


Response A Trees Date palm *Phoenix dactylifera* L. For salt stress conditions

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Abstract

Degradation of agricultural land due to soil salinity and irrigation water is one of the major soil constraints that greatly hinders agricultural production and food security in any country and is one of the most difficult challenges at present, in addition to climate change and increasing frequency lonliness Phenomena Climate Extreme Especially Recurring droughts have attracted the attention of researchers to address them and develop possible solutions to address them by relying on the research aspect, which is of utmost importance, with the aim of improving soil resource capabilities and irrigation management by improving the quality and productivity of irrigation water in order to maintain the sustainability of the agricultural sector. The current review summarizes an explanation of how salt stress affects growth indicators in palm trees, which negatively and significantly affects the ability and production. Agricultural and thus disturbance and imbalance in providing the growing global demand, especially with the steady increase in population growth. Discusses the effect of soil salinity and irrigation water on plant pigments and some growth indicators and characteristics Physics For the fruits The result Furthermore, the article deals with determining the effect of salt stress on the mineral content of leaves and fruits. As significant indicators for assessing the severity and intensity of salt stress, it is therefore recommended to conduct more comprehensive studies on a larger scale, which will contribute to understanding these effects in developing strategies to reduce and minimize salt stress and its harmful effects on date palm cultivation

.Keywords: salt stress , chlorophyll, carbohydrates, total sugars, fruit weight

I. :Introduction

Date palm *Phoenix dactylifera* L. is a monocotyledonous species of theArecaceae family It is a dioecious tree with a .long reproductive cycle and the ability to grow vegetatively under a wide range of different prevailing climatic conditions) Therefore, it is widely cultivated in arid, semi-arid and arid regions in the Middle East and North AfricaKordrostami). *et al ., 2022* and perhaps He is Palm trees Dates he Oldest plants in the world , It represents Palm trees Dates The crop Most importance in Oases And the most important Its products he Dates, He is fruit same value Nutritional High And she) has benefits Healthy Multiple; Chao and Krueger, 2007 (Mia *and al ., 2020*. And there is group from Restrictions and constraints Environmental stresses known as abiotic stresses Which affect Negatively in to set productivity Plants are ,greatly affected by For changes Environmental , where Contributed Stress not Biology like drought Salinity, heavy metals high temperatures, and metal toxicity. in cut Production By percentage Arrive Up to50 for crops Home Because of its % effect on its shape, growth, size, and deformity of growth organs and processes Physiology And acting Food as well as Its productivity; Jalmi *et al ., 2018* (Moustafa-Farag Date palms can adapt to severe drought, high temperatures, and relatively high levels of soil salinity . However, these added amounts of salts due to the salinity of irrigation water lead to a significant decrease in fruit productivity as well as a significant decrease in the number of viable palm trees(, Saleh 2021) Upper Egypt Global Represents Sector Agricultural About .70 % from Operations to withdraw Water On the ,other hand7 %) are affected . from total space the earth Negatively salty Soil2018) ; Mabhaudhi *et al ., Chele et al ., 2021* Salt stress is defined as the stress that occurs as a result of a decrease in the water potential of the root zone or as .(a result of the toxic effect of the accumulation of Salts in soil And water Ground from during Two operations First she practical Weathering Materials Primary Container on Salts that she has Ability on Melting Especially Chlorides Magnesium And sodium And calcium, in when that The process Second to speak from during deposition Salts Portable With the wind And the rain from Oceans It also occurs due to an imbalance between nutrients due to the high concentration ,of salts and poor absorption (Al-Wahaibi2009) . ; ,Al-Rubaie2021 And it constitutes Salinity appendix Threat .(Environmentally Big For plants because to rise concentration salt in soil Changes performance Plant on road Causing in ruin representation food, And toxicity Ionic, And it leads to Stress Oxidative Secondary And stress Osmosis(Wang *et al*



., 2021) The harmful effects of salt stress on the growth and productivity of palm trees are due to ionic poisoning resulting from increased salt concentrations in the soil, represented by chlorine, sulfur and sodium ions absorbed by their roots which leads to a decrease in the chlorophyll content of the leaves, reduces nutrient absorption and causes a deficiency in essential mineral elements In addition to osmotic stress and oxidative stress Oxidative Stress as well as ionic imbalance (Chinnusamy *et al.* , 2005 (Ait - Ei -Mokhtar *et al.* , 2020;

The article aims to highlight the response of date palm trees to salt stress and to demonstrate its harmful effects and consequences

