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A comprehensive review on the effect of salinity on plants and irrigation with water treated by electrostatic field

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***ABSTRACT* : This review attempts to describe the salinity problem and attempt to identify remedies, since research has revealed to what degree salt is hazardous to plants. Salinity is a worldwide issue, not only in Egypt. Salinity is the buildup of harmful salts in the soil, such as sodium and chlorine, which impedes the healthy and natural growth of plants. It affects plants in both morphological and biological ways, causing a decrease in dry and fresh weight, a decrease in the number of leaves, and wilting. As a result, we lose the complete plant, and salt impacts the protein, carbohydrate, antioxidant, and proline content. With the continuance of the salinity problem, a remedy was required , and a group of scientists devised an effective technique to combat it in which plants exposed to salt were watered with water treated with an electric field. Unlike untreated water, processed water has extremely little chlorine and salt. It is also a low-cost option that does not contaminate the environment and is simple to implement. As a result, it is regarded as an excellent remedy for water resistance Salinity.**

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INTRODUCTION

Because there are millions of hectares of potentially irrigated land that might turn salty, there will be more salinity concerns as irrigated agriculture increases. Numerous investigations on this issue have revealed that it has a detrimental influence on plant growth and development in a variety of ways (**Ehtaiwesh et al., 2020**). One of the numerous environmental challenges brought on by climate change is soil salinity. Salinity salt stress is the second most important abiotic factor impacting agricultural production globally, impairing a number of physiological, biochemical, and molecular processes. Salinity, in particular, has an effect on plant production, growth, and development. To defend plants from osmotic stress, salinity responses include ion homeostasis alteration, antioxidant defense system activation, the creation of numerous phytohormones, and increased reactive oxygen species scavenging. Because most crop plants are sensitive to salinity, increasing salt tolerance is critical to preserving global agricultural output. To combat the harmful consequences of salinity, plants respond by activating stress-related genes, proteins, and the accumulation of metabolites So, a summary of the effects of salt stress on crop plants is provided in this review(**Ali reza et al .,2022**). Arid soil is one of the main environmental concerns that limits plant growth due to its high salt concentration. Salinization is the process of making soil saltier (**Hunter et al., 2017).** Soil salinization is a global land degradation problem that primarily affects coastal areas by causing soil salinity (**Raza et al,.2019**). Soil salinity affects 7% of the total world's land, 20% of cultivated land, and approximately 50% of irrigated land **(Hunter et al,.2017**). Furthermore, the area affected by salt is growing at a rate of 10% per year, and if the problem is not addressed by 2050, more than half of the world's arable land will be salinized (**Zorb et al., 2019**). Soil salinity has a number of negative effects on plant growth and yield. Unbalanced hormone or photosynthetic assimilate supply to growing tissues may reduce plant growth and productivity (**Mujeeb et al.,2019)**. Furthermore, ionic toxicities cause protein synthesis and metabolic imbalance (**Liu et al., 2020**). Salt stress can affect plant growth by interfering with seed germination, disrupting enzyme activity, and unbalancing mitosis (**Parvez et al.,2020**).

Effect of salinity on seed germination and morphological character

Seed germination

Salinity is a danger to abiotic stress because it impairs plant development and morphological features, reducing production **(Chrysargyris et al., 2018**). Salinity has an effect on physiological processes in plants, which affects crop development. It also causes osmotic pressure to build up inside plant cells **(Nasri et al., 2017).** Salinity inhibits seed germination and delays seed expansion, which has an effect on plant development. Under the influence of salinity, seed germination is reduced **(Ashwaq Ibrahim et al.,2022).** Salt affects the rate at which plants grow and sprout, with greater saline levels inhibiting sunflower development and lower concentrations delaying seed germination and seedling growth **(Khan et al., 2015).** Salinity inhibits plant growth and lowers the rate of germination height, plant length, root length, and photosynthetic rate. Salinity may have an effect on how cells divide (**Shahid et al., 2018).** The proportion of seed germination and the selection of salt-resistant crops are the most important production parameters (**Mordi et al., 2013**). Plant seedling growth is delayed or less mobilized by reserve food salinity, which stops cell division, grows and harms hypocotyls, and stops cell division (**Rahman et al., 2008)**. Salinity is the most dangerous element influencing the rate of germination and yield caliber (**Chakovari et al., 2016)**. Studies have shown that it has a negative influence on plant growth, photosynthesis, dry weight, fresh weight, and leaf size **(Sabbour et al., 2016)**. Exposed immature seedlings of the lettuce plant are strongly damaged by high concentrations of salt chloride, restricting their development and interrupting germination (**Nasri et al., 2011)**. The rate of germination in the sunflower plant decreases as salt concentrations rise. Greater salinity is related with lower seed germination rates and longer germination durations (**Hag ghani et al., 2008**).

