IJCRM

International Journal of Contemporary Research In Multidisciplinary

Review Article

Salinity Impact on Plant Growth-A Review

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DOI: https://doi.org/10.5281/zenodo.10562569

Abstract

This comprehensive review explores the growing concern about salinity in arable land and its adverse effects on plant growth. The introduction highlights the challenges in defining saline soils and emphasizes the impact of salinity on agricultural production. The types of salinity, including primary and secondary salinity, are discussed, with a focus on natural and anthropogenic causes. The review delves into the effects of salinity on plant growth, covering aspects such as reduction in osmotic potential, soil structure deterioration, and ion concentration. Various types of salinization, including those induced by deforestation, seawater intrusion, point sources, chemical contamination, and overgrazing, are explored. Salinity's impact on abiotic stress conditions like drought, chilling, freezing, and high temperatures is examined. The review also details the effects of salinity on photosynthesis and the reduction of CO2 supply due to stomatal closure. The complex relationship between salinity and environmental factors, such as soil, water, and climate, is discussed, highlighting the importance of understanding these interactions for accurate salt tolerance assessments. The role of glycophytes and halophytes in responding to salt stress is explored, emphasizing their mechanisms for osmotic and ionic stress tolerance. The relationship between salinity and environmental factors is discussed, emphasizing the need for a fundamental understanding of these interactions for accurate salt tolerance assessments. The review concludes with a discussion on strategies for controlling salinity in agricultural production. Farm management practices, fertilization, and leaching are proposed as methods to mitigate salinity issues. The importance of developing salt-tolerant crop genotypes through plant-breeding strategies is also highlighted, with a cautionary note about the potential risk of neglecting efforts to prevent or reclaim saline areas. Overall, the review provides a comprehensive overview of salinity in arable land, covering its causes, effects on plants, and potential mitigation strategies.

Manuscript Information

- **ISSN No:** 2583-7397
- **Received:** 23-12-2023
- **Accepted:** 21-01-2024
- **Published:** 24-01-2024
- **IJCRM:**3(1);2024:77-84

- **Plagiarism Checked:** Yes
- **Peer Review Process:** Yes

How to Cite this Manuscript

Zakir Hussain Malik, R Somasundaram. Salinity Impact on Plant Growth-A Review. International Journal of Contemporary Research in Multidisciplinary. 2024; 3(1):77-84.

Keyword: Salinity, plant growth, agriculture, soil structure deterioration, ion concentration

Introduction

Salinity of arable land is a growing concern in many irrigated, arid, and semi-arid places around the world where rainfall is insufficient to remove salts from the root zone, and it is a substantial contributor to agricultural production loss (Francois and Maas, 1994) [14]. Ponnamperuma (1984)[39] defines saline soils as those with enough salt in the root zone to hinder crop plant growth. However, because salt injury varies according to species, variety, growth stage, ambient conditions, and salt nature, exactly defining saline soils is challenging. The most frequently acknowledged definition of a saline soil was adopted from FAO (1997) [10] as one that has an electrical conductivity of the saturation extract (ECe) of 4 dS m1 or more, and soils with ECe's exceeding 15 dS m1 are considered strongly saline. The common cations associated with salinity are Na+, Ca2+, and Mg2+, while the common anions are Cl-, SO42-, and HCO3-. However, Na+ and Cl ions are considered the most important, since Na+ in particular causes deterioration of the physical structure of the soil, and both Na+ and Cl are toxic to plants (Hasegawa *et al.,* 2000)[18]. Soils were historically classified as saline, sodic, or salinesodic based on the total concentration of salt and the ratio of Na+ to Ca+ and Mg in the saturated extract of the soil (Dudley *et al.*, 1994) [9]. However, this classification has been abandoned in favor of a management-oriented approach, and soil that contains excessive salt is presently referred to as saline or salt-affected, regardless of the specific nature of the problem. Due to an increase in population, there is competition for fresh water among the municipal, industrial, and agricultural sectors in several regions. The consequence has been a decreased allocation of freshwater to agriculture (Tilman *et al.*, 2002). [50] This phenomenon is expected to continue and intensify in less developed, arid-region countries that already have high population growth rates and suffer from serious environmental problems. According to (Carvajal *et al.*, 1999)[7] the direct effects of salts on plant growth may be divided into three broad categories: (i) a reduction in the osmotic potential of the soil solution that reduces plant available water; (ii) a deterioration in the physical structure of the soil such that water permeability and soil aeration are diminished; and (iii) an increase in the concentration of certain ions that have an inhibitory effect on plant metabolism.