-1 The effect of salt stress on plant pigments and some indicators of vegetative and root growth

indicated that irrigation of Halawi palm seedlings with irrigation water of different salt (2011) Abdul Wahid There was -Decimals M1 24 High salt concentration led to) Decismens m1 24 - 0) concentrations ranging between gm100 /mg2.1 a significant decrease in chlorophyll pigment, leaf length and root length, which recorded averages of cm, compared to the control treatment (irrigation with distilled water), which recorded the 13.65 cm and 9.53 ,⁻¹ They Al - Abdoulhadi *et al.* (2011) cm. In the study of 28.43 cm and 28.97 ,⁻¹ gm100 /mg3.16 highest averages of explained that treating three varieties of date palms, namely Khalas, Majdool and Barhi, with sodium chloride at ,mmol caused a significant decrease in the biomass of stems 400 and 200 ,100 ,50 ,0 different concentrations of Al- Abdoulhadi roots and old and new leaves with an increase in the concentration of salts. They also indicated that when studying the effect of different concentrations of sodium chloride on three varieties of date palms *et al.* (2012a) Khalas, Majdool and Barhi , they found that increasing the salt concentration led to a significant decrease in the b and total chlorophyll in the studied chlorophyll ,a photosynthesis process and in the leaf content of chlorophyll reached the conclusion that when using irrigation water with 2016)) varieties. While the study of Abdul Wahid *et al.* Irrigation of date palm seedlings of the Halawi variety led to a significant -Decimals M1 24 a salt concentration of with a steady 13.47- bar · cm² and 14.72 decrease in leaf area and leaf water potential, which recorded averages of compared to the % 47.67. increase in the percentage of water saturation deficiency in the leaf, with an average of bar, while the 4.39- cm² and 29.99 control treatment (irrigation with distilled water) which recorded averages of they studied the (2016) .As for Salman *et al.* %12.67 was in Saturation Watery in The paper^{decrease} percentage of effect of irrigation water salinity on date palm trees of the Khastawi variety and noticed a significant decrease in the the lowest number of^l recorded - dSm7.8 number of leaves, as the irrigation treatment with water with a salinity of Decissimus M1- which 1.2. leaves/shoot) compared to the irrigation treatment with water with a salinity of 22) leaves results of a study conducted^{the} leaves/sapling). It was noted from 28) recorded the highest number of leaves, reaching 0 On ten varieties of palm seedlings treated with two concentrations of sodium chloride Al Kharusi *et al.* (2017) by mM, a significant decrease occurred in growth, leaf chlorophyll content and leaf area for most of the studied 240 , varieties under the effect of high concentration of sodium chloride compared to the control treatment. The study also The effect of salt stress on date palm seedlings of the Halawi variety (2018) included Al-Najjar and Al-Ibrasim which ,¹ · mg L6000 ,3000 ,1000 ,0 irrigated with water containing sodium chloride at different concentrations of resulted in a significant decrease in seedling diameter, leaf width, fresh and dry weight of leaves, and weight . wet compared to the control⁻¹ mg L6000 And dry For roots and total chlorophyll in the concentration treatment of included date palms of the Barhi variety planted in saline soil (soil with a salinity of (2019) treatment. Saleh's study Using irrigation water of varying salinity, a decrease in the height and circumference of the (-Decimals M1 16.76 shoot was observed, as well as an increase in the number of leaves and leaf area, in addition to a decrease in the 2017-2018 And chlorophyll Total And carotenoids in the b And chlorophyll a .chlorophyll content of the leaves , in the control treatment compared to the rest of the treatments that included the addition of ascorbic acid seasons in their study on the change in plant pigments *et al.* (2020) confirmed Shareef's conclusion . silicon and tocopherol of date palm seedlings growing under the influence of abiotic stress factors (salinity, drought, temperature) that and total chlorophyll pigments b chlorophyll ,a salinity stress led to a decrease in the leaf content of chlorophyll Al- Asadi while increasing their content of carotene pigments And anthocyanins . While the results of the study by 24 ,16 ,8 ,0 On the effect of four different concentrations of sodium chloride and Al- Zubaidy showed that (2020) Decissimus M1- On tissue-propagated Barhi date palm , increasing salt concentrations in the growth medium had a And chlorophyll Total The results of b And chlorophyll a · significant effect on reducing the leaf chlorophyll content also indicated that seedlings of Barhi date palm cultivar grown in soils with by Shareef and Omar (2022) the study ,mmol of sodium chloride led to a significant decrease in the number of leaves 150 and ,75 ,0 salt concentrations of ,leaves/seedling 4.08 plant height, and number of roots in the high concentration treatment, which recorded averages of



