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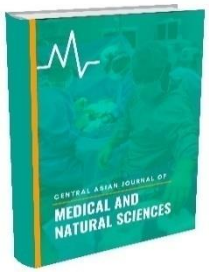

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SALINITY EFFECT IN (ACHEN, OIL CONTENTS OF SUNFLOWER PLANT). HELIANTHUS ANNUUS L.REVIEW

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Abstract: Salinity is a sever abiotic stress cause many problems in soil properaties and transform the soils to not healthy soil for plant growth, the causes of high salinity are multiple, including weather changes and high tepmparture, or arise of groundwater, its evaporation, and deposition of salinity elements on the surface of the soil.The reason may be the flow of salty water, that is unhealthy for plant growth so, the plants damage subject to in all characteristics such as vegetative growth, biochemical triates, physiological changes so, it lead to a threat to human food from their plants. sunflower plant is an oil seed crop glpbally produced, a moderately tolerant to salinity.Salinity causes a changes in oil content and quality an yield production, by this review appear how salinity effect in soil composition and plant growth, salinity arise of Na+ and Cl- which cause a sodity soil of agricultural soils, this review provides a overview of sunflower characteristecs and their growth with an affect in oil content and achen product.

Introduction

Agricultural lands, fields crops, in turn, are usually exposed to various stresses, whether biotic or a biotic stresses, biotic stresse include worms, bacteria, fungi and viruses, abiotic stresses include high heat, radition, loss of water, drought, increase or decrease in nutrients, the most important of these biotic stresses is high salinity in the lands, agricultural crops worldwide, especially in agricultural lands that are exposed to high groundwater, in addition to high cases of evaporation due to high temperatures, water evaporates from the soil, (thuvaraki *et al*., 2023), salinity accumulated on the surface of the soil, especially in countries with long summers, therefore the properties of the soil change and the soil becomes unsuitable for agriculture through its effect on the growth and development of the plant and the plants are exposed to toxic elements as a result of the accumulation, salt elements in plant tissues lead to loss of food safety and loss of food security for population (El-Bially *et al*., 2022) on other hand, plants tacke different forms of adaptation to tolerant salinity as they are immboil organisms, there for, several biochemical changes occur within plant cells, especially in root cells to resist the change in osmotic potential that occurs in the surrounding environment.The roots thus affect the plants ability to absorb the necessary plant nutrients

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that delay the in the growth and development of the plants, (Hamidi *et al*., 2021).

The problem of salinity has increase over time in the world, and it is a complex and large problem facing the world now, salinity has spread over more than 1100mhr of the total agricultural land in the world (Singh, 2022), the salinity and their sources that lead to this problem may be natural result cause geochemical processes or because of activities resulting from human movement atmospheric deposition, in addition of elevation of seawater level, so ground water can movement to soil surface and deposition the sodity elements on soil surface, therefore the evaporation of water from the soil lead to the deposition of salinity elements on the surface of the soil, in addition to the problem of repeated fertilization which leads to a large accumulation of nutrients and their accumulation in the soil(Hopmanes *et al*., 2021).Also watring plant with unhealthy water contaminated with salinity causes siqnificant increase in Na^{+} ions in the soil, in addition to ions of Cl^{-} and SO_4^{+2}, increase of these ions lead to exchanging process of positive ions between the soil and the roots, and thus signs of ion poisning appear on all plants as they pass through transpiration stream, and the severity of the signs appears depending on the plant type and plants tolerance (Stavi *et al*., 2021).

Water constitutes three-quarter of the earth, s surface area, and the salt water found in the seas and oceans constitutes salt about 3.3% of the the ions, present in the salinity tissue in this aquatic environment represented by sodium, magnwsium, potasum, and calicium ions, which represent the positive ions, while the neqative ions are represented by chlorine sulfur bicarbonate, boron oxide, iron is an addition to minor ions found in the periodic table (Fao, 2023).