Types of Salinity

Primary Salinity

The majority of saline-sodic soils are the result of hydrological, pedological, and geological processes that occur naturally. Some of the parent materials of these soils include intermediate igneous rocks such as phenolytes, basic igneous rocks such as basalts, undifferentiated volcanic rocks, sandstones, alluvial, and lagoonal deposits (Wanjogu *et al.,* 2001). [52] Climatic conditions and water management may hasten salinization. Evapotranspiration is critical for the pedogenesis of saline and sodic soils in arid and semi-arid lands (ASAL). According to (Wanjogu *et al.,* 2001), [52] the majority of ASAL receive less than 500 mm of rainfall per year, which, combined with an annual potential evapotranspiration of roughly 2000 mm, leads to salinity**.**

Secondary Salinity

Soils that have experienced secondary salt-affected conditions are those that have been salinized due to human activity, primarily because of inappropriate irrigation techniques. If the irrigation system is not managed so that salts are leached from the soil profile, then poor-quality water will eventually accumulate in the soil due to frequent usage for irrigation. According to Zabolcs *et al.,* 1992), [48] salt affects 50% of all irrigated projects. Due to water logging brought on by ineffective irrigation, anthropogenic salinization happens in arid and semi-arid regions (Ponnamperuma *et al.,* 1984). [39] Generally, this is because of clearing vegetation and changes in land use.

- Deforestation is recognized as a major cause of salinization and alkalization of soils because of the effects of salt migration in both the upper and lower layers.
- Seawater intrusion—coastal aquifer systems where seawater replaces groundwater that has been over-exploited.
- Point source—large levels of salt in effluent from intensive agriculture and industrial wastewater.
- Chemical contamination-induced salinization—this type of salinization is more common in modern intensive agricultural systems, notably greenhouses and intensive farming. Salt tends to collect in closed or semi-closed systems (for example, greenhouses) if chemicals are not removed on a regular basis, resulting in salinity or alkalinity. This sort of salinization is more common in agriculturally intensive countries like Japan and the Netherlands (Pessarakli *et al.,* 1991).[36]
- Overgrazing— According to (Szabolcs *et al.*, 1994), this process happens primarily in arid and semi-arid environments, where natural soil cover is inadequate and insufficient to provide the fodder requirements of significant animal husbandry. Overgrazing causes the natural flora to become sparse and increasing salinization, which can sometimes lead to desertification as the poor pasture shrinks.