5.12 roots/seedling, compared to the control treatment, which recorded the highest averages of 4.19 cm, and 25.35 roots/seedling, while no significant differences were recorded between the 5.15 cm, and 27.68 ,leaves/seedling .treatments in the number of roots, in addition to a significant decrease in the content of the leaves from pigment Full Mol compared with control treatment. The results of the study 150 chlorophyll And the material Dry in treatment on two types of date palm trees (Barhi Al-Zamli) growing under the (2023 : conducted by Awda showed that (Decimals M 27.3 Irrigation water with salinity + -Decimals M1 10.5 influence of salt stress (soil with a salinity of There was a decrease in the total chlorophyll content of the leaves for both cultivars in the control treatment ¹⁻ It was in whether salt stress to Dates Palm trees Trees exposure that .compared to the rest of the treatment treatments Treatment with highly saline irrigation water to increase Her level a growth medium with high salt concentration or .In the root zone, this was reflected in a significant decrease in most of the studied vegetative and root growth traits ,The reason for this may be due to the excessive accumulation of chloride and sodium ions in the absorption zone which in turn led to a reduction in plant growth as a result of their increased concentration in the cytoplasm of the cells and thus the loss of growth enzyme activity. Their increase also caused severe disturbances in the structure of This leads to a decrease in the chlorophyllPhotosynthesis .which inhibits the photosynthesis process, chloroplasts content in the leaves, in addition to a decrease in the net absorption rate and a decrease in the size of mesophyll cells especially the columnar cells in the leaves. The reason may be due to the increase in the levels of free radicals in the , plant tissues, which work directly or indirectly to destroy chlorophyll and accelerate the entry of leaves into the aging stage. The results of some researchers also showed that the increase in salts has a direct effect on the transfer of solutes ,from the leaves to the consumed plant parts, in addition to its effects on the process of opening and closing the stomata and thus a decrease in the diffusion of carbon dioxide to the leaves. As for the decrease and decline in the number of leaves and the small height of the plant, it may be attributed to the high concentrations of salts that cause indirect effects such as their effect on the hormonal balance of the plant and reducing the vital activity, in addition to their osmotic effects that work to reduce the water reaching the plant and thus reduce the speed of cell division and .expansion

-2 Effect of salt stress on some chemical properties

1-2 Effect of salt stress on some chemical properties in leaves

concluded in his study on irrigating Halawi palm seedlings with irrigation water of different (2011) Abdul Wahid The reason for the significant decrease in the -Decimals M1 24 salt concentrations that high salt concentration Dry matter in ¹⁻ .mg/g21.9 and33.5 carbohydrate content of leaves and roots was recorded, with values reaching succession compared to the rest of the treatments, with a steady increase in the concentration of proline in the leaves The highest -Decimals M1 at 24. and roots with an increase in salt concentrations, and the concentration was recorded) dry matter respectively. The results of the study of Al-Najm and Al-Jabry¹ micrograms g 18.8. ,25 values were on the effect of irrigation water quality (drip water, well water) on the Halawi and Sayer cultivars showed a (2012 significant increase in the concentration of the amino acid proline irrigated with well water, which recorded for both The two classes in sequence, While the plants treated with¹ micrograms/ gm 0.98. ,1.2 concentrations of . respectively¹ Micrograms /gm 0.47. ,0.42 tap water recorded the lowest proline content in their leaves, reaching which addressed the effect of salt stress on date palms of the BartamudaDarwesh (2014) The study conducted by ppm, noted a significant increase in14000 0. variety by treating them with sodium chloride at two concentrations the concentration of total soluble carbohydrates in the leaves when treated with the high concentration at a rate of 13 fresh weight. In the study of¹ mg g7 fresh weight compared to the control treatment which recorded a rate of¹ gm g on two varieties of date palms, Barhi and Sayer, grown under the influence of salt stress in a soilAbbas *et al* . (2015) Decissimus m1- , it was found that ^{of} 4.55 Decimals m1- irrigated with water with a salinity 15.93. with a salinity of growth under the influence of salt stress and sulfur treatment led to an increase in the leaf content of total soluble carbohydrates and the amino acid proline for both cultivars compared to the control treatment. The study by Blackett that the treatment of tissue-propagated Barhi date palms with well water (2015) And the Hamidawi ^{that} also found and Euphrates River water led to a significant decrease in the leaf content of the percentage of total soluble carbohydrates and the amino acid proline in the control treatment compared to the rest of the treatments that included also noted in their (2016) the use of different concentrations of humic and at three different times. Faisal and Athafa experiment on the effect of stress Salty on three Categories from Questions Date palms are Sayer, Halawi, and Decimens M1- There was a significant 14. and ,7 ,0 :Khadrawi, and are irrigated with three salt concentrations increase in the concentration of the amino acid proline with the increase in salts, as the plants treated with the high



