at a concentration of 50 mg. Liter^{-1} the highest average fresh weight of shoots reached , grams compared to plants treated with a concentration of 100 mg. L 120.90^{-1} which , .g 0gave the lowest average fresh weight of the vegetative plant, reaching 100.1

The results of the bilateral interaction between the factors of salt stress and urea in the average fresh weight of the shoots were also shown, as the plants treated with salt stress recorded 1ds.m $^{-1}$ and urea at a concentration of 50 mg. L^{-1} he highest average fresh had t weight of the shoots, which reached 133.10 grams, compared to the lowest average fresh weight of the shoots, which reached 95.40 grams for plants treated with salt stress at a concentration of 1ds.m $^{-1}$ of 0 mg. L and urea at a concentration^{-1} .

Either the effect of the dual interaction between the two factors of salt stress and potassium sulfate on this trait gave plants treated with salt stress at a concentration of 1 ds.m $^{-1}$ with potassium sulfate at a concentration of 50 mg. L^{-1} amounted to 127.60 g, compared to the lowest rate of 86.60 g for plants treated with salt stress at a concentration of 3ds.m $^{-1}$ with potassium sulfate at a concentration of 100 mg. L^{-1} .

spraying with potassium As for the binary interaction between treatment with urea and sulfate in this case, treatment with urea at a concentration of 50 mg was recorded. L^{-1} with potassium sulfate at a concentration of 50 mg. L^{-1} The highest average fresh weight erage fresh weight of the shoots, of the shoots was 151.70 g, compared to the lowest av and 1- which was 79.10 g, for plants treated with urea at a concentration of 0 mg. L potassium sulfate at a concentration of 100 mg. L^{-1} .

h salt stress As for the triple interaction between the three study factors, plants treated wit at a concentration of 6ds.m $^{-1}$ and urea at a concentration of 50 mg were characterized. L $^{-1}$ and potassium sulfate at a concentration of 50 mg. L^{-1} with the highest rate of fresh the lowest rate, which weight of the shoots, which amounted to 158.50 g, compared to was 64.20 g for plants treated with salt stress at a concentration of 1ds.m $^{-1}$ and urea at a concentration of 100 mg. L^{-1} and potassium sulfate at a concentration of 0 mg. L^{-1} .

and potassium sulfate on the fresh weight of ,Table No. 1: The effect of salt stress, urea .myrtle shoots

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Interaction effect of urea and salt stress	Potassium sulfate mg/L			Urea mg/L	Salt stress ds.m $^{-1}$
	100	50	0		
95.40	82.40	136.70	67.10	0	1
133.10	115.10	143.90	140.20	50	
101.30	137.60	102.10	64.20	100	
103.10	82.90	115.70	110.60	0	3
103.80	76.70	152.60	82.00	50	
97.90	100.40	81.50	112.00	100	
107.10	72.10	120.60	128.60	0	6
120.60	104.40	158.50	98.80	50	
105.40	138.40	76.80	101.00	100	
11.96	20.71				LSD 0.05
Effect of salt stress	Interference effect				
	Potassium sulfate				Salt stress
	100	50	0		
109.90	111.70	127.60	90.50		1
101.60	86.60	116.60	101.50		3
111.00	104.90	118.70	109.50		6
6.90	11.96				LSD 0.05
Interference effect					
Effect of urea	Potassium sulfate				Urea
	100	50	0		
101.90	79.10	124.40	102.10		0
119.10	98.70	151.70	107.00		50
101.60	125.50	86.80	92.40		100
6.90	11.96				LSD 0.05
101.10		120.90	100.50		Effect of potassium sulfate
6.90					LSD 0.05

:(Dry weight of shoots (g -2

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Table No. 2 shows the significant effect of the three study factors and their interactions on the dry weight of the shoot. If the plants treated with salt stress at a concentration of 6ds.m $^{-1}$ ental season, which amounted to excelled in the average dry weight of the shoot in the experim .g, while the treatment with salt stress at a concentration of 3 was recorded 69.93ds.m $^{-1}$ .decreased in rate, reaching 51.89 g

The same table also showed the effect of plants treated with urea on the average dry the shoots, as the urea treatment was given at a concentration of 50 mg. L weight of $^{-1}$ had the highest rate of 71.44 g, while the treatment recorded urea at a concentration of 100 mg. Liter $^{-1}$ .decrease in the average dry weight of the shoot, reaching 52.60 g

for the effect of spraying with potassium sulfate, the results of the same table showed As the effect on the average dry weight of the shoots, as the treatment was given at a concentration of 50 mg. Liter $^{-1}$ 69.59 the highest average dry weight of shoots reached , grams compared to plants treated with a concentration of 100 mg. L $^{-1}$ which gave the , .lowest average dry weight of the shoot, reaching 53.66 grams

The results of the bilateral interaction between the factors of salt stress and urea in the average dry weight of the shoots were also shown, as the plants treated with salt stress recorded 6ds.m $^{-1}$ and urea at a concentration of 50 mg. Liter $^{-1}$ ighest average had the h dry weight of the shoots, which amounted to 86.03 grams, compared to the lowest average dry weight of the shoots, which reached 52.61 grams for plants treated with salt stress at a concentration of 1ds.m $^{-}$ mg. L and urea at a concentration of 0 1 $^{-1}$.