Salinity effects on plants growth

Drought, chilling, freezing, high temperatures, and salinity are all examples of abiotic stress conditions that plants encounter on a regular basis throughout growth and development. Stress can slow growth and development, diminish output, and even kill plants in extreme circumstances (Krasensky *et al.*, 2012). Salinity has a negative impact on plant growth due to the poor osmotic potential of the soil solution and nutritional imbalance (Munns *et al.,* 2008). [29] Secondary stresses, such as oxidative damage, are frequently induced because of salt stress's fundamental effects, which are caused by its hyperosmotic action. Salinity is the most important abiotic stress that affects crop development and yield. It is one of the world's oldest and most extensively spread environmental concerns. Salinity is defined as an excessive concentration of soluble salts in soil that inhibits plant growth (Zaki *et al.*, 2011) [55]. Increased salinity is a severe problem and a major limiting factor for crop productivity worldwide (Wahid *et al.,* 2007) [51]. The majority of the water on Earth has approximately 30 g of sodium chloride per liter. This can make Earth a very salty planet. Salt stressors have a negative impact on plant shape, function, and homeostasis, as well as a decrease in plant biomass (Parvaiz *et al.,* 2014).[35] High soil salinity can dramatically reduce seed germination and seedling growth due to the combined effects of high osmotic potential and specific ion toxicity. Salt stress has negative impacts on the functioning and metabolism of plants. Salinity is defined as an excessive concentration of soluble salts in soil that inhibits plant growth (Zaki *et al.*, 2011). [55] Increased salinity is a severe problem and a major limiting factor for crop productivity worldwide (Wahid *et al.*, 2007). [51] The majority of the water on Earth has approximately 30 g of sodium chloride per liter. This can make Earth a very salty planet. Salt stressors have a negative impact on plant shape, function, and homeostasis, as well as a decrease in plant biomass (Parvaiz *et al.*, 2014). [35] High soil salinity can dramatically reduce seed germination and seedling growth due to the combined effects of high osmotic potential and specific ion toxicity. Salt stress has negative impacts on the functioning and metabolism of plants. Salinity has diverse outcomes for plants; for example, salt in the soil solution diminishes the accessibility of water to the roots, and the salt reserved in the plant will raise poisonous points in several tissues of plants (Munnus *et al.*, 1995). Salinity has an adverse effect on the seed germination of many crops by creating an osmotic potential outside the seed, inhibiting the absorption of water, or by the toxic effects of Na+ and Cl- (Khajeh-Hosseini *et al.*, 2003).[23] Several investigators have reported plant growth reduction as a result of salinity stress, e.g., in tomato (Romero-Aranda *et al.*, 2001)[44], cotton (Meloni *et al.*, 2001)[28], and sugar beet (Ghoulam *et al.*, 2002).[15] However, there are differences in tolerance to salinity among species and cultivars, as well as among the different plant growth parameters recorded. For instance, Aziz and Khan *et al.*, 2001 found that the optimum growth of Rhizophora mucronata plants was obtained at 50% seawater and declined with further increases in salinity, while in Alhagi pseudoalhagi (a leguminous plant), total plant weight increased at low salinity (50 mM NaCl) but decreased at high salinity (100 and 200 mM NaCl) (Kurban *et al.*, 1999).[25] In the sugar beet leaf area, the fresh and dry mass of leaves and roots were dramatically reduced at 200 mM NaCl, but leaf number was less affected (Ghoulam *et al.*, 2002)[15]. Fisarakis *et al.*, (2001)[13], working with sultana vines, recorded a larger decrease in the accumulation of dry matter in shoots than in roots, particularly at high NaCl concentrations, indicating partitioning of photo assimilates in favor of roots. They proposed that the results might be due to a greater ability for osmotic adjustment under stress by the roots. Effects of salinity on photosynthesis The growth of plants is dependent on photosynthesis, and, therefore, environmental stresses affecting growth also affect photosynthesis (Taiz and Zeiger, 1998). [49] Studies conducted by a number of authors with different plant species showed that photosynthetic capacity was suppressed by salinity (Romero-Aranda *et al.*, 2001).[44] A positive association between photosynthetic rate and yield under saline conditions has been found in different crops, such as *Gossypium Hirsutum* (Pettigrew and Meredith, 1994)[37] and Asparagus officinal (Faville *et al.*, 1999)[11]. Fisarakis *et al.*, (2001) [13] found that inhibition of vegetative growth in plants subjected to salinity was associated with a marked inhibition of photosynthesis. In contrast, there are many studies in which no or A little association between growth and photosynthetic capacity is evident, as in Triticum repens (Rogers and Noble, 1992)[43] and *Triticum aestivum L.* (Hawkins and Lewis, 1993). The effect of salinity on photosynthetic rate depends on salt concentration and plant species. There is evidence that at low salt concentrations, salinity may stimulate photosynthesis. For instance, in B. parviflora, Parida *et al.*, (2004) [34] reported that photosynthetic rate increased at low salinity and decreased at high salinity, whereas stomatal conductance was unchanged at low salinity and decreased at high salinity. Iyengar and Reddy (1996) attributed decreases in photosynthetic rate as a result of salinity to a number of factors:

