Salt toxicity alleviation by phytohormone

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Abstract- The present review gives a vision that salinity stress is a greatly damaging the growth and development of the plant which is ultimately unbalancing the productivity and food demands but the salinity stress can be checked by the application of phytohormone which not only increases the growth and productivity but also accelerate the development process thus phytohormone can be used as a stress alleviator against salinity stress

Keywords – Salt stress, Cyanobacteria, Plant growth promoter

Introduction

As the world's population grows, so does the need for food, creating an inequality between the ag ricultural system and the biosphere. The primary source of this imbalance is environmental stress , which results in unhealthy agricultural practises. These environmental pressures are classified a s biotic or abiotic, with abiotic stress including stress produced by metal, water, light, salt, and so on (Falkowska et al, 2010). Despite the fact that agriculture supports a major portion of the world's population, these strains have an impact on agriculture, either directly or indirectly. Despite the fact that numerous measures have been implemented to improve agricultural productivity, such as the use of pesticides and chemical fertilizers, the micro-flora existing in the soil has been reduced. Along with the increased input of various chemicals such as pesticides, fertilizers, and industrial effluents, there has been an increase in salt content, which impacts the soil micro-flora. Mainly, relating with irrigation practice, normally canal system is mainly implemented , which is largely accountable for salt formation in the soil which is further developing due to water-logging in agricultural field mostly in rice fields (Srivastava AK, 2009). (Srivastava AK, 2009). High salt concentration affects around 7% of the world's land area, 20% of the world's cultivated land, and roughly half of the world's irrigated land (Rhoades and Loveday 1990, Szabolcs 1994). As a result, excessive salinity reduces soil fertility by negatively impacting soil microorganisms such as algae and cyanobacteria, which directly make the soil fertile. Soil micro-flora, notably cyanobacteria, are oxygen-evolving prokaryotic autotrophs that proliferate and replicate magnificently in nature and are crucial residents of rice fields. They are vulnerable to harsh situations, such as excessive salinity. As a result, biomass decreases, which has a negative impact on soil fertility by interfering with nitrogen and carbon fixation. Cyanobacteria survive and thrive in high or changing salinity environments by regulating their cytoplasmic water potential by active extrusion of excess inorganic ions from the cell. Because of the presence of elevated salt in the soil or a surrounding medium, osmotic potential decreases and thus water uptake decreases (Zhu, 2002). Several research have been conducted to investigate the effect of salt stress on microorganisms, algae, and the inhibitory effect of salinity on oxygen evolution, chlorophyll fluorescence, and photochemistry (Lu et al., 1999; Lu and Zhang 2000; Lu and Vonshak 2002). Few investigations on photosynthetic oxygen evolution confirm that salinity stress inhibits plant growth (Allakhverdiev et al., 2000, Kumar et al, 2015). Salinity may have a direct influence on processes involved in electron transport and/or photophosphorylation, resulting in a drop in photosynthesis's quantum efficiency.

Salt stress also disproportionate the generation of reactive oxygen species (ROS) which causes oxidative stress (Affenzeller et al., 2009; Kumar et al, 2015). The oxidative stress is accompanied by increased accumulation of lipids in microalgae (Yilancioglu et al., 2014). Oxidative stress induces generation of reactive oxygen species (ROS) like singlet oxygen ($_1O^2$), superoxide radical (SOR; O_2^-) and hydrogen peroxide (H_2O_2) (Kumar J, 2015). Other radicals such as hydroxide radical (OH^-) may also be generated. Pigments, proteins, lipids and nucleic acids can be malfunctioned by the presence of higher concentration of ROS when it is present beyond the tolerable limit, consequently normal cellular metabolism disturbs. To deal with stress, cyanobacteria activate their antioxidative defense mechanism against increased ROS generation by detoxifying it. These defensive mechanisms include enzymatic antioxidants such as superoxide dismutase (SOD), catalase (CAT), and glutathione-s-transferase (GST), as well as the buildup of non-enzymatic antioxidants such as proline and Cystein, which aid in osmotic correction (Zuppini et al., 2010). Many experiments have been conducted to obtain information on the role of proline as an osmoprotectant. Many Anabaena species have shown an increase in proline levels in response to hyperosmotic stress (El- shimy et al, 2007). It actively scavenges reactive oxygen species and aids in the reduction of stress induced by salinity. (Hong et al., 2000; Reddy et al., 2004; Rodriguez and Redman, 2005.)

There is mounting evidence that several of the growth regulators that work in higher plants may also play comparable roles in algae and cyanobacteria. However, knowledge of plant growth regulator metabolism and action mechanisms in algae is exceedingly limited (Chow et al. 2013). Plants and microorganism thrive in salt contaminated areas by secreting growth stimulating substances such as phytohormones,that serve as a secondary messenger and mediate growth and development at even small concentrations (Hunt et al., 2011). Maintaining aquatic ecosystem microflora or managing aquatic vegetation through the use of natural or synthetic growth regulators is a new step toward understanding the role of plant hormones (auxins, gibberellins, cytokinins, abscisic acid, ethylene, and brassinosteroids) in cyanobacteria. Phytohormones regulate development and growth by facilitating a wide range of morphometric, biological, and developmental processes such as cell division and elongation, stomatal regulation, photosynthesis, transpiration, ion uptake and transport, and the initiation of leaf, flower, and fruit development and senescence. Auxin promotes cell division and chloroplast formation in plants (Jin et al., 2015), whereas cytokinin regulates leaf abscission (Tarakhovskaya et al., 2007).

Conclusion

Phytohormone particularly auxin, cytokinin and gibberellic acid controls and accelerate the growth regulating processes like cell division and cell growth and also up-regulate growth photosynthesis and antioxidant system which ultimately leads to high yield crop which fulfill the food demand of increasing population and also protect plant from abiotic stress condition

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