Either the effect of the dual interaction between the two factors of salt stress and potassium sulfate on this trait gave plants treated with salt stress at a concentration of 6 ds.m $^{-1}$ with potassium sulfate at a concentration of 50 mg. L $^{-1}$ amounted to 81.71 g, compared to the lowest rate, which was 43.96 g for plants treated with salt stress at a concentration of 3ds.m $^{-1}$ with potassium sulfate at a concentration of 100 mg. L $^{-1}$.

nd spraying with potassium As for the binary interaction between treatment with urea a sulfate in this case, treatment with urea at a concentration of 50 mg was recorded. L $^{-1}$ with potassium sulfate at a concentration of 50 mg. L $^{-1}$ The highest average dry weight of st average dry weight of the shoots, the shoots was 100.31 grams, compared to the lowe $^{1-}$ which reached 39.49 grams, for plants treated with urea at a concentration of 0 mg. L potassium sulfate at a concentration of 100 mg. L $^{\text{and-1}}$.

ds.m $^{-1}$ and urea at a concentration of 50 mg were distinguished . L $^{-1}$ and potassium sulfate at a

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concentration of 50 mg. L^{-1} with the highest rate of dry weight of shoots, which amounted to 136.02 g, compared to the lowest rate, which was 32.63 g for plants treated with salt stress at a concentration of 1ds.m^{-1} a at a concentration of 100 mg. Land ure^{-1} and potassium sulfate at a concentration of 0 mg. L^{-1} .

Table No. 2 The effect of salt stress, urea, and potassium sulfate on the dry weight of .myrtle shoots

Interaction effect of urea and salt stress	mg/L Potassium sulfate			Urea mg/L	Salt stress ds.m^{-1}
	100	50	0		
52.61	42.94	70.51	44.38	0	1
72.97	60.84	80.98	77.09	50	
53.98	74.87	54.44	32.63	100	
53.36	41.60	56.03	62.46	0	3
55.33	37.32	83.94	44.74	50	
46.98	52.96	35.30	52.67	100	
66.91	33.95	74.90	91.89	0	6
86.03	57.67	136.02	64.41	50	
56.85	80.82	34.22	55.49	100	
8.430	14.602				LSD 0.05
Effect of salt stress	Interference effect				
	Potassium sulfate				Salt stress
	100	50	0		
59.85	59.55	68.64	51.36		1
51.89	43.96	58.42	53.29		3
69.93	57.48	81.71	70.06		6
4.867	8.430				LSD 0.05
Interference effect					
Effect of urea	Potassium sulfate				Urea
	100	50	0		

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57.63	39.49	67.15	66.24	0
71.44	51.94	100.31	62.08	50
52.60	69.55	41.32	46.93	100
4.867	8.430			
53.66		69.59	58.42	Effect of potassium sulfate
4.867				LSD 0.05

:(%) Percentage increase in plant growth -3

Table No. 3 shows the significant effect of the three study factors and their interactions on the percentage of increase in plant growth. The plants treated with salt stress at a concentration of 6ds.m $^{-1}$ excelled nt growth in the experimental season, the rate of percentage increase in pla in which amounted to 56.70%, while the treatment recorded With salt stress at a concentration of 1 ds.m $^{-1}$ .the rate decreased by 37.70% ,

The same table also showed the effect of plants treated with urea on the average percentage increase in plant growth, given the urea treatment at a concentration of 100 mg. L^{-1} had the highest rate of 53.20%, while the urea treatment recorded a concentration of 0 mg. L^{-1} .hing 39.10%decreased the percentage rate of increase in plant growth, reac

As for the effect of spraying with potassium sulfate, the results of the same table showed the effect on the average percentage increase in plant growth when the treatment was given at a concentration of 100 mg. L^{-1} e increase in plant had the highest percentag growth, reaching 49.40% compared to plants treated with a concentration of 0 mg. L^{-1} , .which gave an average root length of 38.40%

The results of the dual interaction between the two factors salt stress and urea showed a ncrease in plant growth, as plants treated with salt stress recorded 6percentage ids.m $^{-1}$ and

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urea at a concentration of 100 mg. L^{-1} had the highest rate of percentage increase in plant growth, which reached 70.00%, compared to the lowest rate of percentage increase in growth, which reached 28.00% for plants treated with salt stress at a concentration of 1 ds.m $^{-}$ ration of 0 mg. Land urea at a concent 1^{-1} .

Either the effect of the bilateral interaction between the two factors of salt stress and potassium sulfate on this trait gave the plants treated with salt stress at a concentration of 6ds.m $^{-1}$ With potassium sulfate at a concentration of 100 mg. L^{-1} and reached 64.30% compared to the lowest rate of 32.10 for plants treated with salt stress at a concentration of 1ds.m $^{-1.}$ With potassium sulfate at a concentration of 0 mg. L^{-1} .

ary interaction between treatment with urea and spraying with potassium As for the bin sulfate in this case, treatment with urea at a concentration of 100 mg was recorded. L^{-1} with potassium sulfate at a concentration of 100 mg. L^{-1} The highest rate of percentage ase in plant growth reached 61.60% compared to the comparison plants, while the incre lowest rate of percentage increase in plant growth reached 31.90% for the comparison .plants

ds.m $^{-1}$ and urea at a concentration of 100 mg were distinguished . L^{-1} ium sulfate at a and potass concentration of 100 mg. L^{-1} with the highest rate of percentage increase in plant growth, which amounted to 82.50%, compared to the lowest rate, which was 16.70% for plants treated with salt stress at a concentration of 1ds.m $^{-1}$ a at a concentration of 0 mg. and ure L^{-1} and potassium sulfate at a concentration of 0 mg. L^{-1} .

