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EFFECT OF SALINITY STRESS ON PLANT PHYSIOLOGY AND BIOCHEMICAL PARAMETERS: A REVIEW

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ABSTRACT

Plant growth and development are significantly influenced by salinity stress, which also modifies physiological and biochemical processes. This article looks at the various ways that plants respond to salinity stress, including morphological changes, biochemical reactions, and molecular mechanisms. Osmotic stress brought on by salinity interferes with ion homeostasis and water absorption, leading to oxidative stress and cellular damage. Plants adapt to stress by adjusting their osmotic pressure, sequestering ions, and utilizing antioxidant defense systems. Additionally, molecular and genetic methods clarify important pathways related to salinity tolerance, providing information about possible tactics to improve crop resilience. Sustainable agriculture in saline regions depends on an understanding of the intricate interactions between salt stress and plant responses.

Keywords: Stress, Abiotic Stress, Salinity, Physiological Parameters, Biochemical Parameters.

I. INTRODUCTION

Salt stress is one of the foremost imperative abiotic stresses that adversely influence plant development and advancement around the world. Stress is characterized as any abiotic (salinity, Temperature, drought, etc.) or biotic (herbivore) imperative that limits the rate of photosynthesis and diminishes a plant's capacity to change over vitality to biomass (Grime, 1977). World agribusiness is confronting a part of challenges like creating 70 % more nourishment for the developing populace and the efficiency of crops isn't expanding in parallel with the nourishment request. The lower efficiency in most of the cases is credited to different abiotic stresses (Parihar, 2015).

Salinity influences numerous morphological, physiological and biochemical forms, including seed germination, plant development, water and supplement take-up. (Akbarimoghaddam et al., 2011). Salt stress is considered to decrease plant development and execution by a large number of components like modifications in water relations inside the plant (Munns and Tester, 2008; Deinlein et al., 2014) ,also causes toxicities (Kingsbury and Epstein, 1986; Ehret et al., 1990), and oxidative stress (Kravchik and Bernstein, 2013; Shoresh et al., 2011; Reddy et al.,2015). Salinity is additionally considered to decrease the plant accessibility of soil water, the osmotic impact on soil water potential, diminishing plant water take-up (Clark, 1990). Resistance to salinity may in this manner include varieties in reactions to each of these variables (Munns and Tester, 2008). By diminishing the osmotic potential of the soil (i.e., getting to be more negative), plant get to soil water is decreased since of the diminish in add up to soil water potential. As the salinity of the soil increases, so does the soil water substance at which the changeless shrinking point (Slayter, 1957). From a hypothetical point of view, the PWP is decided by the whole of matric and osmotic possibilities. The impact of salinity on soil water accessibility was demonstrated by (Groenevelt et al., 2004), based on the water's characteristic bend of the soil. (Sheldon et al., 2017). Salt- influenced soils are a vital environmental substance within the scene of any bone-dry and semi-arid locale. In India about 9.38 million ha range is involved by salt-affected soils out of which 5.5 million ha are saline soils (counting coastal) and 3.88 million ha antacid soils (IAB, 2000). This could be seen from Jammu & Kashmir (Ladakh locale) in the North to Kanyakumari in South and Andaman & Nicobar Islands within the east to Gujarat within the West. This leads to a genuine danger to human capacity to extend nourishment generation to meet the growing needs. With shortage of great quality water system and rising

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weight of creating more from each hectare of accessible arable arrive, the brackish groundwater has been progressively utilized for water system. Ground water surveys indicate that destitute quality waters being utilized totally different states are 32% to 84% of the entire groundwater improvement (Minhas, 1999).

Numerous ranges with great quality aquifers are imperiled with defilement as a result of groundwater. Unpredictable utilize of destitute quality waters within the nonappearance of legitimate soil water-crop administration hones postures grave dangers to soil wellbeing and environment. Improvement of salinity, sodicity, waterlogging and harmfulness issues in soils not as it were falls apart the quality and amount of produce and limits the choice of cultivable crops, numerous a times the impacts ended up so extreme that lands in the long run go out of development (Dagar, 2005).

