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# THE INFLUENCE OF SALTS STRESS ON PLANT : A REVIEW

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## Abstract

There are several biological and abiotic effects that negatively affect the plant, and the problem of salinity is one of the most important non-biological obstacles in dry and semi-arid lands that affect all types of plants in all stages of the life cycle that begins with the stage of seed germination and seedling growth and ends with harvesting. Here we study our interpretation of the impact of salinity on different aspects of plants.
***Keywords*** : Salinity, plants, stress.

## Introduction

Salinity in soil and water is one of the major stresses that currently limit plant productiveness (*Biabani et al.*, 2013). It's clear that the main obstacle to rising productivity in crop growing regions of the world (Velmurugan *et al.*, 2020). Salinity is defined as the existence in the soil of excessive soluble salt concentrations that retard the growth of plants. The main cations that cause salinities are ($Na^+$, $K^{+2}$, $Mg^+$, $Ca^+$ ) and anions such as ($Cl^-$, $NO_3^-SO_4^{-2}$, $CO_3^{-2}$ and $HCO_3^-$). There is also the presence of trace ions such as ($B^{+3}$, $Ba^{+2}$, Mo, Sr, Li, Rb, F, and Al) Nevertheless, $Na^+$ and $Cl^-$ ions are the most crucial (Hasegawa *et al.,* 2000). Salinity effects seed germination, minimizes nodule formation, delays plant growth and decreases crop yield (Haileselasie and Teferii, 2012; Mohammed and Nulit, 2019). Plants developing in salty soils have a number of ionic compounds and a spectrum of dissolved salt concentrations (Volkmar *et al.*, 1998; Mohammed and Nulit 2019). Such amounts fluctuate due to shifts in water supply, runoff, evapotranspiration and availability of solvents (Volkmar *et al.*, 1998 Heidari, 2009). Germination and seedling properties are the most suitable parameters used for the evaluation of salt resistance in plants. (Boubaker *et al.,* 1996; Jamil, *et al.*, 2006 Mohammed and Nulit, 2020b) Salinity stress by osmotic effects can influence the germination of seeds (Mohammed and Nulit, 2019a). Seed germination is an important mechanism for plant growth in order to achieve an optimum number of seedlings resulting in a higher yield of seeds (Houle *et al.*, 2001; Tabatabaei *et al.,* 2014). Salinity stress slows down the initiation, decreases the intensity and raises the dispersion of germination activities, resulting in decreased plant growth and, eventually, crop yield (Khajeh-Hosseini *et al.*, 2003; Ashraf *et al.,* 2005). The general reaction of many plants to increased salinity is the accumulation of high levels of ($Na^+$ and $Cl^-$) ions in their vacuoles or the redistribution of these ions to various areas of the plant to cause metabolic processes (Nakamura *et al.*, 2002). Some biochemical techniques have been used to improve salt resistance in plants, including regulation of ion transport from roots to leaves, delivery of ions to cell compartments, development of osmotic controls, improvements in photosynthesis and cell membranes, and activation of antioxidant enzymes and other plant hormones. (Nakamura *et al.,* 2002; Tabatabaei and Naghibalghora, 2014). The prevalent salt that induced salinization is NaCl, and it is unsurprising that plants have formed mechanisms to manage its accumulation.

### The influence of salinity on plant growth

Many of the deleterious effects that can be attributed to particular ion toxicities are sodium and chloride, the most common ions in salty soils or water (Omami, 2005; Mohammed and Nulit, 2020a). The degree of growth by salinity decreases markedly with species and to a lesser extent with cultivars (Ghoulam *et al.,* 2002; Maiti, 2010; Mohammed and Nulit, 2020).

Accumulation of salt in the leaves causes premature aging, which reduces the supply of cultures to growth areas and reduces plant growth (Farooq *et al.*, 2017). In more reactive varieties, salt builds up more rapidly as cells cannot segment salt in gaps to the same high degree as resistant varieties, salt stress influences all main processes such as water relations, mineral absorption, growth and photosynthesis (Dubey, 1997; Alqahtani *et al.*, 2018). Salt has ionic and osmotic effects on plants and most documented plant responses to these effects are related to salinity (Munns, 2006). The original and principal consequence of salinity with its osmotic activity at small to moderate concentrations (Ansari *et al.*, 2016). High ion concentrations may affect the integrity and function of the membrane; this interferes with the internal dissolved equilibrium and the synthesis of nutrients, triggering signs of a dietary deficit close to those that arise without salinity (Khan et *al.,* 2000; Mohammed and Nuilt 2019a).