1) Dehydration of cell membranes, which reduces their permeability to CO2. High salt concentrations in soil and water create a high osmotic potential, which reduces the availability of water to plants. A decrease in water potential causes osmotic stress, which reversibly inactivates photosynthetic electron transport via the shrinkage of intercellular space.
2) Salt toxicity is caused, particularly by Na+ and Cl ions. According to Banuls *et al.*, (1990)[5], Cl inhibits photosynthetic rate through its inhibition of NO3-N uptake by the roots. Fisarakis *et al.*, (2001) [13] found that NO3-N was significantly reduced in salt-stressed sultana vines, and this reduction was correlated with photosynthetic reduction. The reduced NO3-N uptake combined with osmotic stress may explain the inhibitory effect of salinity on photosynthesis.
3) Reduction of CO2 supply because of the closure of stomata. The reduction in stomatal conductance results in restricted availability of CO2 for carboxylation reactions (Brugnoli and Bjorkman, 1992)[6]. Iyengar and Reddy (1996) reported that stomatal closure minimizes loss of water by transpiration, and this affects chloroplast light-harvesting and energy-conversion systems, thus leading to an alteration in chloroplast activity. Higher stomatal conductance in plants is known to increase CO2 diffusion into the leaves and thereby favor higher photosynthetic rates. Higher net assimilation rates could in turn favor higher crop yields, as was found by Radin *et al.*, (1994)[40] in Pima cotton (*Gossypium barbadense* L.). However, the results for photosynthetic rate and stomatal conductance presented by Ashraf (2001)[2] for six Brassica species did not show any significant relationship. There are also reports of nonstomatal inhibition of photosynthesis under salt stress. Iyengar and Reddy (1996) reported that this nonstomatal inhibition is due to increased resistance to CO2 diffusion in the liquid phase from the mesophyll wall to the site of CO2 reduction in the chloroplast and reduced efficiency of RUBPC-ase. Other causes of reduced photosynthetic rates due to salinity have been identified by Reddy (1996) as:
4) Enhanced senescence induced by salinity;
5) Changes in enzyme activity induced by changes in cytoplasmic structure; and
6) Negative feedback from reduced sink activity. Although the rate of photosynthesis is reduced under salt stress, this is not

the cause of the reduction in the rate of cell expansion, as suggested by several lines of evidence.

Effects on Plant Water Uptake and ion Homeostasis

Salt has two significant effects on plants: osmotic stress and ionic toxicity, both of which influence all key plant functions (Yadav *et al.*, 2011)[53]. Plants may absorb water and critical nutrients because they have a higher water pressure than soil under typical conditions. When salt stress occurs, the osmotic pressure of the soil solution exceeds that of the plant cells. As a result, the plant does not receive adequate water (Kader, March 2010)[19]. Furthermore, its cells will have lower turgor, and its stomata will close to conserve water. Stomatal closure can result in reduced carbon fixation and the formation of reactive oxygen species (ROS) such as superoxide and singlet oxygen. ROS disrupts cell processes through damage to lipids, proteins, and nucleic acids (Parida and Das, 2005)[33]. Ionic toxicity occurs when concentrations of salts are imbalanced inside cells and inhibit cellular metabolism and processes. Sodium ions at the root surface disrupt plant nutrition of the similar cation potassium by inhibiting both potassium uptake and enzymatic activities within the cell. Potassium is an important nutrient in a plant, regulating over 50 enzymes (Kader, 2010) [19]. Essential for maintaining cell turgor pressure, creating membrane potential, and regulating enzymatic activities, potassium must be maintained at 100–200 mM in the cytosol. Sodium, on the other hand, causes stress at concentrations higher than 10 mM in the cytosol (Kader, 2010 March) [19]. Na+ is a cation similar to K+ and easily crosses the cell membrane. It also acts as an inhibitor of many enzymes, affecting metabolic processes. Calcium cations, however, protect some plants through signaling pathways that regulate potassium and sodium transporters (Parida and Das, 2005) [33]. When a plant senses salt stress through transmembrane proteins or enzymes in the cytosol, the amount of calcium in the cytosol increases (Kader, 2010 March) [19]. Calcium is a second messenger important to many biochemical pathways and can aid plants in responding to salt stress. The osmotic and ionic stress induced by salinity can halt plant growth as the plant focuses its energy on conserving water and improving ionic balance. In order for plants to return to normal functioning and photosynthesis, the plant must facilitate its own detoxification—damage must be prevented or lessened, homeostasis must be re-established, and growth must resume (Zhu, 2001)[56].

