

Plant Tolerance Mechanism Against Salt Stress: The Nutrient Management Approach

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Introduction

The existence of toxic substances in vegetables, limits their qualitative and quantitative benefits. The levels of these substances in vegetables are influenced by the nature of soil in which they are grown. Natural and anthropogenic activities increased the input of salt into the soil and water which have resulted in the widespread occurrence of salt in ecosystems and may severely limit plant growth and productivity. A number of approaches are being used to combat the negative effect of salt in vegetable crops and plants. Among them, nutrient management is one of the good strategies to mitigate the negative effect of salt stress in vegetable crops and plants.

Vegetables, a good source of vitamins and mineral nutrients are prerequisite for good health. Increased human activities, improper irrigation and agriculture practices led to the rise in the level of salt in crop field. Hence it causes substantial decline in crop productivity. The production of vegetables and crop is very low due to its considerable sensitivity to a variety of abiotic stresses. Soil salinity is one of the most important abiotic stresses which affects physiology and biochemistry of plants and significantly reduces yield of the crops [1,2]. Plants respond to salt stress in two phases, first the rapid osmotic stress that results in lower soil water potential due to higher sodium (Na⁺) concentration in the root vicinity whereas, the second is the ionic stress phase that causes the nutritional imbalance and direct toxicity of Na⁺ ions that are present in the plant leaves [3]. High concentrations of Na⁺ and Cl⁻ in the soil solution depress nutrient-ion activities and disturb the nutrient ratios by producing extreme ratios of Na⁺/Ca²⁺, Na⁺/K⁺, Ca²⁺/Mg²⁺, and Cl⁻/NO³⁻ [4], consequently, both osmotic and ionic injury may result in reduced yield or quality [3,4]. To combat the salt stress plants develop several strategies to overcome negative effect produced by salt. This editorial focused on adverse impact of NaCl salinity on vegetable crops and plants, and how plants recover by using nutrient management tools.

Keywords: Nutrient management; Salt stress; Vegetables

Mitigation Strategies Of Plants Under Salt Stress

A number of approaches are being used to alleviate the negative effect of salt in vegetable crops and plants. Proper plant nutrition is one of the good strategies to alleviate the salt stress in crop plants. Mineral nutrient supply to plants also plays a critical role in improving tolerance potential of plant against various environmental stresses including, drought, salinity, disease and temperature [5]. Ion and osmotic homeostasis is necessary for plants to be salt tolerant and maintain intercellular K⁺/NH⁴⁺ homeostasis [6]. Salt tolerance in plants increases by reducing the sodium uptake of plants and in this reduction, potassium (K) plays a key role [7]. The exogenous application of K⁺ regulates the NH⁴⁺ toxicity and consequently, will help the salt stressed plant in reducing the overload energy of toxic NH⁴⁺ efflux to uphold plant growth under high NH⁴⁺ nutritional and salinity stress environment [8].

Nitrogen (N) is considered as one of the essential macronutrients required by the plants for their growth and development. Moreover, N is the main constituent of all amino acids in protein and a number of nitrogen containing compounds such as amino acids (proline and glycinebetaine), amides, imino acids and polyamines are accumulated in plants subjected to salinity [6]. Saline soil is generally poor in nitrogen [6] and reduction in NO³⁻ uptake could be mostly due to high Cl⁻ content in soil. Exogenous application of N may reduce the effect of salinity and enhanced the growth of vegetable plants. Similarly, externally supplied calcium (Ca²⁺) eased the toxic effects of NaCl, apparently by facilitating a higher K⁺ to Na⁺ selectivity [9] application of Ca²⁺ also maintains membrane integrity and selectivity thus reducing Na⁺ and Cl⁻ toxicity in plant [4]. These essential plants nutrients alleviate salt stress by decreasing permeability of plasma membranes that consequently maintain membrane integrity and function.

Conclusion

In conclusion, salt stress significantly decreased plant growth and productivity of vegetable crops. The exogenous application of nutrient could offer an economical and simple solution for farmers to rid off crop production problems caused by salinity. Nutrient management application of nitrogen, potassium, phosphorus, sulphur and calcium can improve the vegetable production even under salt stress. But it needs further investigations at physiological and molecular levels to gain deeper insight in understanding NaCl and different nutrient interaction in vegetable crops.

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