Table No. 3: The effect of salt stress, urea, and potassium sulfate on the percentage .increase in plant growth of myrtle plants

Interaction effect of urea and salt stress	Potassium sulfate mg/L			Urea mg/L	Salt stress ds.m $^{-1}$
	100	50	0		
28.00	38.10	29.20	16.70	0	1
40.00	36.60	41.50	41.90	50	
45.00	49.70	47.50	37.80	100	
45.60	39.90	52.10	44.90	0	3
36.60	34.30	48.50	27.00	50	

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44.50	52.60	43.10	37.80	100	
43.70	48.40	48.40	34.10	0	6
56.30	62.10	58.60	48.10	50	
70.00	82.50	70.60	57.00	100	
9.77	16.92				LSD 0.05

Effect of salt stress	Interference effect			
	Potassium sulfate			Salt stress
	100	50	0	
37.70	41.50	39.40	32.10	1
42.20	42.30	47.90	36.50	3
56.70	64.30	59.20	46.40	6
5.64	9.77			LSD 0.05
Interference effect				
Effect of urea	Potassium sulfate			Urea
	100	50	0	
39.10	42.10	43.20	31.90	0
44.30	44.40	49.60	39.00	50
53.20	61.60	53.70	44.20	100
5.64	9.77			LSD 0.05
49.40		48.80	38.40	Effect of potassium sulfate
5.64				LSD 0.05

:(Root length (cm - 4

Table No. 4 shows the significant effect of the three study factors and their interactions on the root length trait. If the plants treated with salt stress at a concentration of 3ds.m $^{-1}$ excelled the in experimental season, which reached 56.84 cm, while the treatment with salt stress at a concentration of 1ds.m $^{-1}$ recorded .a decrease. On average, it reached 53.76 cm

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root The same table also showed the effect of plants treated with urea on the rate of length, as they were treated with urea at a concentration of 0 mg. L^{-1} had the highest rate of 58.51 cm, while the treatment recorded urea at a concentration of 50 mg. L^{-1} decreased .the average root length, reaching 53.71 cm

spraying with potassium sulfate, the results of the same table showed As for the effect of the effect on the average root length, as the treatment was given at a concentration of 0 mg. L^{-1} the highest average root length reached 57.61 cm compared to plants treated , ncentration of 50 mg. Lwith a co^{-1} .which gave the average root length as 52.39 cm ,

The results of the bilateral interaction between the factors of salt stress and urea on the average root length were also shown, as the plants treated with salt stress recorded 6ds.m - 1 and urea at a concentration of 0 mg. L^{-1} ot length, which had the highest average ro reached 62.33 cm, compared to the lowest average root length, which reached 49.74 cm for plants treated with salt stress at a concentration of 1ds.m^{-1} and urea at a concentration of 100 mg. L^{-1} .

Either the effect of the bilateral interaction between the two factors of salt stress and potassium sulfate on this trait gave the plants treated with salt stress at a concentration of 3ds.m^{-1} With potassium sulfate at a concentration of 100 mg. L^{-1} ched 63.07 cm rea compared to the lowest rate of 49.11 cm for plants treated with salt stress at a concentration of 1ds.$m^{-1.}$ With potassium sulfate at a concentration of 50 mg. L^{-1} .

th potassium As for the binary interaction between treatment with urea and spraying wi sulfate in this case, treatment with urea at a concentration of 0 mg was recorded. L^{-1} with potassium sulfate at a concentration of 100 mg. L^{-1} The highest root length rate reached ched 50.96 cm, for plants cm, compared to the lowest root length rate, which rea 65.89 potassium sulfate at a concentration $^{\text{and } 1-}$ treated with urea at a concentration of 50 mg. L of 100 mg. L^{-1} .

ds.m^{-1} with urea at a concentration of 0 mg were distinguished . L^{-1} and potassium sulfate at a mg. L concentration of 100^{-1} with the highest rate of root length, which was 70.73 cm, compared to the lowest rate, which was 40.67 cm, for plants treated with salt stress at a concentration of 6ds.m^{-1} and urea at a concentration of 50 mg. L^{-1} and potassium sulfate oncentration of 100 mg. Lat a c^{-1} .

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Table No. 4 The effect of salt stress, urea, and potassium sulfate on the root length characteristic of myrtle plants

Interaction effect of urea and salt stress	Potassium sulfate mg/L			Urea mg/L	Salt stress ds.m $^{-1}$
	100	50	0		
54.48	56.27	45.70	61.47	0	1
57.07	51.47	53.40	66.33	50	
49.74	44.53	48.23	56.47	100	
58.73	70.73	55.73	49.73	0	3
50.73	60.73	43.73	47.73	50	
61.07	57.73	58.73	66.73	100	
62.33	70.67	55.67	60.67	0	6
53.33	40.67	63.67	55.67	50	
52.22	56.33	46.67	53.67	100	
4.650	8.055				LSD 0.05
Effect of salt stress	Interference effect				
	Potassium sulfate				Salt stress
	100	50	0		
53.76	50.76	49.11	61.42		1
56.84	63.07	52.73	54.73		3
55.96	55.89	55.33	56.67		6
2.685	4.650				LSD 0.05
effect Interference					
Effect of urea	Potassium sulfate				Urea
	100	50	0		
58.51	65.89	52.37	57.29		0
53.71	50.96	53.60	56.58		50
54.34	52.87	51.21	58.96		100
2.685	4.650				LSD 0.05
56.57		52.39	57.61		Effect of potassium sulfate
2.685					LSD 0.05