while the control, $0.902 \mu\text{g/gm}$. reaching concentration recorded the highest content of proline in their leaves (Al-Najjar and Al-Abrasim, 2018). The results of the study indicated that the 0.687 treatment recorded the lowest content of proline. On ten varieties of palm seedlings treated with two concentrations of sodium chloride (240 and 480 mmol), a significant decrease in the water content in the leaves of the studied varieties under the influence of the 240 mmol high concentration of sodium chloride compared to the control treatment. In the study of Al-Najjar and Al-Abrasim on the effect of salt stress on date palm seedlings of the Halawi variety irrigated with water containing sodium chloride at different concentrations (240, 3000, 1000, 0 mg/L), the results showed a significant decrease in the carbohydrate content of the leaves, accompanied by a significant increase in the amino acid proline in the treatment compared to the control treatment (Saleh, 2017). The results of his study on Barhi date palms confirmed that the addition of ascorbic acid, silicon and tocopherol to irrigation water of varying salinity led to a significant increase in the leaf content of the amino acid proline compared to the control treatment. There was a decrease in the concentration of total carbohydrates, soluble protein, free amino acids and vitamin C in the concentration of total carbohydrates, soluble protein, free amino acids and vitamin C in the control treatment compared to the 2017-2018 study. The results of the study showed a significant increase in the amino acid proline for both seasons. Study rest of the treatments that included the addition of ascorbic acid, silicon and tocopherol. And I conclude from that treatment with sodium chloride at a high concentration (240 mM) led to a significant increase in the leaf content of the amino acid proline compared to the control treatment. In their study on date palm seedlings growing under the influence of abiotic stress factors (salinity, drought, temperature) showed that salinity stress led to an increase in the leaf content of the amino acid proline. Al-Helou (2020) also studied the effect of treating date palm trees with different concentrations of sodium chloride (225, 150, 75, 0 mmol), which caused an increase in the leaf content of total soluble carbohydrates in the high concentration treatment (225 mmol) compared to the control treatment, which recorded the lowest rate of total soluble carbohydrates (23.32 mg/g) at a rate of 75 mmol. Faisal and Abdullah (2021) also conducted a study on the effect of salt stress on the Halawi variety growing in the soil with a salinity of 14.8 Decimols/m³. The results of the study showed a significant increase in the leaf content of total soluble carbohydrates and the amino acid proline in the control treatment compared to the rest of the treatments that included the use of calcium nitrate and selenium as treatment treatments. Al-Badri (2021) studied the effect of treatment with different concentrations of sodium chloride (150, 100, 50, 0 mg/L) compared to the control treatment. The results showed an increase in the leaf content of the amino acid proline in the high concentration treatment, recording a concentration of 13.39 $\mu\text{g/gm}$. As for Mahdi (2022), he found that the control treatment which recorded the lowest concentration of amino acid proline (10.88 $\mu\text{g/gm}$) in his study on the effect of adding different concentrations of sodium chloride to irrigation water (20, 10, 5, 2.5 mg/L) the occurrence of an increase in the leaf content of total soluble carbohydrates with an increase in the concentration of salts. While the results of the study of Awda (2023) indicated on two varieties of date palm trees (Barhi Al-Zamli) growing under the influence of salt stress (soil salinity 27.3 Decimols/m³) the leaf content of total soluble carbohydrates and the amino acid proline decreased for both cultivars in the control treatment compared to the rest of the treatment treatments.

The increase in salts reduces the protein building processes and also contributes to increasing its decomposition, which causes an increase in the accumulation of the amino acids that make it up which is proline, especially in the leaves and roots, which is considered one of the mechanisms and means that plants use to confront environmental stresses, including salt stress, by increasing the speed of its building or inhibiting the effectiveness of proline oxidizing enzymes. Also, high salt concentrations lead to an imbalance in the plant's carbohydrate content as a result of the decomposition of starch by the glycolysis process, which is attributed to a deficiency in the nitrogen source (amino acid), which in turn leads to nutritional competition between cells.

Effect of salt stress on some chemical properties of fruits

noted during his study on the effect of irrigation water salinity on two varieties of Barhi and Halawi date palm (2010) trees growing in two different locations, the first of which is As-Sudur, which is irrigated with irrigation water with a salinity of 13.20 Decimols/m³. The results of his study showed that the percentage of dry matter in the fruits of the Barhi variety irrigated with irrigation water with a salinity of 13.20 Decimols/m³ was significantly higher than the control treatment. The results of the study of Al-Barak (2012) showed that the percentage of dry matter in the fruits of the Barhi variety irrigated with irrigation water with a salinity of 10.5 Decimols/m³ was significantly higher than the control treatment. While the results of the study of Al-Barak (2012) showed that the percentage of dry matter in the fruits of the Barhi variety irrigated with irrigation water with a salinity of 10.5 Decimols/m³ was significantly higher than the control treatment.