Salinity entrance and arrival debasement is broadly detailed due to the over-extraction of groundwater within the Kutch and the coastal Saurashtra areas in Gujarat. Preservation of arrive and water, hence, gets to be the central topic for advancement of arrive and water utilization in these locales. To address this issue, a few measures have already been taken within the Saurashtra locale to decrease salinity entrance like energizing groundwater, building cultivated lakes, utilize of dribbles and sprinklers. In any case, salinity entrance in coastal regions was tended to through a brief located improvement approach for the development of physical framework like check dams, bandhas and giving financial motivating forces without considering the particular common and social contexts (Viswanathan, Pathak and Bandi, 2016).

II. TYPES OF SALINITY

1. Primary salinity-naturally occurring salinity:

Most of the saline-sodic soils are created due to characteristic topographical, hydrological and pedological forms. The soil parent materials of saline and sodic soils include intermediate igneous rocks such as phonolites, basic igneous rocks such as basalts, undifferentiated volcanic rocks, sandstones, alluviam and lagoonal deposits (Wanjogu et al., 2001). Climatic variables and water administration may quicken salinization. In semi-arid and very arid areas (ASAL) evapotranspiration plays a really critical part within the pedogenesis of saline and sodic soils. They have also mentioned that most of the ASAL get less than 500 mm of precipitation every year and this, coupled with a yearly potential evapotranspiration of approximately 2000 mm leads to salinization (Safdar et al., 2019).

2. Secondary Salinity(Anthropogenic) :

Auxiliary salt-affected soils are those that have been salinized by human-caused components, basically as a result of disgraceful strategies of water system. Utilization of water for water system in the long run leads to salt builds up within the soil unless the administration of the water system framework is such that salts are filtered from the soil profile. Szabolcs (1992) assessed that 50% of all watered plants are salt influenced. Human-centered salinization occurs in bone-dry and semi-arid regions due to water logging brought approximately by inappropriate water system (Ponnamperuma, 1984). Deforestation is recognized as a major cause of salinization and alkalization of soils as a result of the impacts of salt relocation in both the upper and lower layers of the soil. Salinization caused by defilement with chemicals, such kind of salinization more regularly happens in cutting edge seriously in rural frameworks, like nurseries and seriously cultivating frameworks. In closed or semi closed frameworks (e.g., nurseries) salts tend to build-up in case chemicals are not expelled routinely, causing salinity or alkalinity. In nations with seriously agribusiness such as Japan and the Netherlands, this sort of salinization occurs (Pessarakli, 1991). Szabolcs (1992) stated that this occurs basically in dry and semi parched regions, where the common soil cover is lacking and barely fulfills the feed prerequisite of broad creature cultivation.

III. CAUSES OF SALINITY

1. Natural cause:

Climatic components and water administration may quicken salinization. In parched and semi-arid lands evapo-transpiration plays an awfully imperative part within the pedogenesis of saline and sodic soils. Another sort of salinity occurs in coastal ranges subjected to tides and the most cause is interruption of saline water into waterways (Cyrus et al., 1997) or aquifers (Howard and Mullings, 1996). Coastal rice crops in Asia, for occurrence, are regularly influenced by introduction to ocean water brought in by tornados around the Indian

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Sea (Sultana et al., 2001). Cyclic salts are sea salts carried inland by wind and stored by precipitation and are primarily sodium chloride. Depending on winning winds and separate from the sea-coast the rainwater composition significantly shifts. The composition of ocean water is communicated as g kg^{-1} or ppt (parts per thousands) and is nearly uniform around the globe. The electrical conductivity of ocean water is 55 dS m^{-1} whereas that of water is around 0.01 dS m^{-1} (Yadav et al., 2009).