As for the sources of fresh water suitable for irrigation, there has been a siqnificant delay and decline, which affects crop productivity successively due to the lack of healthy water required for plant cultivation (Ohya and Nakao, 2001).In general, salinity directly affects ground processes in a negative way, so a delay in plant growth and development was observed, and most of the areas where it appears it has the effect of salinity in the coastal areas of the sea, especially since salinity affects this area due to tidal movement(Foronda, 2022).The most common salt compound that appears in this region is NaCl, and its increase in irreqation water causes a loss of fresh or usable water for irrqation plants and thus a loss in the level of plant nutration for the population(Rady *et al*., 2019).

Salinity causes many physiological, chemical, anatomical and phenotypic changes in many plants especially those irreqated with salty water.The first changes that occur in plants are an imbalance in the plant cell membranes in addition to an imbalance in the nutrient within the plants therefore research studies have focused most of their attention on the changes that occur, it occurs in plants, whether flowing, anatomically, physiologically or chemically in addition to environmental changes (Isayenkov and Mathuis, 2019).

Plants have been used since ancient times for nutritional purposes as well as for medicinal uses in many countries, whether poor countries, these plants are considered a source of many medical treatments and are used to treat many diseases, the sunflower plants is one of the plants that is used for nutritional and medicinal purposes around the world and is cultivated, this plant is for its seeds, which are rich in oils, these oils are widely used for industrial and commercial purposes (Dawood *et al*., 2014 ;Talaat *et al*., 2015)in many countries, as thses oils contain a high percentage of fats reaching 43-52% and proteins reaching 9-25% as there plants, the sunflower plant is affected by its composition, the soil in soil in which it grows, such as nutrients salinity elements, as well as toxic elements that enter into the properties of the soil (Kuldeep, 2016).

Sun flower (*Helianthus annuus* L.)

Sun flower is considered one of the most important agricultural crops that humanes have been interested in cultivating in many regions

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of the world, this plant is described as being herbaceous, annual 1-4meters hight with a tap root with a dense vegetative cluster, and an upright, thick stem, a stuff, plump unbranched, the leaves ovate to heart shaped mostly 5-20cm long and 5-15cm wide, the inflorescence of sunflower is capitate (Han *et al*., 2022), image(1)

flower **seeds**

Image 1: sun flower plant (Helianthus annuus L.)

Important components of Sunflower

One of the important components of the sun flower is the oil which found in its seeds, as it contains many effective components, including essential acids that are essential for the bodys growth and functions, such as unsaturated fats that work to reduce blood cholesterol, sun flower seed oil also contains a group of vitamins, such as vitamin B, which is an antioxidant that eliminates free radicls and prevents them from oxidizing cholesterol, vitamin B is also considered the basic protective elements for skin cells as it works to protect the skin during exposure to ultraviolet rays, it also contains(seeds of sun flower) dietary fiber and proteins that are easily digestible (Saudy *et al*., 2021), due to its nutritional, medical and industrial importence, interest in it in recent years has focused on methods of cultivation, such as the use of biofertilizers that play a role in the growth of this plant.th Fatty acid which found in seeds of sun flower are palmitic, stearic, oleic, and linoleic(Pilorage, 2020). Also sun flower have many biological active compound such as Alkaloids, Carbohydrates, Phenolic compound, AllelochemicalsSaponin, Tannins, Terpenoids, Steroids, Flavonoids. (Ullah *et al*., 2021)

Agricultural lands are of great importance in the economic life of countries, therefore, the interests of most researchers focus on studying the various effects that effect the quality of the soil, which can neqatively affect the productivity of vegetable crops, one of the most important problems to which agricultural soils are exposed is the problem of salinity, especially those lands that are exposed to high temperatures, which leads to the evaporation of water from the soil, leading to the accumulation of salinity on the surface of the soil, causing a siqnificant change in the properties of the soil transforming that soil into a stressed soil that is not suitable for agriculture in general, thus leading to a reducation in plant production, as well as neqatively affecting food safety for populations(Thuvaraki *et al*., 2023).