total, 2010-2011 confirmed the presence of a significant decrease in the percentage of total soluble solids, neutralizable acidity, total sugars and sucrose in the fruits during the wet stage in the Al-Faw site, and recorded values 0.015, % 67.04 respectively, compared to the FAO website which recorded % 62.95, % 66.88, % 0.034, % of 63.58. On the effect of soil salinity of El-Khawaga (2013) respectively. In the study conducted by, % 67.62, % 70.83, % ppm on three date palm cultivars (Siwi, Zaghoul and Hayani), it was found that there was a significant decrease in the percentage of total soluble solids, total sugars, reducing sugars and total soluble tannins with an increase in both study for crude fiber in the fruits in the control treatment compared to the antimicrobial treatments. Salinity on date palm trees of Salama also showed *et al.* (2014). The results of the study conducted by 2010-2011 seasons Irrigation water salinity⁺ -Decimals m1 9.1 the Hayani variety growing under the influence of salt stress (soil salinity there was a significant decrease in the percentage of total dissolved 2012-2013, Decismens M1-) For the seasons 8.1 dissolved solids to total acidity, and total sugars in the control^{total} solids, total neutralizable acidity, the ratio of 2015) treatment compared to the treatments using magnesium fertilizer. The study of Jassim and Ta'ima also showed. On the impact addition Sulfur And calcium And sour Citric acid on date palm trees of the Sayer variety growing in (There was a significant decrease in the percentage of dry matter, moisture content (1- Decismens M 17.21) saline soil total soluble solids, total neutralizable acidity, reducing and total sugars, and sucrose in the control treatment, conducted on Shukr date (2017) .compared to the rest of the treatments. Treatment. The study of Al-Sahhaf et al Decismens M1- High salinity led to a decrease in the percentage of total 22.3 palms grown in soil with a salinity of, indicated in his study conducted on two varieties of date palms, the results of Al-Tamimi (2020) sugars in the fruits.. is irrigated with water with a salinity of^{and} -Decimals m1 6.64 Zahdi and Khastawi, growing in soil with a salinity of total soluble solids there was a decrease in the fruit content of the percentage of, growing seasons 2018-2019 Decismens M1- For the 10.54 Barhi date palm cultivar growing under salt stress conditions (soil with of Fekry *et al.* (2020) On the In the study The results showed a 2018-2019. ppm) for the seasons 1700 Irrigation water with salinity of + ppm 2600 salinity significant decrease in the percentage of total dissolved solids, total sugars, reducing sugars, and total neutralizable acidity in the control treatment compared to the rest of the treatment treatments that included the addition of Humic In her study on date palms of the Halawi variety grown under (2020) AL- Temimi discussed and selenium. While is And the soil salinity -Decimals M1 6.63 the influence of salt stress irrigated with saline water with a salinity of Decismens M1-, and its results showed a decrease in the fruit content of total and reducing sugars. It was also 18.88 Decimals 16.37 In his study on date palm trees of the Sayer variety growing in saline soil (2021) the graft^{that} found There was a significant decrease in the percentage of dry matter, moisture content, total soluble solids, total -M1 acidity, total and reducing sugars, and sucrose of the fruits in the control treatment compared to the treatment the, Faisal and Abdullah (2021) treatments that included the addition of Sulfur And calcium And sour Citric. As for Decismens 14.8 results of their study on the effect of salt stress on the Halawi variety grown in soil with a salinity of There was a significant decrease in the 1- Decismens M 6.03 is irrigated with irrigation water with a salinity of^{and} -m1 percentage of dry matter, total soluble solids, total and reducing sugars, sucrose and moisture content of the fruits in the control treatment compared to the rest of the treatments that included the use of calcium nitrate and selenium as on two varieties of date palm trees (Barhi Al-Zamli) growing (2023) treatment treatments. a study by Awda 27.3 Irrigation water with salinity⁺ -Decimals M1 10.5 under the influence of salt stress (soil with a salinity of, Decismens M1-) The results indicated a decrease in the percentage of dry matter, total soluble solids, reducing sugars both varieties in the control^{for} sucrose and total sugars, with an increase in the percentage of moisture content treatment compared to the rest of the treatments that included the use of tocopherol. And glutathione. Salt stress which are compounds that cause damage to the plasma membranes of cells radicals, stimulates the production of free and work to oxidize proteins and inhibit the effectiveness of many essential enzymes. They also cause severe damage They also affect cell metabolism such as respiration and photorespiration, causing RNA nucleic acids and DNA to a malfunction and disturbance in the process of electron flow. As for the decrease in the percentage of sugars, it may be attributed to the fact that the increase in salt concentrations directly affects the carbohydrate content of the leaves as a result of the increase in the respiration process through the effect of sodium ions in the respiratory chain, which in turn causes a decrease in carbohydrate levels, which is reflected in a decrease in the production of sugars in the fruits and thus a decrease in the percentage of total dissolved solids, of which sugars constitute the largest part.

-3 The effect of salt stress on some physical characteristics of fruits and total yield

) The results of a study conducted by Al-Hamd 2010 on the effect of irrigation water salinity on two varieties of date (palm trees, Barhi, Halawi and Nami, were found in two locations (the first is As-Sudur, which is irrigated with irrigation water with a salinity of 6.13 -Decissimus m1¹) and (II) the tails that are irrigated with irrigation water with a salinity of