2. Anthropogenically induced salinity

Auxiliary salt influenced soils are those that have been salinized by human caused components, basically as a result of disgraceful strategies of water system. Destitute quality water is regularly utilized for water system, so that in the long run salt builds up within the soil unless the administration of the water system framework is such that salts are filtered from the soil profile Szaboles (1992) assessed that 50% of all watered plans are salt influenced. As well few endeavors have been made as of late to get to the degree of human-induced auxiliary salinization and, concurring to Blossoms and this makes it troublesome to assess the significance of salinity to future rural efficiency (Yeo, 1995). Ohara (1997) has stated detailed increasing salinization with expanding water system since 1950's and within the Shansa Territory in China, more than one third of the full region of watered arrive is salinized (Qiao, 1995). Human-centered salinization occurs in parched and semi parched zones due to waterlogging brought approximately by inappropriate water system (Ponnamperuma, 1984).

The Salinity caused by human exercises other than water system and incorporate but are not restricted to the taking after are mentioned below.

(a) Deforestation: It is recognized as a major cause of salinization and alkalinization of soils as a result of the impacts of salt movement in both the upper and lower layers. Deforestation leads to the lessening in normal precipitation and expanded surface temperature (Hastenrath, 1991; Shukla, 1990). Beat lean soil quickly gets dissolved within the nonattendance of soil green cover. Without the trees there to act as a buffer between the soil and the rain, disintegration is for all intents and purposes inescapable. Soil disintegration at that point leads to more noteworthy sums of run-off and expanded sedimentation within the waterways and streams. The combination of these components leads to flooding and expanded salinity of the soil (Domries, 1991; Hastenrath, 1991). The Indian fields formed by the waterways of North India progressively getting salt affected as coastal zones of Ganges especially lower Ganges fields and Sundarban estuarine zones. In Southeast India, for illustration, tremendous ranges of farmer forestland got to be progressively saline and soluble inside many a long time after the felling of the woods (Szaboles, 1994). In Australia, a nation where one-third of the soils are sodic and 5% saline (Fitzpatrick, 1994), there's genuine hazard of salinization on the off chance that arrive with shallow unconfined aquifers containing water with more than 0.25% add up to solvent salt is diminished of trees (Bui et al., 1996). Szaboles (1992) evaluated that 50% of all inundated plans are salt influenced. As well few endeavors have been made as of late to get to the degree of human-induced auxiliary salinization and, agreeing to Blossoms and Yeo (1995) this makes it troublesome to assess the significance of salinity to future rural efficiency. All things considered, Ohara (1997) has detailed increasing salinization with expanding water system since 1950's and within the Shansa Area in China, more than one third of the entire region of inundated arrive is salinized (Qiao, 1995). Human-centered salinization happens in parched and semi dry zones due to waterlogging brought approximately by disgraceful water system (Ponnamperuma, 1984).

(b) Aggregation of air-borne or water-borne salts in soils: Szaboles (1992) has detailed that chemicals from mechanical emanations may deposit within the soil, and in case of high concentration, it could result in salt deposition within the upper layer of soil. Additionally, water with significant salt concentration such as wastewater from districts and slime may damage the upper soil afterward causing salinization and/or alkalization (Bond, 1998).

(c) Contamination with chemicals: It often occurs in modern intensive agricultural systems,particularly in green houses and intensive farming systems.(Yadav et al.,2009)

(d) Overgrazing: This process occurs mainly in arid and semi arid regions,where the natural soil cover is poor and scarcely satisfies the fodder requirement of intensive animal husbandry(Szaboles,1994). The characteristic vegetation becomes sparse and dynamic salinization creates, and in some cases the method closes up in desertification as the field reduces due to overgrazing (Yadav et al., 2009).

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IV. EFFECT OF SALINITY ON PLANT PHYSIOLOGY

Salinity has extreme effects in plants at a physiological level since it limits the capacity of plants to take up water (Armando et al., 2022). Salinity creates ionic and osmotic stress in plants. Osmotic stretch caused by expanding the sum of salt in soil, reduces the sum of water that plant utilize and as a result physiological dryness occurs. After these conditions, ionic push happens within the plant with disintegration of plant particle adjust (Yildiz et al., 2021).