:(the root total (g Fresh weight of - 5

Table No. 5 shows the significant effect of the three study factors and their interactions on the fresh weight of the root system. If the plants treated with salt stress at a concentration of 6ds.m $^{-1}$ ht of the root system in the experimental season, which excelled in the average fresh weig .amounted to 66.70 g, while the treatment with salt stress at a concentration of 3 was recorded ds.m $^{-1}$ .Decrease in the average fresh weight of the root system, reaching 43.75 grams

lso showed the effect of plants treated with urea on the fresh weight of The same table a the root system, given the urea treatment at a concentration of 0 mg. L^{-1} had the highest rate of 61.00 g, while the urea treatment recorded a concentration of 100 mg. Liter^{-1} .ase in the average fresh weight of the root system, reaching 53.84 gramsdecre

As for the effect of spraying with potassium sulfate, the results of the same table showed the effect on the average fresh weight of the root system, as the treatment was given at a concentration of 100 mg. L^{-1} the highest average fresh weight of the root system , reached 63.31 grams compared to plants treated with a concentration of 0 mg. L^{-1} which , .resulted in a decrease in the average fresh root weight, reaching 48.47 g

esults of the binary interaction between the factors of salt stress and urea were also The r shown in the percentage of fresh weight of the root system, as the plants treated with salt stress recorded 6ds.m $^{-1}$ and urea at a concentration of 0 mg. L^{-1} The highest average fresh weight of the root system, which reached 87.44 grams, compared to the lowest average fresh weight of the root system, which reached 40.27 grams for plants treated with salt stress at a concentration of 3ds.m $^{-1}$ entration of 100 mg. Land urea at a conc^{-1} .

Either the effect of the bilateral interaction between the two factors of salt stress and potassium sulfate on this trait gave plants treated with salt stress at a concentration of 1 ds.m $^{-1}$ with potassium sulfate at a concentration of 100 mg. L^{-1} amounted to 73.03 g,

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compared to the lowest rate of 35.82 g for plants treated with salt stress at a concentration of 3ds.m $^{-1}$ with potassium sulfate at a concentration of 0 mg. L^{-1} .

binary interaction between treatment with urea and spraying with potassium As for the sulfate in this case, treatment with urea at a concentration of 50 mg was recorded. L^{-1} with potassium sulfate at a concentration of 100 mg. The highest rate of liter^{-1} was 73.44 g, compared to the lowest rate of fresh weight of the root system, which was 37.67 g, for potassium sulfate at a $^{\text{and } 1-}$ plants treated with urea at a concentration of 50 mg. L concentration of 50 mg. L^{-1} .

ds.m $^{-1}$ with urea at a concentration of 50 mg re characterized . Lwe^{-1} and potassium sulfate at a concentration of 100 mg. L^{-1} with the highest rate of fresh weight of the root system, which amounted to 121.13 g, compared to the lowest rate, which was 20.93 g, for plants concentration of 3 treated with salt stress at ads.m $^{-1}$ and urea at a concentration of 0 mg. L^{-1} and potassium sulfate at a concentration of 0 mg. L^{-1} .

Table No. 5 The effect of salt stress, urea, and potassium sulfate on the fresh weight of the root system of myrtle plants

Interaction effect of urea and salt stress	Potassium sulfate mg/L			Urea mg/L	Salt stress ds.m $^{-1}$
	100	50	0		
45.08	39.83	52.60	42.80	0	1
74.99	121.13	43.40	60.43	50	
55.92	58.13	74.10	35.53	100	
50.49	50.27	80.27	20.93	0	3
40.49	40.93	33.27	47.27	50	
40.27	55.27	26.27	39.27	100	
87.44	89.67	82.33	90.33	0	6
47.31	58.27	36.33	47.33	50	

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65.33	56.33	87.33	52.33	100	
4.205	7.284				LSD 0.05
Effect of salt stress	Interference effect				
	Potassium sulfate				Salt stress
	100	50	0		
58.66	73.03	56.70	46.26		1
43.75	48.82	46.60	35.82		3
66.70	68.09	68.67	63.33		6
2.428	4.205				LSD 0.05
Interference effect					
Effect of urea	Potassium sulfate				Urea
	100	50	0		
61.00	59.92	71.73	51.36		0
54.84	73.44	37.67	51.68		50
53.84	56.58	62.57	42.38		100
2.428	4.205				LSD 0.05
63.31		57.32	48.47		Effect of potassium sulfate
2.428					LSD 0.05

:(Dry weight of the root system (g - 6

Table No. 6 shows the significant effect of the three study factors and their interactions on the dry weight of the root system. If the plants treated with salt stress at a concentration of 6ds.m $^{-1}$ excelled the experimental season, which amounted the average dry weight of the root system in in to 25.40 g, while the treatment with salt stress recorded at a concentration of 3ds.m $^{-1}$ decreased .in rate, reaching 18.82 g

The same table also showed the effect of plants treated with urea on the average dry