13.20-Decimals M1 A significant decrease in fruit length, dry weight and total productivity of the tree occurred in the () Dhanab site compared to the Sadur site. Al-Barrak2012) also indicated in his study on the effect of irrigation water salinity on Barhi date palm trees in the Qurna and Fao sites for the two agricultural seasons2010-2011, that there was a significant decrease in fruit weight, flesh, average seed weight, average fruit length and diameter in the fresh stage for the Fao site, and recorded values of 6.72g ,6.01 ,g0.715 ,g28.18 ,mm21.64 ,mm, respectively, compared to the Fao site which recorded5.11 ,g4.4 ,g0.709 ,g16.85 ,mm8.88 mm, respectively, in addition to a decrease in productivity in the fresh stage for the Fao site, which recorded46.00 kg compared to the Fao site, which gave61.00 kg. As forEl- Khawaga's study (2013) on the effect of soil salinity, which is1088 , parts per million, on three varieties of date palms (Siwi Zaghoul and Hayani). The results showed a significant decrease in fruit weight, fleshy layer weight, cluster weight and total productivity of a single palm in the control treatment compared to the antimicrobial treatments. Salinity and the study seasons2010-2011 . While the study conducted bySalama *et al* . (2014) on date palm trees of the Hayani variety growing under the influence of salt stress (soil salinity9.1-Decimals M1 Irrigation water salinity + 8.1 -Decismens M1 and for the seasons (2012-2013, they noticed ^a ,significant decrease in the weight, size, length, diameter of the fruits weight, dry matter to the fleshy layer of the fruit, seed weight and total productivity compared to the treatment treatments) using magnesium fertilizer. The results of the study by Jassim and Ta'ima also showed2015 On the impact of addition () Sulfur And calcium And sour Citric acid on date palm trees of Sayer variety growing in saline soil17.21 Decismens M¹⁻ There was a significant decrease in the average length, diameter, volume, weight of the fruit, average weight of the (. fleshy layer, and average weight of the seed in the control treatment compared to the rest of the treatments. Treatment) .Salman et al2016 also conducted a study on the effect of three salt concentrations (1.2 ,3.5 ,7.8 - dSm¹ of irrigation water on date palm trees of the Khastawi variety. The results showed a significant decrease in the total yield of the tree The irrigation treatment with water with a salinity of7.2 -Decismens M1^{The}) lowest total yield was4 (kg/sapling compared to the irrigation treatment with salinity1.2-Decimals M1) Which recorded the highest total yield of 9 kg/sapling). In addition, the results of theAltemimy study showed that *et al* . (2019) on two date palm cultivars, Zahdi and Khastawi, growing under salt stress (soil with salinity6.64-Decimals M1 Irrigation water with salinity + 10.54 -Decimals M1 (There was a significant decrease in the weight, length, diameter, size of the fruit, fleshy layer, and seed weight in the control treatment compared to the rest of the fertilization treatments . The Khastawi variety was more affected by salinity than the Zahdi variety. As mentioned byFekry . *et al* . (2020) in their study on Barhi date palms grown under salt stress conditions (soil with salinity of2600 ppm Irrigation water with salinity of +1700 ppm) for the seasons2018-2019 a significant decrease occurred in the weight, length, diameter of the fruit and the total productivity , of the palm tree in the control treatment compared to the rest of the treatment treatments that included the addition of) Humic and selenium . The data of the study conducted by Taima showed that2021 On date palm trees of the Sayer () variety growing in saline soil16.37-Decimals M1 A significant decrease in the average length, diameter, volume and (weight of the fruit. The average weight of the fleshy layer, the average weight of the seed , the average weight of the cluster, and the average production of one palm tree compared to the treatment treatments that included the addition of Sulfur And calcium And sour Citric . The results of the study byShareef and Omar (2022) on date palm seedlings of the Barhi variety grown in soils with salt concentrations of0 ,75 and ,150 mmol of sodium chloride showed a significant , increase in the leaf content of total soluble proteins and the concentration of the amino acid proline and ascorbic acid with a decrease in dry matter with an increase in the treatment with the high concentration compared to the control) treatment, which gave the lowest values. The results of the study conducted by Awda2023 on two varieties of date (palm trees (Barhi Al-Zamli) growing under the influence of salt stress (soil with a salinity of10.5-Decimals M1 + Irrigation water with salinity27.3 Decissimus M1-) There was^a decrease in the average size, length and diameter of the fruit after6 and12 ,weeks of pollination, as well as a decrease in the average size, length, diameter and weight of the fruit weight of the fruit flesh and the weight of the seed during the Khalal stage, in addition to a decrease in the weight of the cluster and the amount of the total tree yield for both varieties in the control treatment compared to the rest of the treatments that included the use of tocopherol. And glutathione . Increased salts in the soil solution leadto a decrease in the value of thewater potential which hinders the absorption of water by the plant, which leads to a decrease in the , filling pressure of the cells and thus inhibits growth, which is the main cause of water stress. The cell expansion process is also very sensitive to salt stress , which in turn affects the leaf area and thus reduces the efficiency of the photosynthesis process. Increased salt levels also contribute to reducing the flexibility of cell walls and thus affecting the growth process .of fruits and other plant parts