Some plants have the ability to adapt to stress conditions, including salinity stress, therefore, a group of chemical changes occur in the cells to increase the plants ability with stress, (Shrivastava &Kumar, 2015), these include changes at the level of plant cells, starting with the root cells, causing a group of transformations and changes due to changes in the osmotic potential in the region of the roots, causing a condition of ion poisoning is due to an increase in the level of sodium and chlorine ions, therefore an ionic imbalance occurs in the root cells, and this leads to changes in cellular metabolism in the plant cells. Many studies have proven the occurance of physiological and biochemical changes in the plants when plants is exposed to salinity stress, (Sadak *et al*., 2015), these changes may lead to death of plants, especially of sensitive types to salinity, or it may lead to adaptations of the process of osmotic adjustment in the root cells, which includes the formation of organic molecules from the sugars and proteins present in the plants to maintain the swelling of the cells and not expose them to the state of swelling cells to prevent plasmosis which can occure, (Sobhanian *et al*., 2016).

One of the most important stresses affecting plants is the effects of salinity due to the neqtive effects resulting from them, which

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neqatively affect the growth and development of the plant (Saudy *et al*., 2021).Increasing the level of salt elements in the soil causes high osmosis and decrease in the water potential in the root cells, which leads to a lack of natural flow of water, which fills the need plant, the problem of salinity is widwspread in arid and semi-arid regions around the world, (Aslam *et al*., 2021;Abd El-Mageed *et al*., 2022).

There is a larg number of agricultural lands irrigated with saline water(Niamat *et al*., 2019), so many researchers have noticed that irrigation with salt water comes as a result of the lack of suitable water for irrigation due to high tempertures and lack of enauph water(Klopp and Daigh, 2020;Zabala *et al*., 2020 Ma *et al*., 2021).

The high level of salt elements in the plants tissues, especially ions causes rapid and clear changes in the physiological characteristics that appear on the plant which are positively linked to phenotypic changes that are clearly and quickly affected(Li *et al*., 2022).Also, an increase in salt elements causes changes in the level of ionic and osmotic balance in the cells, which leads to the clouser of stomata in the leaf cells and the continued passage of toxic salt ions in the transpiration stream, causing damage to plant cell membranes, especially in the leaves(Han *et al*., 2022).

Many studies have noted that the most have noted that the most important local elements that cause increased sodity in the soil are Na^+, Cl^-, the salt elements present in the salt composition are SO_4, HCO_3, Mg^+, the presence and spread of salt elements in plant tissues leads to the formation of ROS(Reactive Oxigen Species) in plant tissues, leading to oxidation in nucleic acid, protein and.lipids, (Zentgraf *et al*., 2022).

Main mechanisms in plants can improve ability to tolerant salinity stresses by modulate osmotic potential in roots of plants and leaf expansion were maintain and conductance of stomata, and balance the level of nuteriants at optimal level(Nisha *et al*., 2021;Zhang *et al*., 2022), also the second mechanisms of. tolerance salinity by involve the ability to reduce stress on plant by reduced the sodium amount wich found in cells (Kumari and Bhatlal, 2021).So, the first mechanism by excluding sodium from leaves and sodium ions are trapped in the gaps(Zhang *et al*., 2022), by pathway of symplastic for Na^+ and Cl^- occure during specific transporters and channels, during transport cation Na^+, H^+ antiporter (Arif *et al*., 2020), there are mechanisms for revers saline elements from cell damage like gene experession for (SOD super oxide dismutase), (APX ascorbat peroxidase), (POX peroxidase), (GR glutathione reductase) and non enzymatic enzymatic enzyme such as (Ascorbate AC), (Phenolic compound PC) and (Glutathione GT) (Kamincka *et al*., 2022).

As for the role of genes in the plants exposure to salt stress, they participate in the plants adaptation in the face of salinity, as the plants shows certain mechanisms, when it effected by salinity, especially when toxic ions bind to specific sites on the plants cellular membranes(Li *et al*., 2022), the plant also shows other activities in terms of antioxidant activity, enzymatic oxidation to remove reactive oxygen species(ROS) (Pittaro *et al*., 2016).