Height

Plants lose height as sodium chloride level increases (**Houimli et al., 2008; Rui et al., 2009**). The lengths of the plants reduced with increasing NaCl concentrations in the *Vigna unguiculata* L. cowpea investigated by (**Taffouo et al., 2009)** and the Vigna mungo L. analyzed by (**Kapoor et al., 2010**). As sodium chloride levels increased, shoot length reduced (**Pattanagul et al., 2008)**.Under low salt concentrations, stem length and plant growth increase in the research on Brassica campestris L. (**Memon et al., 2010)**, but less than the control (**Sevengor et al., 2011**). A drop in shoot height caused by protoplasmic dehydration, a decrease in relative turgidity caused by turgor loss, and a decrease in cell proliferation and division (**Raza et al., 2014**). Increases in salt concentrations have a negative influence on plant height, as evidenced by the significant height loss reported (**Razzaque et al., 2009). (Amirjani,.2010).** The larger root density seen in these plants indicates better resilience and, most likely, a bigger buildup of reserves (**Gómez-Bellot et al., 2013)**. This would boost the plants' tolerance to saltwater environments and speed plant establishment, particularly in desert areas.

fresh and dry plant weight

The proportion of germination, root length, fresh and dry plant weight, and seedling growth decrease as salt concentrations rise **(Akhtar et al., 2009)** What salinity does to a plant differs in salt type, salt content, and ionic concentration **(Yadav et al., 2010)**

discovered that salt causes an increase in root diameter **.**

The dry weight of the plant decreases as salinity increases. According to**(Datta et al.,2009),** soil salinity is a problem that poses a threat to production since it interferes with plant growth and photosynthesis and reduces the weights of both fresh and dried plants at various salt levels **(Zahra, 2010**).

Plant growth

Salinity has a substantial influence on okra productivity when cultivated in dry and semi-arid environments. Because salt has a direct influence on water relations and nutrient absorption, okra plants are especially vulnerable to it in their early stages of growth.

Photosynthesis

Salt stress has an influence on photosynthesis both now and in the future. Salt-induced stomatal limitations can interrupt photosynthesis and diminish carbon intake in the short term. This process has the ability to produce a rapid halt in development even after only a few hours of salt exposure. Long-term salt stress can also affect photosynthetic processes because young leaves absorb salt and their levels of chlorophyll and carotenes decrease, even in halophyte plants (**Duarte et al., 2013)**. Ionic stress limits leaf development in the latter phases of growth, and extended salt exposure promotes leaf senescence, which reduces photosynthetic rate (**Sathish Sundararajan et al.,2021).**

Effect of salinity on biochemical content of plants:

Total Chlorophyll:

Salinity increases chlorophyll concentrations, which causes chlorophyll degradation and hinders chlorophyll synthesis (**Acosta-Motos et al., 2017).** Salt-sensitive plants lose a higher proportion of their chlorophyll content than salt-resistant plants (**El-Hendawy et al., 2017**). The saltiness of sodium chloride reduces chlorophyll content (**Sathish Sundararajan et al.,2022).** Because of the fall in nitrogen levels in plant tissues, which decreased the rate of photosynthesis and the amount of chlorophyll, chlorophyll content reduces in high salt concentrations (**El-Beltagi et al.,2022**) In the sunflower plant, the percentage of chlorophyll reduces when the saline level rises (**Mehtap GÜRSOY et al.,2022)**. Photosynthetic pigments, chlorophyll stability index, relative water content, protein content, and carbohydrate content were all reduced in both wheat cultivars at all three salt stress concentrations (**Pooja Singhet al.,2022)**. According to research (**Taffouo et al., 2010),** salinity hinders and destroys chlorophyll production. The amounts of chlorophyll a and b and carotenoids varied with salt concentration (**Pinheiro et al., 2008).** When exposed to salt, several plants, notably cowpea (*Vigna unguiculata L.*), Catharanthus roseus (L.), (**Taffouo et al. 2009**), and (**Vigna subterranean 2010**), exhibit a decrease in total chlorophyll content.High salt concentrations resulted in a considerable and detectable decrease in the overall amount of chlorophyll (a and b), as assessed by comparing chlorophyll percentages in control plants (**Dhanapackiamet al., 2010).** When salinity and chlorophyll content have an inverse relationship, the effect of salt on chlorophyll may reach its lowest percentage as a result of high salinity content. (**Amira et al.,2011**) Increased sodium chloride concentrations increase carotenoid content in chlorophyll a and b (**Jamil et al., 2012)**.In the other review (**Ahmad et al., 2019**), a significant decrease in total chlorophyll content was seen in all soybeans (**Saad-Allah, 2015)**.demonstrate that salt stress kills photosynthetic pigments in plants, resulting in chlorosis, necrosis, and early senescence, among other major changes that limit plant development. Because of NaCl overabsorption, long-term salt exposure causes severe ionic and oxidative stresses in plants. These stimuli are harmful impact on plant growth.