-4 The effect of salt stress on the mineral content of leaves



Lessonby Al- Abdoulhadi *et al.* (2012a) The effect of different concentrations of sodium chloride on three varieties of date palms: Khalas, Majdool and Barhi. They noted that increasing the salt concentration led to a decrease in the concentration of potassium and nitrogen and the ratio of sodium to potassium with an increase in the concentration of sodium in the studied varieties. The results of the study by Al- Abdoulhadi showed *et al.* (2012b) on the effect of different concentrations of sodium chloride on three date palm cultivars: Khalas, Majdool and Barhi . The increase in salt concentration led to a significant decrease in the leaf content of nitrogen , potassium, calcium, magnesium and chlorine) with an increase in sodium and potassium/sodium ratio in the studied cultivars. The study of Al-Najm and Al-Jabri2012 on the effect of irrigation water quality (running water, well water) on Al-Halawi and Al-Sayer cultivars also showed (,that irrigation with well water led to a decrease in the concentrations of nitrogen , phosphorus, potassium, magnesium .calcium and manganese, and for both The two varieties compared to plants irrigated with running waterSalama also mentioned *et al.* (2014) in their study on date palm trees of the Hayani variety growing under the influence of salt stress soil salinity)9.1-Decimals M1 Irrigation water salinity + 8.1 Decismens M1-) and for the seasons 2012-2013, there was a significant decrease in the leaf content of nitrogen, phosphorus, potassium, calcium and magnesium in the control treatment compared to the treatment treatments using magnesium fertilizer. As for the study conducted byDarwesh (2014) on the effect of salt stress on date palms of the Bartamuda variety by treating them with sodium chloride at two concentrations0. 14000 ppm. It was noted that there was a significant increase in the concentration of sodium, potassium, calcium and chlorine when treated with the high concentration compared to the control treatment which recorded the , lowest values. WhileAbbas *et al.* (2015) A study on the two varieties of date palm, Barhi and Sayer, growing under the influence of salt stress in a soil with a salinity of15.93. Decimals m1- irrigated with water with a salinity of 4.55 Decissimens m⁻¹ and the results showed a significant increase in the concentration of sodium and chlorine with a decrease , in potassium and potassium/sodium for both varieties in the control treatment compared to the rest of the treatments. In) .addition, Salman et al2016 in their study on the effect of irrigation water salinity on date palm trees of the Khastawi (variety found a significant decrease in the leaf content of nitrogen, phosphorus, potassium, calcium and magnesium in the irrigation treatment with water with a salinity of7.8 - dSm¹ compared to the irrigation treatment with a salinity of1.2 Decissimus m⁻¹ recorded the highest concentration, while the sodium concentration in plant leaves increased in the irrigation treatment with water salinity of7.8 - dSm¹ compared to the irrigation treatment with salinity of1.2 Decissimens M1- which recorded the lowest concentration of sodium. Faisal and Adhafa^{confirmed that}) 2016 in their study on the effect (of stress Salty on three Categories from Questions Date palms are Sayer, Halawi, and Khadrawi, and are irrigated with :three salt concentrations0 ,7 and ,14. Decismens M1- There was a significant decrease in the leaf content of major and minor elements nitrogen , phosphorus, potassium, iron, manganese and calcium for all varieties in the control treatment) compared to the high concentration treatment . A study2019 dealt with (Al Kharusi *et al.* Two date palm cultivars Zabad andUmsila were treated with sodium chloride. The results showed an increase in the sodium content of the leaves in the high concentration treatment in theZabad cultivar compared to the leaves of theUmsila cultivar and an increase , in the potassium content of the leaves in the high concentration treatment in theUmsila cultivar. Compared with the leaves ofZabad cultivar the potassium/sodium ratio increased in the high concentration treatment of ,Zabad cultivar. comparison with papers CategoryUmsila) In the study conducted by Saleh .(2019) on Barhi date palms grown in saline soil (soil with a salinity of16.76-Decimals M1 Irrigation water of varying salinity), the results indicated a decrease in + the concentration of nitrogen , phosphorus, potassium, silicon and the potassium/sodium ratio with an increase in the concentration of sodium and chlorine for both seasons2017-2018 in the control treatment compared to the rest of the treatment treatments that included the addition of ascorbic acid , silicon and tocopherol . also : mentioned2019 In their study on the treatment of tissue-propagated Nabut Saif date palms with different concentrations (of sodium chloride, they found that increasing the concentration of salts led to an increase in the leaf content of sodium and chloride while decreasing the potassium concentration and the potassium/sodium ratio. While the studyby Fekry showed *et al.* (2020) conducted on Barhi date palms grown under salt stress conditions (soil with salinity of2600 .(ppm Irrigation water with salinity of +1700 ppm) for the2018-2019 seasons - A significant decrease in the leaf content of mineral elements nitrogen , phosphorus, potassium, calcium and magnesium occurred in the control treatment compared to the rest of the treatment treatments that included the addition of Humic and selenium . The results of the studyby Faisal and Abdullah (2021) on the effect of salt stress on the Halawi variety grown in soil with a salinity of14.8 Decismens -m1^{and} is irrigated with irrigation water with a salinity of6.03 Decismens M1- There was a significant decrease in the content of leaves of calcium and potassium and the potassium/sodium ratio^{with} the increase of sodium in the control treatment compared to the rest of the treatments that included the use of calcium nitrate and selenium as treatment) treatments. As for Al-Masoudi2012 she noted during her study on the treatment of date palm trees of the Jabjab ,(variety with three types of irrigation water with different salt concentrations4 ,10 ,15 Decismens M1- , that high salt concentrations led to a decrease in the leaf content of major elements nitrogen, phosphorus and potassium compared to