The role of plant hormones also appears in helping plants adapt to salinity conditions, such as the hormons in addition, genes participate in the formation of other compounds when the plants are subjected to salinity, these compounds work as osmosis modifiers and also participate in removing the influence of reactive toxic ions (Arif *et al*., 2020).

Many studies have showen the effect of salinity on sunflower plants, such as Han *et al*(2022), as study of where they noticed that salinity at a level of 5-8ds.m^{-1}, shows a clear effect on the growth of sun flower plants, and another study conducted by(Gabriel *et al*., 2022).)in which they showed that increasing salt concentrations above 5ds.m^{-1} leads to noticeable changes in the content of oils and achen yield Gabriel *et al*., (2022) they showed treatment the four genotype of sun flower plan couses low in

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achen yield and oil content figure (1).The sun flower plant is one of the plants that tolerates salinity up to 3ds.m^{-1}, like the rest of the plants that are moderately tolerant to salinity, it is exposed to physiological and chemical changes in addition to a reducation in the amount of seed yield, which in turn reduces the percentage of oils produced, also Xiaoyu *et al*., (2022) showed the sun flower plant have decrease in productivity and oil content if treatment with salinity up to 3dsm^{-1}.

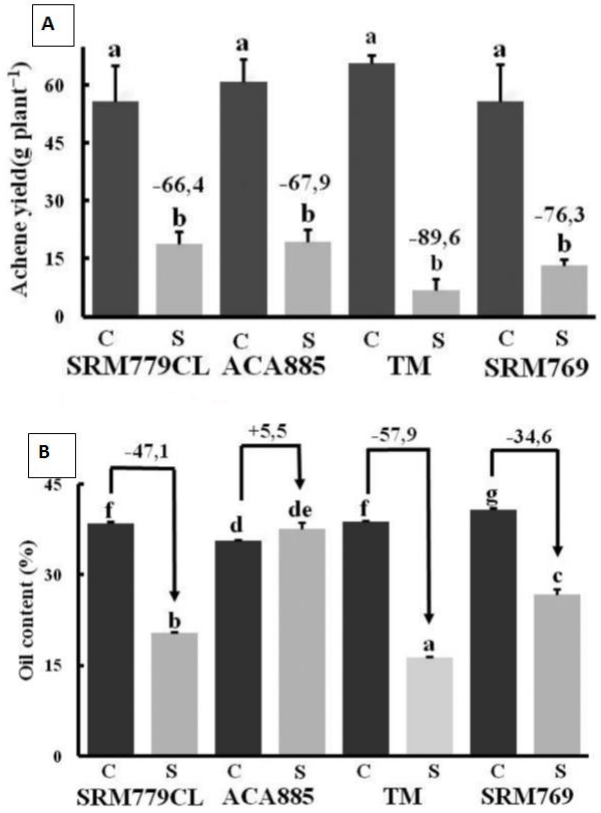

Fig. 1. Effect of salinity 130 mM NaCl on A: achene yield and B: oil content (%) in four sunflower hybrids genotypes. C: control, S: salinized plants different on the LSD at p ≤ 0.05 (Gabriel et al., 2022).

Conclusion

This review discussed the reasons of salinity and their effects in growth, achen productivity, oil content of sunflower plant, also showed the phytotoxity of soil elements for plants and provides information about reasons of salinity and there effects in tolerance of varies plant species.