Total phenols:

Because salt increases the overall quantity of phenolic compounds available, red lettuce generates more antioxidants (**Nikos et al.,2022).** Although plants naturally produce phenols as they develop, this percentage increases in response to salt. Phenols are naturally created by plants during growth, but their proportion rises in response to salt.This causes cell membrane damage, and plants manufacture phenols to protect themselves against salt (**Baenas et al., 2014**). Four Capsicum annuum L. genotypes were subjected to two levels of salt stress ('Caro F1', 'Berenyi F1', 'Somborka', and 'Novosadka').The number of phenols increased significantly in response to salt (**Libia et al.,2022)**.

Production of phenols is a type of response to salinity in the species *Capsicum annuum L* (**Fidanka.,et al.,2004)**The studies demonstrated that plants exposed to salt stress have several mechanisms to reduce the negative effects, such as ion homeostasis, compatible solutes, also known as compatible osmolytes (proline, sugars, glycine betaine, and polyols), (**Baenas et al.,2014)**antioxidant modulation, polyamines, and hormones. High salinity has an effect on a plant's total phenol content. *Calendula officinalis L*., also known as marigold (**Hend et al.,2022**) antioxidant performance crude extracts of three Asclepiadaceae species, *Calotropis procera L., Peruglaria tomentosa L., and Pentatropis spiralis*, were analyzed for total flavonoid content (TFC) and total phytochemical content (TPC) (Forsk). They have an inverse relationship with salinity, with abundance increasing as salinity increases (**Yousef Al-Dalahmeh et al., 2022)**. The number of phenols is directly proportional to salinity; the higher the salinity, the more phenols **(Nouman et al., 2012**). The overall quantity of phenols in halophytic species increases with salinity (**Sharma and Ramawat, 2012)**. The leaflets of S. glauca seedlings The concentration of phenzel increases as the concentration of sodium chloride increases (**Rajamane et al., 2014).** (**Miladinova et al., 2013).** *Shorea glauca* interior Higher salt concentrations resulted in a significant increase in flavonoids (**Rajamane et al., 2014)**. The position of the flavonoids was not affected by salinity (**Gavin et al., 2012).** The total phenolic content increases with increasing salt chloride concentrations compounds increased in artichoke leaf (**Rezazadeh et al., (2012) (Hanen et al., (2008).**

Total soluble sugar:

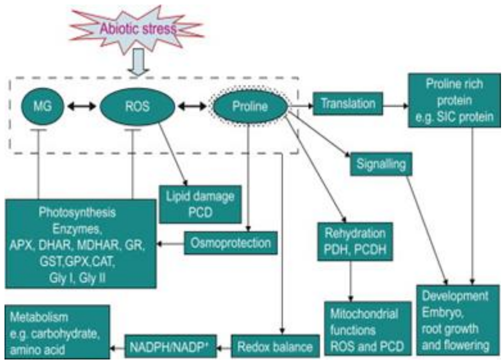
The salinity reduced the sugar content compared to the control plants, and the plant's productivity experienced a 55.9% reduction in damage. Carbohydrate levels in several essential plants, such as the Fabaceae family (pea, chickpea, common bean, and lentil), have been shown to drop dramatically when exposed to salt (**Amira et al.,2022)**.