.the control treatment^{Also} ,Shareef and Omar (2022) showed in their study on Barhi date palm seedlings grown in soils with salt concentrations of 0, 75 and 150 mmol of sodium chloride, a significant decrease in the leaf sodium content with a significant increase in the concentration of potassium and the potassium/sodium ratio in the control treatment) compared to the high concentration treatment. like that Awda2023) indicated in her experiment on two varieties of date palm trees (Barhi Al-Zamli) growing under the influence of salt stress (soil with a salinity of 10.5-Decimals M1 + Irrigation water with salinity 27.3 Decimals M1-) indicates a decrease in the leaf content of nitrogen, phosphorus and potassium for both varieties in the control treatment compared to the rest of the treatments which included the use of tocopherol And glutathione . Stress Salty Leads to Occurrence imbalance in Balance Ionic , so It is happening inhibition to absorb Elements Mission For operations Physiology For plants And Most important that Ions Nitrogen, Calcium And potassium and others , And The known that ion SodiumNa⁺ fast Access to cell because an effort membrane in Inside negative The charge is (200-120mv so It is accumulate inside cell In concentrations range Between 1000-1000 times more from His focus in Walls cells, that ion SodiumNa⁺ is component Sam For cells Vegetarianism . In when that ion K⁺ from Elements essential as that ion Sodium Compete ion Potassium on Locations Cellular especially when low . concentration ion Calcium in The cell

II. Conclusions

Previous studies and the current review have shown some important conclusions regarding the effect of salt stress on date palms, including, perhaps : It is considered Palm trees Dates he Oldest plants in The world, which has the ability to grow widely in dry, semi-dry and arid areas, and due to the increasing salinity of soils and irrigation water, this has negatively affected its growth and productivity in terms of quantity and quality. Studies indicate that salts Most Common existing in soil salty in Iraq she chloride Sodium And chloride Calcium and chloride Magnesium and chloride Potassium The effect of salt stress on green leaf indicators, including photosynthetic pigments, leaf length and width, leaf area, dry and fresh .weight of leaves, and root indicators in terms of root length, root biomass, and dry and fresh weight of roots, is evident In addition, high salt levels have an impact on the total carbohydrate content of leaves. And the sour Aminoproline , total soluble solids, total neutralizable acidity, reducing sugars, sucrose and total sugars were used as indicators. Chemical to evaluate the effect of salts, and the reason for salt stress is a significant decrease in some of the studied physical indicators such as length, diameter, size and weight of the fruits, which played a role in reducing the productivity of a single bunch and thus affecting the total productivity of a single tree. The results show the seriousness of the effect of salts on the content of mineral elements in the leaves . In addition, the article also emphasizes the importance of studying the response of date palm trees to salt stress as an indicator to indicate and evaluate the increase in salinity levels, and shows the urgent need to conduct comprehensive studies for the purpose of documenting the mechanisms and strategies necessary to treat soils affected by salinity, which helps in mitigating its effects and damages with the aim of reclaiming lands and protecting .date palm cultivation

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Response of date palm trees (*Phoenix dactylifera* L.) to salinity stress conditions

Review article

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Abstract

Deterioration of agricultural lands resulting from soil salinity and irrigation water is one of the main soil constraints that greatly hinder agricultural production and food security in the country, which is considered one of the most difficult challenges at the present time, in addition to climate change and the increased frequency and intensity of extreme phenomena, especially recurring drought episodes, which has raised Researchers pay attention to the purpose of seeking to confront it and develop possible solutions to address it by relying on the climate research aspect, which is extremely important with the aim of improving the capabilities of soil resources and irrigation management by Improving the quality and productivity of irrigation water in order to maintain the sustainability of the agricultural sector. The current review summarizes an explanation of how salt stress affects growth indicators in palm trees, which has a negative and significant impact on agricultural capacity and production and thus disrupts and disrupts the provision of the growing global demand, especially with the rapid increase in population growth . It discusses the effect of soil salinity and irrigation water on plant pigments, some growth indicators, physical characteristics of fruits, and overall yield. Moreover, the article deals with determining the effect of salt stress on the content of mineral elements in leaves and fruits. The article highlights the importance of studying the response of physiological characteristics of fruits as significant indicators for evaluating the severity of stress. Therefore, it is recommended in diligence to conduct more comprehensive studies on a larger scale, which contributes to understanding these effects in developing strategies to reduce and reduce salt stress and its harmful effects on date palm cultivation.