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Gycophytes

Glycophytes make up the vast majority of all plant life, including vital economic and food crops. Glycophytes cannot withstand salt stress, although they can build defenses against it. These plants are particularly sensitive to salt concentrations, with inhibition or death occurring at 100–200 mM. Fruit trees, such as citrus and avocado, are much more susceptible, requiring soil with NaCl levels below a few millimoles per liter (Zhu, 2007)[57]. Salinity has an impact on seed germination and other normal plant processes in growing plants (Malcolm *et al.*, 2003)[27]. Glycophytes cannot be regarded as salt-tolerant; rather, they possess salt resistance mechanisms. Glycophytes cope to some extent by increasing the K+/Na+ ratio through active ion transport, changing ionic and electrochemical gradients to favor cytosolic activities (Yadav *et al.*, 2011)[53]. Salt accumulates in the reproductive organs and leaves, and the plant prioritizes survival above growth or reproduction (Zakharin and Panichkin, 2009)[54]. Arabidopsis thaliana is a model glycophyte that has allowed researchers to better understand salt resistance in glycophytes at the genetic, cellular, and whole plant levels (Zhu, 2001). However, there is not much glycophytes can do in order to adapt to salty conditions; research is being done into transgenetic plants that use genes from halophytes to increase salt tolerance in a glycophyte. In order to combat the negative effects of salt stress on glycophytes, soil salinity must decrease or glycophytes must slowly adapt through natural processes, anthropogenic breeding, or genetic modification (Zhu, 2001) [56].

Halophytes One percent of plants are halophytes and can tolerate levels of salt concentration anywhere from 300 to 1000 mM of salt (Zhu 2007)[57]. The major differences in halophytes are their abilities to compartmentalize sodium and accumulate osmolytes while maintaining constant potassium concentrations. They can accumulate more salt in leaves and roots and force sodium across the tonoplast with highly Na+/K+ selective protein transporters (Radyukina *et al.*, 2007)[41]. Most halophytes respond to salinity through exclusion (Yadav *et al.*, 2011)[53]. In mangroves, 99% of salts are excluded by the roots (Aslam *et al.*, 2011)[3]. Even so, plants must take up salt under salt stress and store it in vacuoles or tissues where its damage is least or secreted. Secretion occurs through the shedding of salty leaves and also through salt glands, specialized cells on the leaves and stem that secrete salt, which is then washed away by rain or wind (Aslam *et al.,* 2011) [3]. Halophytes and glycophytes share some similar genes, and some of the genes glycophytes express under salt stress are always expressed in halophytes (Radyukina *et al.*, 2007)[41]. In halophytes, gene expression includes the LEA protein, enzymes for the biosynthesis of osmolytes, transporters for ions, and regulatory molecules like protein kinases and phosphatases (Aslam *et al.*, 2011) [3]. Of particular importance is the synthesis of osmolytes. Osmolytes are low-molecular-weight compounds that do not interfere with normal biochemical reactions but do help maintain a water potential more negative than the soil so that water uptake can take place (Parida and Das, 2005) [33]. For example, gene expression is responsible for higher levels of the osmolyte proline in Thellungiella halophila, the model halophyte organism (Kant *et al.,* 2006)[20]. Halophytes also have a mechanism for scavenging reactive oxygen species and eliminating them (Parida and Das, 2005) [33]. Transgenic traits from halophytes could be used in glycophyte crops in order to increase salt tolerance, specifically by inserting genes that regulate the production of osmolytes in the cytosol to re-establish ion and electrochemical gradients (Zhu 2001) [56].