Where as the coordinate impact of osmotic and ionic stresses is salinity, deteriorations in structure and amalgamation of harmful components composes auxiliary impact (Yildiz et al., 2021). Salt stress affects light-harvesting complex arrangement and directly does impact on photosynthesis (Chen and Hoehenwarter, 2015). It is known that the impact on photosynthesis is due to high and low salt concentrations, maybe from stomata, non-stomata, or both confinements. A few variables can be numbered as a reason for diminishing photosynthetic movement. To begin with, the reason is diminishment in cell permeabilization of CO_2 as a result of parchedness of films (Yildiz et al., 2021). Photosynthetic electron transport is influenced contrarily due to osmotic stretch caused by tall salt concentration. With particle harmfulness caused by sodium and Chloride particles, essential nutrients can not be taken , and this situation leads to restriction of photosynthesis and era of responsive oxygen species (ROS). The changes in enzyme activities also cause decrease in photosynthesis. With decrease in photosynthesis arrangement, receptive oxygen species increases and expanding of ROS affects the production of proteins that empower detoxify of these ROS (Yildiz et al., 2021). Where as plants adapt to changing environments, they undergo the activation of biochemical processes that prevent oxidative damages against photosystem, leaf morphology. chloroplast shade composition and numerous other changes. (Yildiz et al., 2021).

V. EFFECT OF SALINITY ON BIOCHEMICAL PARAMETERS

ROS (Reactive Oxygen Species) harms the macromolecules including proteins, carbohydrates, nucleic acids, and lipids (Ibrahim, 2016). Sugars give carbon and vitality for cellular metabolic forms leads to plant development and advancement. However, under stressful conditions, carbohydrate metabolism results in an increase in sugar levels. (Armando et al., 2022). Studies have shown that plants mobilize starch and fructans from storage organs (roots, stems, and amyloplasts in leaves) to increase the accumulation of sugars, such as glucose, fructose and sucrose (Armando et al.,2022). This accumulation of sugars under salt stress (Parida et al.,2002),play a leading role in osmoprotection, osmotic adjustment, carbon storage, and radical scavenging. Sugars are hence the most osmolytes that take part in osmotic adjustments and can contribute up to 50% of the full osmotic potential in a few plant species (Pack, 1976). Salinity affects all sorts of sugars including monosaccharides (glucose and fructose), disaccharides (trehalose and sucrose), and oligosaccharides (Armando et al., 2022). When the plant is subjected to any stress, protein blend is one of the foremost adversely influenced anabolic forms. (Bohnert and Jensen, 1996). Plant tissues ordinarily react to salt stress by debasing proteins or creating copious salt stress related proteins (Wang et al., 2015). Jaleel et al., (2008), with their consider on Catharanthus roseus and Hordeum vulgare (Khosravinejad et al., 2009) with their consider on grain moreover watched that the treatment with sodium chloride decreased protein substance within the plant seedlings. Saline stretches moreover causes evacuation of potassium particles by plant roots, which leads to a physiological imbalance since potassium is fundamental for protein blend. (Ayala-Astorga and Alcaraz-Meléndez, 2010).

VI. CONCLUSION

To sum up, salt stress is a major abiotic element that negatively affects plant growth and development worldwide. It lowers the speeds at which photosynthesis occurs and the amount of biomass that plants can produce from energy. Crop productivity is hampered by the difficulty of rising food demand in agriculture, which is primarily attributable to abiotic stressors like salt. Many morphological, physiological, and biochemical processes in plants are impacted by salinity, such as oxidative stress response, water and nutrient intake, and seed germination. Developing ways to improve crop resilience in saline conditions requires an understanding of the mechanisms behind salt tolerance. Solving salinity-related problems is essential for global food security and sustainable agriculture.

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