### The influence of Salinities on seed germination

The process of germination and development of seedlings is very susceptible to salt stress. In fact, the highest percentage of germination happens in non-salty environments and declines depends on the rise of salinity levels (Koyro and Eisa, 2008). Decreased water imbibition of the seed under salty conditions, osmotic and ion toxin, with the accumulation of ($Na^+$ and $Cl^-$) ions very close to the seed, prevents seed germination (Ghafoor *et al.*, 2014). Ascending salt amounts not only avoid seed germination, but also prolong the germination period by slowing germination startup (Shannon and Grieve, 1999). Low salt levels usually reduce the germination rate and higher salt levels decrease the percentage of germination (Munns, 2005). Kumari *et al.* (2019) showed that the stress induced by NaCl had a significant impact on germination as well as on early development on Soybean Genotypes. Pusa-9712 and PS-1572 tended to be more accommodating relative to E-20, JS-20-19, Bragg and PUSA-16. Pusa 9712 and PS 1572 can be used to shift tolerance to salinity stress (180mMNaCl) Ibrahim, (2016); the majority of the genotype was prone to salt stress (180mM NaCl). Another study on *B. rapa rapa* seed under various types and levels of salts and showed the seed germination significantly decreased with increased the levels in all types of salts (Mohammed and Nuilt 2019).

**The influence of Salinities on water relations**

Improvement of the crop in salty conditions needs an knowledge of sodium and chloride ions, salinity disturbs the water connections of the plant due to a reduced supply of water from the soil solution due to a reduced osmotic capacity (Ahanger and Agarwal, 2017). Khan *et al.* (2013) studied on *Cucumis sativa* and showed the water potential gradually decreases with elevated levels of salinity.

**The influence of Salinities on root and shoot lengths**

The length of Root and shoot are the most critical salt stress indicators since roots are contacting directly with the soil and extract water from the soil and then shoots allow the rest of the plant to be supplied, so the shoots and roots lengths provide essential indicators of the response of a plant to stress conditions (Jamil and Rha, 2004; Kazemi *et al.*, 2014). Past experiments on the impact of different salt types (NaCl, CaCl2 and KCl) and levels (0, 1, 3, 5, 7 and 9) dS $m^{-1}$ on seed germination and early seedling growing of four pumpkin varieties find that length of root and shoot duration appear to reduce when the solution EC is higher than 5 $dSm^{-1}$, irrespective of salt types and in all varieties. (Aydinsakir *et al.,* 2013). Similar results on *Cucumis melo* have shown that increased levels of stress of NaCl lead to a decrease in root and shoot length (Sohrabikertabad *et al.*, 2013)

Analysis of medicinal plant naked pumpkin (*Cucurbita pepo*) in two separate studies with salt-affected seeds (NaCl)) and five salinity levels (0, 60, 120, 180 and 240) mMol showed that increasing salt levels from control to 240 mMol reduced in seedling dry weight. The influence of Salinities on seedling fresh and dry weight (Lalelou *et al*., 2013). Mohamed and Nuilt, (2019b) had shown that the dry weights of the *Cucumis sativus* cv. MTI2 seedlings decrease significantly with increasing salt levels in five source of salts Baghbani *et al.* ( 2013) also stated that the overall biomass of the cucumber varieties decreased with increased salinity. The findings have shown that the values for the Characteristics under review on wheat cultivars, such as fresh, And the dry weight, as well as their elongation rate, was significantly influenced by growing amounts of Salinity, however differed depending on cultivars and salinity ratios (Borlu *et al*., 2018).

**The influence of Salinities on leaf photosynthesis**

Decreasing of growing plants due to salinity resulted in a decline in the leaf area of the plant. The decrease in growth results from many physical effects including changes in the balance of ions, water status, mineral nutrition, stomatal activity and efficiency of photosynthetic (Stedute *et al.,* 2000). Photosynthesis, one of the most essential physiological mechanisms, accounts for 90% of the dry matter in plants (Koyro and Eisa, 2008). Depending on the level of salinity, treatment period, species and plant age, the photosynthetic potential of plants grown under saline conditions is depressed (Koyro and Eisa, 2008; Sarwar and Shahbaz 2020).

Past research tests the salt-tolerant properties of *Vicia faba* L. on foliar cultivars. Four salt stress levels were added to the three cultivars picked. Important variations between the cultivars, salt-stress therapies, and their relationship were observed in the data, suggesting the heterogeneity and differential reaction of the cultivars to salt stress. Salt treatments decline the content of chlorophyll a and chlorophyll b, leaf number, functional leaf characteristics such as photochemical quality, net photosynthetic rate also decreased with salt stress (Hussein, 2017).

**Salinities Induced anatomical and morphological changes**

Both shooting and root development are affected by environmental conditions. They affect both the activation of buds and the growth rate in the first instance. (Gabriel céccoli *et al.,* 2011). High salt content, particularly chloride and sodium sulfate, affects the growth of plants by changing their morphological (Mohammed and Nulit, 2019a), anatomical (Mohammed and Nulit, 2020) and physiological characteristics (Hacke and Sperry, 2001). It is understood that biomass of the root system decreases under stressful conditions, but extensive investigations of morphological and anatomical mutates of roots that challenge various saline environments are rare. (Bell, 1986). Salinity reduces length and diameter of the root, and anatomically it affects processes of cell division and expansion. Decrease the size of apical meristems, vascular cylinder and cortex. In addition, it stimulates exodermis and endodermis suberization or the development of atypical structures including rhizodermis with phi-thickening (Hilal, 1998). Céccoli, *et al*., 2011

The most typical anatomical reaction to salinity is due to modifications of the cell wall At a molecular level, It is understood that certain genes are expressed when exposed to salt and that a range of proteins involved in salt tolerance have been reported. (InfoStat, 2006). Solmaz *et al.* (2011), studies of the stomatal and leaf characteristics of dihaploid melon under salinity showed that the amount of stomata in the unit region increased; stomata size decreased, however. When compared to control, the leaf area, width and length were also reduced. As salt levels increased, the degree of histological changes in the leaves of the cucumber increased (Mohammed and Nulit, 2020a).