Relationship between Salinity and Environmental Factors

Plants' ability to withstand salinity is determined by the combination of salinity and environmental elements such as soil, water, and climate (Shannon *et al.,* 1994) [46]. For example, many crops are less tolerant to salinity when cultivated in hot and dry settings than in cold and humid environments (Maas and Hoffman, 1977)[26]. Under hot and dry circumstances, yield decreases more rapidly with increasing salinity than under cool and humid conditions. This is mostly due to lower ion accumulation and/or improved plant-water interactions under the latter conditions (Salim, 1989)[45]. As a result, a fundamental understanding of these interactions is required for an appropriate estimate of salt tolerance. Controlling salinity in agricultural production Saline areas can be transformed into croplands that are more productive by limiting salt-water infiltration through good farm management practices, treating soil toxicities and nutrient deficits, and draining salts from the root zone. Grow salt-tolerant cultivars to save on reclamation costs. These practices are mentioned below. Farm management practices Salinity levels can be reduced by changing agricultural management methods. Munns *et al.,* (2002)[31] believe that irrigated agriculture might be supported by better irrigation strategies, such as the adoption of partial root zones. Munns *et al.*, (2002)[31] propose that irrigated agriculture could be sustained by better irrigation practices such as the adoption of partial root zone drying methodology and drip or micro-jet irrigation to optimize the use of water. They suggested that salinity could also be contained by reducing the amount of water passing beyond the roots by reintroducing deep-rooted perennial plants that continue to grow and use water during the seasons that do not support annual crop plants. This may restore the balance between rainfall and water use, thus preventing rising water tables and the movement of salt to the soil surface. Deep-rooted perennial lucerne (*Medicago sativa*) has been found to lower the water table sufficiently to allow subsequent cropping (Ridley *et al.*, 2001). Such practices will rely on plants that have a high degree of salt tolerance. Salt tolerance in crops will also allow the more effective use of poor-quality irrigation water. Niknam and McComb (2000)[32] suggested that trees could be planted to take up some of the excess salt since they have high water use and can lower water tables to reduce salt discharge into streams and prevent secondary salinization of the surrounding areas. However, it has not been proven to what extent the tree planting would assist in preventing salt stress in neighboring fields.

Fertilization Leads to Improvements

Salinity causes nutrient imbalances, particularly lower concentrations of macro elements (N, P, K, and Ca) in plant tissues. As a result, the easiest technique for restoring normal nutrient concentrations within the plant is to boost their concentrations in the root zone by applying higher fertilizer dosages. Many studies have found that adding calcium to the growth medium reduces salt stress (Kaya *et al.*, 2002) [21]. Depending on the concentration ratio, sodium and calcium can replace one another in the plasma membrane, and calcium may reduce salt toxicity. Song and Fujiyama (1996)[47] found that tomato plants grown in saline medium with supplemental Ca2+ accumulated 40% less Na+ and 60% more K+ than salinized plants without such a supplement. Increased Na+ in the growth medium generally decreases the K+ content, suggesting an antagonism between Na+ and K+ (Adams and Ho, 1995) [1]. The addition of K+ to the nutrient solution has been found to raise K+ concentrations in the leaves and ameliorate salinity stress effects (Kaya *et al.*, 2001)[22]. The effect of salinity on P in plants depends on the concentration of P in the nutrient solution. At high P concentrations, leaf injury has been interpreted as P toxicity induced by salinity (Awad *et al.*, 1990) [4]. However, at low P concentrations in the root medium, salinity was reported to inhibit P uptake by roots and translocation to the shoot (Martínez *et al.*, 1996)[7]. At low P concentrations in the root medium, supplementary P applied to the saline growth medium enhanced the capacity of the tomato plant to regulate Na+, Cl, and K+ distribution and improved plant growth (Awad *et al.*, 1990; Kaya *et al.*, 2001) [4,21]. Under salt stress conditions, the uptake of N by plants is generally affected, and the application of supplementary N has been found to ameliorate the deleterious effects of salinity (Gómez *et al.*, 1996). The approach of raising fertilizer dosages may work for irrigation with water at low salt concentrations. When water of high salinity is applied, however, the concentration of antagonistic ions required is so high that it causes a marked increase in the osmotic pressure of the soil solution, compounding the stress imposed by the salinity ions (Feigin, 1985)[12]. Furthermore, Grattan and Maas (1988) [16] reported that in some species, a very high concentration of nutrients, e.g., P, could interact negatively with salinity ions, resulting in severe toxic effects.