Growing sodium chloride concentrations have an impact on all physiological functions in plants, including photosynthesis. They also limit the rate of leaf surface growth, reducing the amount of carbohydrates in the leaves (**Abdelgawad et al,.2019).** The reasons of salinity's negative impact on plant development include osmotic stress and ionic toxicity. Chloride and salt toxicity not only creates nutritional problems, but also physiological dryness by lowering the osmotic potential of soil fluids, which encourages the accumulation of appropriate solutes such as soluble carbohydrates and proline to aid in water absorption (**Muhammad et al., 2020**). Under advanced salinity pressure, there was a considerable buildup of soluble sugars in contrast to control plants (**Amira K. Nasrallah et al.,2022).** The quantity of soluble sugars in the pea plant is disrupted due to hormonal control, ionic and osmotic imbalance, and salinity (**Swapnil Sapre et al.,2022)**. According to (**Farooq et al.,2017**), oxidative damage caused by salt stress reduces water absorption This causes an accumulation of soluble carbohydrates inside plant cells. Salinity lowers the quantity of fructose and glucose in tomato plants compared to control plants (**Carlos Agius et al.,2022).** As a result of an osmotic pressure imbalance, salinity induces the buildup of dissolved sugars (**Pattanagul et al, 2008).** The proportion of soluble and insoluble carbohydrates in the root and shoot decreased with increasing salt concentrations **(Chakovari et al., 2016). (Mosahebeh et al,.2016)**.

Free proline:

Salinity activates the gene that produces proline, causing proline to accumulate in the body *L. scindicus* seeds have more radical proline and root proline as salt increases. The proportion of proline in the plant's (*L. scindicus*) buds, roots, and seedlings rose in response to the increase in salt rates (**Jahangir A. Malik et al.,2022).** According to research, the chilli pepper plant has a balanced proline ratio when compared to other stressed plants (**Sumreen**

Anjum et al.,2022). Ionic toxicity, osmotic stress, impaired nutritional absorption, hormonal instability, and the overproduction of reactive oxygen species are all caused by high salinity, which causes proline to accumulate more Immediately (**Mohammad Bagher et al.,2022**) Although salt inhibited the development of *Zea mays L.* plants, it increased proline content (**Muhammad Abdullah.,2022)**.When subjected to high salt levels, the plant okra (*Abelmoschus esculentus L.*) showed a greater proline content (**Sathish Sundararajan et al.,2022).**Proline levels in higher plants are higher than in lower plants, and salt impacts this quantity to rise (**Dogan et al., 2010; Nabati et al., 2011)**.Proline is required for membrane stability in plant cells. Proline synthesis has been described as a common plant response to water stress, increasing the Na+:K+ ratio.The Ca+2 ratio of the growth fluid led proline concentrations to increase in four Brassica species: **B. juncea, B. campestris, B. napus, and B. carinata** , to considerably increase in response to salt stress. Under salinity stress, salt-tolerant cultivars of **B. juncea** accumulate considerably more proline in leaves than salt-sensitive cultivars. Proline accumulation in plant tissues as a result of salt stress was observed to considerably decrease lipid peroxidation in B. juncea (**Karimi et al., 2009)**. Proline is an osmotic adaption mediator, a cell membrane stabilizer, and an enzyme and hormone regulator (**Benhassaini et al., 2012).** An increase in the buildup of proline and soluble carbohydrates inside the cells, which enhances plant resistance through ion absorption, is one of the good indicators of tolerance to high salt levels in addition to osmotic correction (**Ramezani et al., 2011**). When exposed to salt, proline levels in leaves increase significantly (**Zhani et al., 2010). (Yang et al. ,2013)** shown that proline accumulation increased in wheat (**Khan et al., 2009 and Shafi et al., 2011),** *Paulownia imperialis* (**Astorga et al., 2010),** Atriplex (**Ouiza et al., 2010)**, rapessed (**Farhoudi i, 2011**), and pepper (**Farhoudi and Tafti .,2011). (Chookhampaeng ,. 2011**). The total free proline content in all soybean cultivars increased with increasing sea salt concentration during sea salt stress **(Saad-Allah, 2015**). When subjected to salt stress, proline levels in leaves and roots increased significantly when compared to controls (**Chakovari et al., 2016; Mosahebeh et al., 2016).** The cause of the rise in proline percentage is unknown Proline synthesis rises due to a reduction in proline oxidation rate (**Benhassaini et al., 2012).** When subjected to osmotic stress, proline (Pro), which is derived from glutamic acid, acts as an osmoprotectant. During salt stress, Pro protects suitable osmolyte enzymes in plants, removes free radicals, controls cell redox, buffers cytosolic pH, and stabilizes subcellular structures.It also lowers NaCl-induced K+ efflux from roots, carbon and nitrogen storage, and salt-stress signaling.Numerous studies have been conducted to investigate the association between proline content and plant resistance to adverse environmental factors. Proline accumulation in cells protects against a range of damaging effects, including salt, low and high temperatures, water and osmotic stressors, and H2O2 stress.The buildup of proline is Plant tolerance to drought and salinity is critical. Osmolyte, ROS scavenger, redox balancer, cytosol pH buffer, molecular chaperon, and protein structural stabilizer (**Martin Kohlmeier et al., 2003).**