Refrences

1. Abd El-Mageed T, Mekdad A, Rady M, Abdelbaky S, Saudy H, Shaaban A(2022) Physio-biochemical and agronomic changes of two sugar beet cultivars grown in saline soil as influenced by potassium fertilizer. J. Soil Sci. Plant Nutr., 22, pp. 3636-3654
2. Arif y, Singh P, Siddiqui H, Bajguz A, Hayat H(2022)Salinity induced physiological and biochemical changes in plants: an omic approach towards salt stress tolerance Plant Physiol. Biochem., 156, pp. 64-77
3. Aslam A, Khan S, Ibrar D, Irshad S, Bakhsh A, Gardezi A, Ali M, Hasnain Z, Hashimi A, Noor M, Brestic M, Skalicky M, . Zuan A (2021)Defensive impact of foliar applied potassium nitrate on growth linked with improved physiological and antioxidative activities in sunflower (Helianthus annuus L.) hybrids grown under salinity stress Agron, 11, p. 2076, 10.3390/agronomy11102076.
4. El-Bially M., El-Bially H Saudy., Hashem F(2022) Salicylic acid as a tolerance inducer of drought stress on sunflower grown in sandy soil Gesunde Pflanzen, 74, pp. 603-613
5. FAO.(2023) Global Soil Partnership. Available online: https://www.fao.org/global-soil-partnership/resources/highlights/detail/en/c/1412475.
6. Foronda D (2022) Reclamation of a saline-sodic soil with organic amendments and leaching. Environ. Sci. Proc. 16, 56. [Google Scholar]
7. Gabril C, Sergio A, Melina S, Maria L, Fernando F, Lucas D(2022) Salinity tolerance determination in four sunflower (Helianthus annuus L.) hybrids using yield parameters and principal components analysis model.J.Annals of Agricultural Sciences.v(67)2.211-

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8. Hamid S., Ahmad I, Akhtar M, Iqbal M, Shakir M, Tahir M, Rasool A, Sattar A, Khalid M, Ditta A, Zhu B(2021) Bacillus subtilis Y16 and biogas slurry enhanced potassium to sodium ratio and physiology of sunflower (Helianthus annuus L.) to mitigate salt stress Environ. Sci. Pollut. Res., 28 (2021), pp. 38638-38646
9. Han X, Kang Y, Wan S, Li X (2022)Effect of salinity on oleic sunflower (Helianthus annuus L.) under drip irrigation in arid area of Northwest China Agric. Water Manag., 259, Article 107267, 10.1016/j.agwat.2021.107267
10. Hopmans J.W., Qureshi., Kisekka A, Munns I., Grattan S(2021) Rengasamy, P.; Ben-Gal, A.; Assouline, S.; Javaux, M.; Minhas, P.S.; et al. Critical knowledge gaps and research priorities in global soil salinity. Adv. Agron, 169, 1–191.
11. Isayenkov S and Maathuis M (2019)Plant salinity stress: many unanswered questions remain Front. Plant Sci., 10, p. 80, 10.3389/fpls.00080 View article View in Scopus Google Scholar
12. Kamran, M., Parveen A., Ahmar S., Malik Z., Hussain, S., Chattha, M.S., Saleem MAdil, Klopp H and Daigh A(2020) Measured saline and sodic solutions effects on soil saturated hydraulic conductivity, electrical conductivity and sodium adsorption ratio Arid Land Res. Manag., 34, pp. 264-286
13. Kuldeep S (2016) Response of boron application to sunflower(Helianthus annuus L.) under saline conditios. Ph.D thesis.
14. Li S, Wu G, Lin L, SKOR H and NH X (2022)synergistically control Na+ and K+ homeostasis in sugar beet (Beta vulgaris L.) seedlings under saline conditions J. Plant Biochem. Biotechnol., 31, pp. 71-84.
15. Zheng W, Lei G, Wu J, Huang J(2022)Predicting the rooting depth, dynamic root distribution and the yield of sunflower under different soil salinity and nitrogen applications Ind. Crop.Prod., 170, Article 113749, 10.1016/j.indcrop.2021.113749
16. Niamat B, Naveed M, Ahmad Z, Yaseen M, Ditta A, Mustafa A, Rafique A, Bibi R, Sun N, Xu M(2019) Calcium-enriched animal manure alleviates the adverse effects of salt stress on growth, physiology and nutrients homeostasis of zea mays L Plants, , p. 480, 10.3390/plants8110480
17. Nisha N and Anan G, (2021)Nithaniyal Conceptual review on the conventional and genome-wide association analysis towards developing salinity tolerance in rice Plant Gene, 28 (2021), Article 100327, 10.1016/j.plgene.100327
18. Ohya H, Suzuki T and Nakao S(2001) Desalination, 134, 29–36 CrossRef CAS.
19. Pilorage (2020)Sunflower in the global vegetable oil system: situation, specificities and perspectives OCL, 27, p. 34, 10.1051/ocl/2020028
20. Rady M., Talaat N., Abdelhamid M., Shawky B., Desoky E. Maize M(2019)Zea mays L. grains extract mitigates the deleterious effects of salt stress on common bean (Phaseolus vulgaris L.) growth and physiology. J. Hortic. Sci. Biotechnol. 2019 doi: 10.1080/14620316. 1626773. in press. [CrossRef] [Google Scholar]
21. Sadak S; Abdelhamid M and U Schmidh (2015) Effect of the foliar application of amio acids on plant yield and physiological parameters in bean plant irrigation with seawater, Act a Biological colmbian 20(1)141-152.
22. Saudy, H., El-Bially, M., El-Metwally, I., Shahin, M., 2021. Physio-biochemical and agronomic response of ascorbic acid treated sunflower (Helianthus Annuus L.) grown at different sowing dates and under various irrigation regimes. Gesunde Pflanzen 73, 169–179
23. Shrivastava P and R Kumar (2015) Soil Salinity., A serious environmental issue and