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ight of the root system, as it gave a urea treatment at a concentration of 0 mg. Lwe^{-1} had the highest rate of 23.03 g, while the treatment recorded urea at a concentration of 100 mg. L^{-1} .g decreased the average dry weight of the root system, reaching 21.90

As for the effect of spraying with potassium sulfate, the results of the same table showed the effect on the average dry weight of the root system, as the treatment was given at a concentration of 100 mg. Liter^{-1} e root system, the highest average dry weight of th , reaching 24.61 grams, compared to plants treated with a concentration of 0 mg. L^{-1} , .which gave the average dry weight of the root system as 20.99 g

dry The results of the binary interaction between the factors of salt stress and urea on the weight of the root system were also shown, as the plants treated with salt stress recorded 1ds.m $^{-1}$ and urea at a concentration of 50 mg. L^{-1} The highest average dry weight of the root system, which reached 32.67 grams, compared to the lowest average dry weight of the root system, which reached 16.74 grams for plants treated with salt stress at a concentration of 6ds.m $^{-1}$ ation of 50 mg. Land urea at a concentr^{-1} .

Either the effect of the bilateral interaction between the two factors of salt stress and potassium sulfate on this trait gave the plants treated with salt stress at a concentration of 1ds.m $^{-1}$ With potassium sulfate at a concentration of 100 mg. L^{-1} which amounted to , g, compared to the lowest rate, which was 15.71 g for plants treated with salt stress 30.14 at a concentration of 3ds.m $^{-1.}$ With potassium sulfate at a concentration of 0 mg. L^{-1} .

As for the binary interaction between treatment with urea and spraying with potassium sulfate in this case, treatment with urea at a concentration of 50 mg was recorded. L^{-1} terwith potassium sulfate at a concentration of 100 mg. The highest rate of li^{-1} was 29.52 g, compared to the lowest rate of dry weight of the root system, which was 16.38 g, for potassium sulfate at a and 1- plants treated with urea at a concentration of 50 mg. L concentration of 50 mg. L^{-1} .

ds.m $^{-1}$ with urea at a concentration of 50 mg were characterized . L^{-1} and potassium sulfate at a concentration of 100 mg. L^{-1} with the highest rate of dry weight of the root system, which amounted to 53.90 g, compared to the lowest rate, which was 8.60 g for plants ress at a concentration of 3treated with salt stds.m $^{-1}$ and urea at a concentration of 0 mg. L^{-1} and potassium sulfate at a concentration of 0 mg. L^{-1} .

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Table No. 6 The effect of salt stress, urea, and potassium sulfate on the dry weight of the root plants system of myrtle

Interaction effect of urea and salt stress	Potassium sulfate mg/L			Urea mg/L	Salt stress ds.m $^{-1}$
	100	50	0		
19.48	17.23	25.53	15.67	0	1
32.67	53.90	18.07	26.03	50	
18.57	19.30	22.50	13.90	100	
20.43	17.97	34.73	8.60	0	3
19.18	17.60	17.97	21.97	50	
16.84	22.00	11.97	16.57	100	
29.18	20.40	25.07	42.07	0	6
16.74	17.07	13.10	20.07	50	
30.29	36.07	30.73	24.07	100	
4.274	7.403				LSD 0.05

Effect of salt stress	Interference effect Potassium sulfate			Salt stress
	100	50	0	
23.57	30.14	22.03	18.53	1
18.82	19.19	21.56	15.71	3
25.40	24.51	22.97	28.73	6
2.468	4.274			LSD 0.05

Interference effect

Effect of urea	Potassium sulfate			Urea
	100	50	0	
23.03	18.53	28.44	22.11	0
22.86	29.52	16.38	22.69	50
21.90	25.79	21.73	18.18	100
NC	4.274			LSD 0.05
	24.61	22.19	20.99	Effect of potassium sulfate
	2.468			LSD 0.05

µg.gm) Proline concentration in plant leaves _7^{-1}) :

Table No. 7 shows the significant effect of the three study factors and their interactions on the character of proline concentration. If the plants treated with salt stress at a concentration of 3 ds.m $^{-1}$ excelled the average concentration of proline in the experimental season, which amounted in to 17.76 microg.g^{-1} while the treatment with salt stress recorded at a concentration 6 ,ds.m $^{-1}$ decreased in rate, reaching 8.41 micro gm^{-1} .

effect of plants treated with urea on the proline The same table also showed the concentration rate, as the urea treatment gave a concentration of 100 mg. L^{-1} had the highest rate of 17.59 µg.g^{-1} while the treatment recorded urea at a concentration of 50 , mg. L^{-1} ine concentration rate, reaching 12.69 microg.gdecreased the prol^{-1} .

As for the effect of spraying with potassium sulfate, the results of the same table showed the effect on the proline concentration rate, as the treatment gave a concentration of 100 mg. L$^{-1,}$ t proline concentration reached 18.07 microg.gthe highes^{-1} compared to plants treated with a concentration of 50 mg. L^{-1} which gave the average proline concentration , as 8.95 microg.g^{-1} .

ss and urea in the The results of the bilateral interaction between the factors of salt stre concentration of proline were also shown, as the plants treated with salt stress recorded 1 ds.m $^{-1}$ and urea at a concentration of 100 mg. L^{-1} The highest rate of proline concentration reached 28.89 microg.g^{-1} rate of proline concentration, which compared to the lowest , reached 4.52 microg.g^{-1} for plants treated with salt stress at a concentration of 1ds.m $^{-1}$ and urea at a concentration of 0 mg. L^{-1} .

ress and Either the effect of the bilateral interaction between the two factors of salt st potassium sulfate on this trait gave the plants treated with salt stress at a concentration of 3ds.m $^{-1}$ With potassium sulfate at a concentration of 100 mg. L^{-1} and reached 23.39 µg.g^{-1} compared to the lowest rate of 5.80 µg.g^{-1} for plants treated with salt stress at a concentration of 1ds.m $^{-1}$ With potassium sulfate at a concentration of 50 mg. L^{-1} .