Soluble Amino Acids

Under the influence of salt, the plant accumulates amino acids (alanine, arginine, glycine, serine, leucine, and valine, as well as the imino acid, proline, and the non-protein amino acids, citrulline and ornithine) and amides (such as glutamine and asparagines). Different high sodium chloride concentrations cause visible stress, which alters plant amino acid content. (**Elhamid and colleagues**

.,2014). According to studies, the quantities of amino acids stored in the soybean plant have dramatically risen **(Saad-Allah, 2015**). Plants change their amino acid metabolism in a variety of ways in response to salt. Arabidopsis thaliana leaves' amino acid profiles and proteome alter after early recovery from low water potential or excessive salinity. Both medications created oxidative stress, which resulted in While the patient was recuperating, he had a biphasic stress reaction. Free amino acids collected as a result of the breakdown of highly prevalent proteins such as ribosomes and photosystems' component elements. Numerous low abundance amino acids had catabolic pathways active, indicating that they were being utilized as an alternative respiratory substrate to compensate for the diminished photosynthesis. Our findings indicate that the early stress recovery period is critical for fast detoxification of potentially hazardous amino acids such as Lys (**Willian et al., 2019).**

Total Crude Protein

Among the seaweed In research, protein content was shown to be much greater (**KristofferStedt et al., 2022).** Wheat protein content has grown dramatically, according to research (**Alireza et al.,2022**). Salinity has a noticeable effect on protein levels. Plants harbor grass carp (*Ctenopharyngodon idella)* and black carp (*Mylopharyngodon piceus)* (**Le-tian Qu et al.,2022)**.Plant protein content is increased by salt concentration (*Vigna mungo (L.),* **Kapoor and Srivastava) (2010). P**rotein content rises in direct proportion to salt concentrations **(Amira and Qados, 2011).** When compared to controls, salt stress reduced protein synthesis and protein content in wheat plants (**Mosahebeh et al., 2016).** The accumulation of proline and protein under stress in many plant species has been linked to stress tolerance, with concentrations being larger in stress-tolerant plants than in stress-sensitive ones. Proline is known to accumulate widely in higher plants, and its accumulation is generally in considerable amounts in response to salinity to protect the cell by balancing the osmotic strength of the cytosol with that vacuole and external environment had high concentrations of proline.Protein content in salt stressed plants increased significantly as a result of salinity stress. Protein accumulations are especially critical for cell survival during salt stress and produce membrane stability. One might assume that salt-tolerant cultivars produce greater protein concentrations due to improved osmotic control these plants have a mechanism that reduces sodium toxicity in the cytoplasm compared to sensitive plants, preventing protein degradation under salt stress (**Goudarzi et al., 2009).**