**The influence of Salinities on stomata and density of trichomes on plant**

Trichomes are considered to be found on the surfaces of stems, leaves, sepals and fruit, as well as on the edges of sepals and leaves (Springob *et al*., 2009 . Previous studies have already shown that glandular and unglandular trichomes work in plants to minimize heat load, improve water absorption, improve seed disperse, improve resistance to freezing, shield plant structures from the harmful effects of UV-B, act as taxonomic criteria, serve as an insect repellent and provide a means of defense against pathogens and herbivores (Serna and Martin, 2006; Hoeflich, 2019). General Observations on (Trichosanthes cucumerinaL.) The leaf surfaces (baxial and adaxial) were seen to be smooth, without any visible wax crystals. It was also noted that the trichomes were soft and easily susceptible to harm from the SEM beam and the vacuum created in the chamber of the microscope. With treatments for morphotype, leaf structure, and salinity, stomatal densities differ. The abaxial surface had slightly more stomata in general than the adaxial surface (Odunayo Clement adebooye *et al*., 2011; Adebooye *et al*., 2012).

**The influence of Salinities on grafted and un grafted**

The grafting of vegetables on compatible rootstocks provides a range of advantages and so several studies on the topic have been conducted in past years (Rouphael *et al*., 2010) Grafts were used to induce resistance low temperatures (Bulder *et al*., 1990) and high temperatures (Rivero *et al*., 2003)and iron chlorosis in calcareous soils (Romera *et al*., 2001) and to enhance nutrient uptake and mineral nutrition Increased endogenous hormone synthesis (Proebsting *et al*., 1992), increased salt and flood tolerance (Yetisir *et al*., 2006), reduced absorption of residual organic contaminants from farm soil (Otani and Seike, 2006), and reduced adverse effects of boron and copper toxicity (Rouphael *et al*., 2007; Bőhm *et al*., 2013). In some countries, Usage of grafted seedlings has also increased dramatically in vegetable cultivation specially in watermelon According to Viktória Bőhm *et al*. (2013) observation, increased salty levels in irrigation water resulted reduction the fresh weight of the leaves of both grafted and un-grafted watermelon, however the decrease in Zucchini grafted leaves was not harmful to concentration 100 mmol of salinity. The total fresh weight of the plant leaf was statistically comparable for plant that were not grafted, Lagenaria grafted, and self-grafted including both control and 100 mmol.

Salama and Mona, (2016) performed morphological and anatomical analyses of the cucumber grafting on three separate wild stocks. To research the composition of the cucumber, they used three separate salt levels (1.7, 2.9 and 4.2) dS/m. The findings showed that the cucumbers grafted onto the rootstock cucurbita had greater values than their control (non-grafted).

**Salinities and yield crop**

Ultimately, the above-mentioned impact of salinity stress on plants contribute to a lessening in crop yield, which is the most important impact of salt stress on agriculture. Last investigations on *F. vulgare*, f and shown that increasing the salinity of irrigation water have negative effect of the all parameters of plant growth and yield including plant height, fresh weight yield (Semiz *et al*., 2012). Dehshiri and Modares, (2017) studied on Three Rapeseed Cultivars and founded that the salinity impact on grain yield was significant and yield reduced from 2.8 t $ha^{-1}$ at 0 dS $m^{-1}$ to 1130 t $ha^{-1}$ at salinity of 15 dS $m^{-1}$. Salinity has more impacted the number of pods per plant than other yield elements. Grain content of oil and protein has been reduced and increased by salinity, respectively, increasing the salinity concentration improved the protein content. Ramkumar and Velmurugan, (2019) have been analyzed the influence of salinity on the yield characteristics of two varieties of African marigold (Coimbatore Local and Nilakkottai Local) and have been shown that All parameters of two varieties significantly decrease with higher levels of salinity such as flowers number , single flower weight, diameter of flower, and flower bio mass.

## Conclusion

Salinity is one of the main environmental factors that has a critical role in germination and anatomical malformation in plants. The most important salt is NaCl, which can cause abnormality effects on plant development. This salt in multiple kinds of concentration as a multiple effects on crops developing such as germination process and anatomical factors. There are various mechanisms in response to salinity effects. Various studies have been shown that molecular process are involved in this phenomenon. Multiple kinds of genes may have a critical role in salinity tolerance. Gene modification will increase the salinity resistance in various plant species, depending on the various styles of study.

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