As for the binary interaction between treatment with urea and spraying with potassium at a concentration of 100 mg was recorded. L sulfate in this case, treatment with urea^{-1} with potassium sulfate at a concentration of 0 mg. L^{-1} had the highest rate of 34.51 µg.g^{-1} compared to the lowest rate of 6.66 µg.g^{-1} for plants treated with urea at a concentration assium sulfate at a concentration of 0 mg. Lpot $^{\text{and } 1-}$ of 50 mg. L^{-1} .

ds.m $^{-1}$ with urea at a concentration of 100 mg were distinguished . L^{-1} and potassium sulfate at a concentration of 0 mg. L^{-1} with the highest rate of proline concentration, which g.gamounted to 63.92 micro$^{-1,}$ compared to the lowest rate, which was 0.59 microg.g^{-1} for plants treated with salt stress at a concentration of 1ds.m $^{-1}$ and urea at a concentration of 50 mg. L^{-1} and potassium sulfate at a concentration of 50 mg. L^{-1}.

of salt stress, urea, and potassium sulfate on the character of Table No. 7 The effect proline concentration in Ilias leaves

Interaction effect of urea and salt stress	Potassium sulfate mg/L			Urea mg/L	Salt stress ds.m $^{-1}$
	100	50	0		
4.52	0.76	11.44	1.35	0	1
17.49	51.24	0.59	0.63	50	
28.89	17.40	5.36	63.92	100	
24.56	49.68	12.16	11.82	0	3
11.37	9.54	16.13	8.45	50	
17.35	10.94	8.49	32.61	100	
9.47	10.64	9.46	8.32	0	6
9.22	6.25	10.52	10.90	50	
6.53	6.16	6.42	7.01	100	
0.7145	1.2376				LSD 0.05
Effect of salt stress	Interference effect				
	Potassium sulfate				Salt stress
	100	50	0		
16.96	23.13	5.80	21.96		1
17.76	23.39	12.26	17.63		3
8.41	7.68	8.80	8.74		6
0.4125	0.7145				LSD 0.05
Interference effect					
Effect of urea	Potassium sulfate				Urea
	100	50	0		
12.85	20.36	11.02	7.16		0
12.69	22.34	9.08	6.66		50
17.59	11.50	6.76	34.51		100
0.4125	0.7145				LSD 0.05
18.07		8.95	16.11		Effect of potassium sulfate
0.4125					LSD 0.05

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mg. 100 g) Carbohydrate content in leaves -8^{-1} (dry weight:

Table No. 8 shows the significant effect of the three study factors and their interactions on the character of carbohydrate content. If the plants treated with salt stress at a concentration of 6 ds.m $^{-1}$ excelled the average carbohydrate content in the experimental season, which amounted to in while treatment with salt stress at a concentration of 1 , $^{1-}$ mg. 100 gm 177.10ds.m $^{-1}$ recorded a mg. 100 gm decrease in the rate, reaching 154.50^{-1} .

wed the effect of plants treated with urea on the average The same table also sho carbohydrate content, as it gave the urea treatment at a concentration of 100 mg. L$^{-1,}$ the mg. 100 gm highest rate reached 175.6^{-1} while the treatment recorded urea at a , iterconcentration of 0 mg. l^{-1} a decrease in the average carbohydrate content, reaching , mg. 100 gm 162.8^{-1} .

As for the effect of spraying with potassium sulfate, the results of the same table showed a concentration the effect on the average carbohydrate content, as it gave the treatment at of 0 mg. Liter$^{-1,}$ mg. 100 gm the highest rate of carbohydrate content reached 174.70^{-1} compared to treated plants at a concentration of 50 mg. L^{-1} which gave the average , .carbohydrate content as 163.20

The results of the binary interaction between the factors of salt stress and urea in terms of carbohydrate content were also shown, as the plants treated with salt stress recorded 3 ds.m - ^{1} and urea at a concentration of 100 mg. Liter^{-1} arbohydrate had the highest c mg. 100 g content, reaching 185.50^{-1} compared to the lowest average carbohydrate mg. 100 gm content, which amounted to 147.60^{-1} for plants treated with salt stress at a concentration of 1ds.m $^{-1}$ and urea at a concentration of 50 mg. L^{-1} .