Antioxidant Enzymes

Antioxidants reduced oxidative damage by increasing non-enzymatic antioxidants like ascorbic acid and glutathione and enzymatic antioxidants like superoxide dismutase (SOD), catalase (CAT), peroxidase (POX), and ascorbate peroxidase (NR).(**Mona Dawood et al.,2022**). When salt concentrations rise, antioxidants increase, functioning as a defense for the plant and helping it to withstand in Aloe vera (**SabaKavian et al.,2022**). To adapt to osmotic stress and ion toxicity induced by salt, the plant generates osmolytes such as proline and soluble carbohydrates, as well as intracellular compartmentation and antioxidants to maintain a positive turgor pressure. Superoxide dismutase (SOD) and other antioxidant enzymes Plants are protected from reactive oxygen species by catalase (CAT) and glutathione peroxidase (GPx) (**Fatemeh Azizi et al 2022**). (ROS) (**Wang et al., 2012**) discovered an increase in the amount of enzymes such as superoxide dismutase (SOD), catalase (CAT), peroxidase (POD), polyphenol oxidase (PPO), ascorbate peroxidase (AXP), and glutathione reductase (GRT). According to (**Zamani et al., 2011),** the amount of antioxidant enzymes rises as salinity rises. As oxidative stress produced by salt increases, the number of antioxidants within the plant rises (**Chookhampaeng, 2011)**. Salt stress raises the concentration of reactive oxygen species (ROS) in plant cells, such as hydrogen peroxide (H2O2) and superoxide (O2-), which slows cell growth (**Yongchao etal 2002).** The presence of oxidative stress is a key indicator of salt stress due of an imbalance in ROS and antioxidant levels (e.g., superoxide dismutase (SOD), peroxidase (POX), and catalase (CAT)). Under ideal conditions, plant cells maintain a redox equilibrium, or a balance between ROS and antioxidants (**Garcia-Caparroset al.,2021).**Excess ROS in plants slows food absorption and destroys critical macromolecules such nucleic acids, proteins, and membrane lipids, resulting in impaired membrane integrity. As a result, the rate of ROS formation far outnumbers the rate of scavenging. Plants store a vast number of appropriate solute molecules. Plants, on the other hand, have developed defense mechanisms to counteract the negative effects of salt, including the accumulation of various antioxidant enzymes such as POX, SOD, APX, and CAT, as well as non-enzymatic antioxidants such as tocopherol and carotene, and glutathione (**Weisany et al., 2012).** Plants produce a high level of ROS under diverse stress situations, resulting in oxidative stress, while antioxidant enzymes protect against these oxidative stress conditions (**Mahmud et al.,2019).**

Elements

Higher salt concentrations have significantly harmed plants through osmotic stress, ion toxicity from accumulated Na+ and Cl-, and oxidative stress from an excess of reactive oxygen species (**Lu et al., 2017; Causin et al., 2020; Saberi Riseh et al., 2021**). Plant K+, Ca2+, and Mg2+ contents decrease as a result of salinity-induced intracellular ion imbalance (**Nieves-Cordones et al., 2016; Assaha et al., 2017; Manishankar et al., 2018; Isayenkov and Maathuis, 2019; Arif et al., 2020; Shahzad et al., 2021).** The ratio of (K+, /Na+) and osmotic adjustment determine how effectively (K+, /Na+)hemostasis is maintained in plant cell walls when salinity is present (**Nieves-Cordones et al., 2016; Assaha et al., 2017; Manishankar et al., 2018; Isayenkov and Isayenkov, 2018) Maathuis, 2019; Arif et al., 2020; Shahzad et al., 2021)**. For the plant throughout its whole life cycle in the wild as well as seedlings in seeds and seedlings, salinity poses a very serious threat.

Electrostatic water and salinity

To battle salinity and enhance development, we should remove excess salt from the soil by removing it from the root zone. Previously, they used expensive procedures to cleanse the soil by filtering away salt. They then devised a revolutionary therapy method based on electrical energy The initial application of electrical energy was in the reaction of biological systems. Numerous studies have been conducted to investigate how electrical energy influences plant development. They observed that plant growth responds to the consumption of electric energy by growing. Plants are sensitive to static electric fields (EF), they discovered. It went through alterations that increased the length of the stem, the number of leaves, the number of branches, and the surface area of the leaves. These modifications also increased the plant's protein and chlorophyll content, which increased the pace of photosynthesis and the quantity of plant growth (**Kristina Schmiedchen.etal 2018).**Furthermore, they observed that electrically treated water included less heavy metals such as lead, cadmium, chromium, copper, manganese, and zinc than untreated water, which has significant levels of these elements of filthy fungi and algae, more turbidity, and more chlorine, iron functions as a catalyst for some enzymes. Additionally, treated water contains less salt than that, which gives plants some salinity tolerance (**Yoshinori Matsuda et al.,2018).**

Plants under salinity

According to (**Mohsen Dastorani et al.,2022), t**here was a significant difference in plant resistance to salinity when comparing plants from (*Helianthus annuus L)* irrigated with traditional irrigation and another plant irrigated with water treated with electrostatic or electromagnetic fields, as the treated water had positive effects on stem height, diameter, fresh leaf mass, and yield. In compared to plants of the same species that served as controls