Leaching

Leaching soils to remove soluble salts is the most effective method known to reclaim saline soils. This requires good permeability of the soil and good-quality irrigation water. Removal of salts by leaching reduces salt hazards for plants but might cause permeability to decrease and pH to increase, resulting in the decomposition of roots as soil is changed from saline to sodic (Dregne, 1976)[8]. Although the best long-term solution to salinization is to provide adequate drainage, this process is expensive. Hence, many irrigation schemes, particularly in developing countries, lack adequate drainage (Toenniessen, 1984) [39]. Uses of salt-stress-tolerant plants some areas have naturally occurring salinity, and salt-tolerant crop plants may provide a better, or perhaps the only, means of utilizing these resources for food production. Salinity can possibly also be managed by biologically manipulating the plants (Shannon, 1994) [46]. Identification of plant genotypes with tolerance to salt and incorporation of desirable traits into economically useful crop plants may reduce the effects of salinity on productivity. Developing crop plants tolerant to salinity has the potential to make an important contribution to food production in many countries. This will permit the use of low-quality water and thereby reduce some of the demand for higher-quality water. Great effort is, therefore, being directed toward the development of salt-tolerant crop genotypes through the use of plant-breeding strategies involving the introgression of the genetic background from salt-tolerant wild species into cultivated plants (Shannon, 1994; Pitman and Laüchli, 2002) [46, 38]. However, it should be borne in mind that there is also the risk that the availability of salt-tolerant genotypes will result in less effort to reclaim saline areas or to prevent salinization. In the longer term, this will be counterproductive.

Conclusion

In conclusion, the review provides a comprehensive understanding of salinity in arable land, emphasizing its detrimental impact on agricultural productivity. Saline soils, defined by electrical conductivity levels, pose a significant challenge to crop growth due to reduced osmotic potential, soil structure deterioration, and ion toxicity, particularly from sodium and chloride ions. The types of salinity, including primary and secondary salinity, are discussed, highlighting natural and anthropogenic factors contributing to soil salinization. The effects of salinity on plant growth are multifaceted, encompassing reductions in osmotic potential, interference with nutrient balance, and the induction of secondary stresses like oxidative damage. The review underscores the importance of salinity as a major abiotic stressor affecting global crop development and yield. Furthermore, the distinctions between glycophytes and halophytes are explored, revealing the inherent sensitivity of most plants to salt stress. Glycophytes exhibit salt resistance mechanisms, while halophytes possess specialized adaptations to tolerate high salt concentrations. Understanding the genetic and physiological mechanisms underlying salt tolerance in these plant types opens avenues for developing crops with enhanced resilience to salinity. The relationship between salinity and environmental factors, such as soil, water, and climate, is crucial in assessing the overall impact on plant health. The review suggests various farm management practices, fertilization strategies, and leaching as potential solutions to mitigate salinity-related issues in agricultural systems. In the broader context, the review advocates for sustainable agricultural practices, emphasizing the need for continued research on salt-tolerant crop genotypes. While the development of such genotypes holds promise for addressing salinity challenges, it is essential to balance these efforts with strategies for soil reclamation and prevention. The review concludes by highlighting the importance of managing salinity to secure global food production and address environmental concerns associated with soil degradation.

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