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plant growth promoting bacteria as one of the tools of its alleviation, Saudi J of Biol Sci, 22:123-131.

24. Singh, A. (2022)Soil salinity: A global threat to sustainable development. Soil Use Manag. 38, 39–67. [CrossRef]
25. Sobhanian N; Pakniyat H; Kodshooli M ; Dorostlkar S and Z Aliakbari (2016) Electrophoresis study of wheat (Triticum aestivum L.) Protein changes under salinity stress Science research 4(2) : 33-36.
26. Stavi I.Thevs, N.; Priori, S. (2021)Soil salinity and sodicity in drylands: A review of causes, effects, monitoring, and restoration measures. Front. Environ. Sci. 330, 712831. [Google Scholar] [CrossRef]
27. Stavi, I., Thevs N., Priori S., (2021) Soil salinity and sodicity in drylands: A review of causes, effects, monitoring, and restoration measures. Front. Environ. Sci. 330, 712831. [CrossRef]
28. Thuuaraki B;Guoxin S;Nardana E;Hong Z(2023)Plant response Mechanisms to salinity stress.J.Plants.v(12)12.
29. Ullah A., Bano A., Khan N(2021) Climate change and salinity effects on crops and chemical communication between plants and plant growth-promoting microorganisms under stress. Front. Sustain. Food Syst. 5, 618092. [CrossRef]
30. Xiaoyu H, Yaohu K, Shuqin W, Xiaobin L (2022) Effect of Salinity on Olic Sunflower (Helianthus annuus L.) Under drip irrigation in arid area of Northwest China. Agr.wat.Mang. v(259)107267.
31. Zabala J, Marinoni L, Taleisnik E, Ribero G, Schrauf G(2020) Salt tolerance in argentine wheatgrass is related to shoot sodium exclusion Crop Sci., 60, pp. 2437-2451
32. Zentgraf U, Andrade-Galan A, Bieker A(2022) Specificity of H2O2 signaling in leaf senescence: is the ratio of H2O2 contents in different cellular compartments sensed in arabidopsis plants? Cell. Mol. Biol. Lett., 27, p. 4, 10.1186/s11658-021-00300-w
33. Zhang M, Bai R, Nan M, Ren W, Wang C, Shabala S, Zhang J(2022)Evaluation of salt tolerance of oat cultivars and the mechanism of adaptation to salinity J. Plant Physiol., 273, Article 153708, 10.1016/j.jplph.2022.153708

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