When compared to control plants, the use of treated water as electrostatics increased the content of (NPK) in the growth medium due to a decrease in the proportion of harmful toxic ions in it, resulting in an increase in the mass of dry and fresh plants, faster seed growth, and an increase in the productivity of the crop irrigated with treated water in plant (barley) (**El-Zanaty et al.,2021**). (**Mohsen Dastorani et al.,2022**) discovered that magnetically treated water enhances the plant's resistance to salt and productivity, as seed growth rises. (**Emily Sappington et al,.2018)** discovered a substantial reduction in the rate of leaf area growth and withering. This is evidence of salt stress, since many plants were unable to live under the influence of salinity for more than 28 days, but plants watered with treated water did not. The water was electrostatic, and the plant was able to exhibit some salinity resistance expressions. The application of electrostatic water to the plant (*Calendula officinalis*) improved the percentage of dry and fresh weight, stem diameter, and chlorophyll content **(Janan et al., 2005**). When compared to control plants, water treated with an electric field has been shown in tests to have an effective effect on boosting physiological responses, as well as the capacity to stimulate growth and increase chlorophyll content (**Kristina et al.,2018).** Various salt-affected plants were treated to an electric field, which resulted in the development of a reaction and the capacity to resist salinity, as well as a reduction in the toxicity of cations ($Al3+$, $Mn2+$, $Ca2+$, $Mg2+$, H+, +, Na+, +, and K+,) (**Peng et al., 2011).** Studies on the plant *(Antirrhinum majus*) under the influence of salinity demonstrated the creation of resistance in plants exposed to the electrostatic field versus control plants via an increase in proline and chlorophyll content as well as an increase in antioxidant content enzymes(**sami et al .,2005**). The plant (*SUMMER SQUASH)* exposed to an electric field showed a rise and improvement in vegetative growth features, as well as an increase in yield (**sara et al., 2009).** SUNFLOWER (*HELIANTHUS ANNUUS L*.) research has revealed that farmers may increase crop yield by exposing the seeds to a magnetic field (**Baser Kouchebagh et al., 2014)**.

When electrostatic water was tested on plants (*orchards*), it was observed that there was a variance and a positive impact on plant features, with the length of the stem and the number of leaves rising in these plants compared to the control plants. Electrostatic water affects plants at the cellular and molecular levels, increasing reactive oxygen species, chlorophyll content, and proline levels in response to salt (**Yan-Bo Hu., 2016).** There are several novel ways to treat soil salinity, such as treatment with nanotechnology or water treatment technology with magnetic solutions. (**Alhammad et al., 2023**) conducted study on a salinity-exposed bean plant treated with nanotechnology, and the outcomes were seen by treating the plant as well. (**Touati etal 2023**) carried out a process on the (olive trees), but it was treated by exposing the water to a magnetic field, and the crowns were also observed by treating the plant However, when the results were compared to previous studies on the same plant, it was discovered that the plant treated with the electrostatic field developed faster in terms of the plant recovering faster and becoming able to produce healthy fruits in a shorter time, as well as in comparison to the other three treatments. Water that has been electrostatically cleaned is pure and does not contaminate the environment. It is simple for farmers to utilize, saves money and work, and is a resource that is always accessible because it is based on water, which is a renewable resource.

Conclusion

According to the review, soil salinity is one of the many environmental stressors caused by climate change. Salinity/salt stress is the second most important abiotic factor impacting agricultural production globally, impairing a number of physiological, biochemical, and molecular processes. Salinity, in particular, has an effect on plant production, growth, and development. To defend plants from osmotic stress, salinity responses include ion homeostasis alteration, antioxidant defense system activation, the creation of numerous phytohormones, and increased reactive oxygen species scavenging. Because most crop plants are sensitive to salinity, increasing salt tolerance is critical to preserving global agricultural output. Plants respond to salt by activating stress-related genes, proteins, and enzymes in order to combat the deleterious consequences of salinity as well as metabolite buildup As a result, this paper provides an overview of the impacts of salt stress on agricultural plants. We emphasize modern physical solutions to salt resistance, such as electromagnetic or electrostatic methods for enhancing salinity tolerance in plants. Presoaking seeds in treated water by electrostatic field yielded better results than seeds soaked in water and later irrigation with treated water. Consequently, scientific discoveries and summaries on the expanding issue of the impact of electrical fields on fruit growth, yield, ripening, and shelf life, as well as the prospective application electrostatic field in agricultural productivity and resistance of salinity . More research is needed to develop electric-field-generating devices suitable for use in field and greenhouse crops.

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