Either the effect of the bilateral interaction between the two factors of salt stress and potassium sulfate on this trait gave the plants treated with salt stress at a concentration of 6ds.m $^{-1}$ With potassium sulfate at a concentration of 0 mg. L^{-1} while the ,81.20was 1 mg. 100 g lowest rate was 145.20^{-1} treated with salt stress at a concentration of for plants 1ds.m $^{-1}$ With potassium sulfate at a concentration of 50 mg. L^{-1} .

potassium As for the binary interaction between treatment with urea and spraying with

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sulfate in this case, treatment with urea at a concentration of 100 mg was recorded. L^{-1} with potassium sulfate at a concentration of 0 mg. L^{-1} had the highest rate, reaching mg. 100 gm 180.10^{-1} mg. 100 g Compared to the lowest rate of 158.20^{-1} for plants potassium sulfate at a concentration $^{\text{and 1-}}$ treated with urea at a concentration of 50 mg. L of 50 mg. L^{-1} .

ds.m $^{\text{-1 and urea at a concentration of 50 mg}}$ were distinguished . L^{-1} and potassium sulfate at a L .concentration of 0 mg^{-1} with the highest rate of carbohydrate content, which amounted mg. 100 gm to 202.80^{-1} mg. 100 gm Compared with the lowest rate, it was 132.40^{-1} For plants treated with salt stress at a concentration of 1ds.m $^{-1}$ and urea at a concentration of L .mg 50^{-1} and potassium sulfate at a concentration of 50 mg. L^{-1} .

Table No. 8 The effect of salt stress, urea, and potassium sulfate on the carbohydrate .content of Ilias leaves

Interaction effect of and salt urea stress	Potassium sulfate mg/L			Urea mg/L	Salt stress ds.m $^{-1}$
	100	50	0		
153.40	140.20	156.30	163.70	0	1
147.60	161.00	132.40	149.50	50	
162.50	161.50	147.00	179.10	100	
166.20	161.50	162.50	174.50	0	3
171.10	165.20	167.60	180.30	50	
185.50	180.50	194.20	181.80	100	
168.80	174.00	171.00	161.40	0	6
183.90	174.40	174.50	202.80	50	
178.70	193.30	163.30	179.4	100	
11.48	19.88				LSD 0.05

Effect of salt stress	Interference effect			
	Potassium sulfate			Salt stress
	100	50	0	
154.50	154.30	145.20	164.10	1
174.30	169.10	174.80	178.90	3
177.10	180.60	169.60	181.20	6
6.63	11.48			LSD 0.05

Interference effect				
Effect of urea	Potassium sulfate			Urea
	100	50	0	
162.80	158.60	163.20	166.50	0

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167.50	166.90	158.20	177.50	50
175.60	178.40	168.20	180.10	100
6.63	11.48			LSD 0.05
168.00		163.20	174.70	Effect of potassium sulfate
6.63				LSD 0.05

: Discussion

From Tables (1, 2, 3, 5, 6), it was shown that the effect of salt stress on the characteristics of the fresh and dry weight of the shoot, the percentage increase in plant growth, the fresh and dry ere the treatment was superior to 6weight of the root system, and the carbohydrate content, wh ds.m. $^{-1}$ At a rate in the rate of the previous characteristics, and the reason may be due to the increased release of potassium in the soil, which leads to increased absorption by the plant, as it ter the salinity of the irrigation water, the greater the release of potassium was found that the grea) in the soilAl-Kubissi and Al-Hadethi .(2019 ,

As for the results of tables (4, 7), they showed the superiority of treatment with salt stress at a concentration of 3ds.m $^{-1}$ n the rate of root length and proline content. This may be due to the i availability of potassium, which helps the plant roots to grow and stimulates the plant cells to) .divideNasralla *et al.,* 2016).

As for the treatment with urea, Table No. (3, 7, 8) shows that the urea treatment at a concentration of 100 mg/L excelled in the rate of characteristics of the percentage increase in y be that chemical plant growth and the content of proline and acarbohydrates. The reason ma fertilizers stimulate plant growth through the role Nitrogen in protein synthesis and increases) meristematic activityFarahat *et al.,*) which is consistent with the results of ,(2014Al-Taher *et al.* .on paulownia plants (2020)

showed that urea treatment at a concentration of 50 mg/L was superior to the (2 ,1) Tables average characteristics of the fresh weight of the shoot and the dry weight of the shoot. The rease in dry reason may be the role of nitrogen in increasing metabolic processes and an inc matter rates as a result of the increase in respiratory activity. Absorption of water and nutrients) and photosynthesis processes are invested in the production of dry matterFarahat *et al.,* 2014).

ffect of urea treatment on the average root length As Tables 4, 5, and 6 showed, there was no e .characteristics and the fresh and dry weight of the root system

As for the potassium sulphate treatment, tables (3, 5, 6, 7) showed that the potassium sulphate superior to the average characteristics of the treatment at a concentration of 100 mg/L is percentage increase in plant growth, fresh and dry weight of the root system, and proline content. The reason may be that its abundance Potassium, in sufficient quantities for growth, is due to its l division and works to improve the performance of plant hormones such as auxins and role in cel gibberellins, which directly contribute to cell expansion and elongation (Hassoun and Abdel .(Wahed, 2012

ium sulfate at a concentration of As for Tables (1, 2), it was shown that the treatment with potass mg/L was superior to the average fresh and dry weight characteristics of the shoot. The reason 50 may be due to the role of potassium in reducing the damage of environmental stresses, in light of of transpiration, which leads to a reduction in From osmotic stress, the reduction in the speed) which would reduce water loss and improve plant growth under stressShahid *et al.,* or it ,(2019 e may be the reason for the role of potassium in improving hormonal balance in light of th) inhibiting hormones-promoting hormones and the decrease in growth-increase in growth Charysargyris *et al.* ., 2017).

As shown in Table (4, 8), there was no effect of potassium sulfate treatment on average root .length traits and carbohydrate content

: Sources

:Arabic sources

Design and analysis of . (Rawi, Khashia Mahmoud and Abdul Aziz Muhammad Khalaf (2000-Al Kutub for printing and publishing. College of Agriculture and -agricultural experiments. Dar Al .gher Education and Scientific Research. IraqForestry. University of Mosul. Ministry of Hi

Dulaimi, and Khawla Hamza -Omair, Faten Hussein Al-Najjar, Muhammad Abdel-Al Muhammad (2020). The date palm and its role in resisting salt stress. Dhi Qar University Journal .169-Issue (2). pp. 154 (of Agricultural Research. Volume (9

Hassoun, Rawaa Hashem and Aqeel Hadi Abdel Wahed (2012). The effect of spraying with .potassium chloride on some vegetative and chemical characteristics of local mango seedlings Mangifera indeca of the College of Agriculture / University L. The Second Scientific Conference .263-of Karbala, 2012: 260

The effect of salt -Abdul Wahed, Aqeel Hadi (2012). Mechanics of salt tolerance of date palms 2 .stress on the leaf content of date palm seedlings*Phoenix dactylifera* L like -eis a plant hormon substance. Basra Research Journal ((Sciences)). Issue 38. PartB.1 .P. 72: 79 .

:Foreign sources

Al-Kubissi, K. Y., and Al-Hadethi, Y. K. (2019). Effect of irrigation with different saline water and potash fertilizers in the kinetics of potassium release in the soil. Anbar Journal of Agricultural Sciences, 17(1), 102-111. https://doi.org/10.32649/ajas

Acosta-Motos, J. R., Ortuño, M. F., Bernal-Vicente, A., Diaz-Vivancos, P., Sanchez-Blanco, M. J., & Hernandez, J. A. (2017). Plant responses to salt stress: adaptive mechanisms. *Agronomy* , *7* (1), 18.

Al Taher, ZAA, Hassan, FA, & Hassan, ARO (2020). Effect of nitrogen fertilizer, ascorbic acid, the number of additions, and their interactions on the physical traits of paulownia plant (Paulownia tomentose L.). *Euphrates journal of agricultural science* , *12* (1).

Chrysargyris, A.; Drouza, C., and Tzortzakis, N. (2017). Optimization of potassium fertilization/nutrition for growth, physiological development, essential oil composition and antioxidant activity of Lavandula angustifolia Mill. J Soil Sci Plant Nutr. https://doi.org/10.4067/ S0718- 95162017005000023

Dubois MK ; Crilles, K. A. Hamiltor, J. K. Rebers D. A., and Smith, F. (1956). Colorimetric method for determination of sugars and related substances.Annl. Chem., 28:350-365.

Farahat MM, EM Fatma El-Quesni, MA El-Khateeb, AS El-Leithy and Kh. I. Hashish(2014). Impact of Combined Chemical and Biofertilizers on Vegetative Growth and Chemical Composition of Paulownia kawakamii Seedlings.Middle East Journal of Agriculture Research,3(4): 852- 858.

Gardeli C., Papageorgiou V., Mallouchos A., Theodosis K., Komaitisn M. (2008). Essential oil composition of Pistacia lentiscus L. and Myrtus communis L.: Evaluation of antioxidant capacity of metabolic extabolic extracts. Science Direct, Food Chemistry., 107: 1120 – 1130.

Gonçalves, YDS, Freitas , MSM, Carvalho, AJCD, Vieira, ME, Peçanha, DA, Cunha, JM, & dos Santos, PC (2022). Potassium sources impact on cassava plant productivity, quality and mineral composition. *Journal of Plant Nutrition* , *45* (1), 86-94.

Nasralla, A. Y., S Ati, A., & AT El Fahdawi, W. (2016). Role of Potash Fertilization in Reduction of Water Stress in Moonbean (Vigna radiata L.) and Yield Components. *Al-Qadisiyah Journal For Agriculture Sciences* , *6* (1), 103-115.

Rawat, J., Pandey, N., & Saxena, J. (2022). Role of potassium in plant photosynthesis, transport, growth and yield. *Role of potassium in abiotic stress* , 1-14.

Stojanova, M.T.; Stojkova, I.; Ivanovski, I. and Stojanova, M., (2016).

The effect of foliar fertilizing on the yield of Primorski almond

cultivar in valandovo. Zbornik Radova, 21 (23): 111-116.

Shahid, M., Saleem, M. F., Saleem, A., Raza, M. A. S., Kashif, M., Shakoor, A., & Sarwar, M. (2019). Exogenous Potassium–Instigated Biochemical Regulations Confer Terminal Heat Tolerance in Wheat. Journal of Soil Science and Plant Nutrition, 19(1): 137–147. https://doi.org/10.1007/s42729-019-00020-3

Sumbul, S., Ahmad, M. A., Asif, M., & Akhtar, M. (2011). Myrtus communis Linn.-A review. Indian Journal of Natural Products and Resources Vol. 2(4), December 2011, pp. 395-402.

Troll, W. and Lindsley, J. (1955). A photometric method for the determination of Prolin. Journal of Biological Chemistry, 215:655-660.

Wang, J., Wang, D., Zhang, G., Wang, Y., Wang, C., Teng, Y., & Christie, P. (2014). Nitrogen and phosphorus leaching losses from intensively managed paddy fields with straw retention. *Agricultural Water Management* , *141* , 66-73.

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