- Osmotic effect hinders water uptake into the plants
- Specific ion effect causes nutritional imbalance in the plants
- Destruction of soil structure and reduction in permeability

2.4.1 Osmotic Deregulation

Water uptake by the plant from the root hairs is due to concentration gradient that exists among cell sap of root cells and soil solution. High salt concentration in the soil reduces water potential difference between plant cell and soil solution (BPMC 1996). High salt content in soil solution makes soil water potential more negative, this means that water is held more strongly in soils and reduces the movement of water into the cell. If salt concentration continues to increase making water potential more negative a level come when water may move out of cell to soil solution (Silvertooth and Norton 2000).

Due to this high negative potential, plants are unable to use soil water in spite of sufficient water availability in soil. Thus in this condition plant requires more energy to take water and it effects plant proper growth and development. Under drought condition especially in clayey soil, osmotic deregulation is more prominent as plant require more energy to take the water from the soil at given moisture level (Conway 2001; Gonzalez et al. 2004).

Reduction in plant growth, cell dehydration and possibly plant death are the consequences of high salinization in normal plant (less tolerant plants) but halophytes (salt tolerant plants) adopt certain physiological changes to survive under stress conditions (Scianna 2002). Salt stress symptoms appear in plants are similar to drought stress symptoms like stunted plant growth, change in color of leaves, curling of leaves and overall plant growth is suffered (Denise 2003). These indications may occur within a few days of plantation or after numerous weeks in young seedlings while in older or mature plants salt stress causes browning of leaves from tips and overall wilting of plants (BGS 2001).

Salt stress increases the production of reactive oxygen species (ROS) such as such as superoxide ($O_2^{\bullet-}$), hydrogen peroxide ($H_2O\ _2$), hydroxyl radical (OH•) and singlet oxygen ($1O\ ^2$) because in salt stress carbon fixation is limited in plants due to little carbon dioxide availability (Ahmad and Sharma 2008; Ahmad et al. 2011;

Ahmad et al. 2010; Parida and Das 2005; Hakeem et al. 2013). Oxidation of proteins, nucleic acid and lipids is done by these highly reactive species (ROS) and thus damages plants cells (Ahmad et al. 2010; Apel and Hirt 2004; Pastori and Foyer 2002).

Under saline conditions, production of ROS species in many plants is augmented (Hasegawa et al. 2000). Due to these ROS species, membrane damage was observed which leads to cellular injury and toxicity cause by salinization in various crop plants for example pea tomato, mustard, soybean and rice (Ahmad et al. 2009; Dionisio-Sese and Tobita 1998; Gueta-Dahan et al. 1997; Mittova et al. 2004; Hakeem et al. 2012).

2.4.2 Nutrition Imbalance

There are specific ions which have direct toxic effect on plants (Scianna 2002). Among these ions are boron, sodium and chloride which have negative effect on crop emergence, plant growth and crop development. Even the small quantities of these ions retard the plant growth (Gonzalez et al. 2004).

Furthermore, if sodium ions are present in high concentration it hinders the uptake of other nutrient ions which are required by the plants for proper growth by altering soil physical and chemical properties (Scianna 2002). This can cause disturbance in nutrient balance in the plants and upset plant mineral nutrition by impeding nutrient uptake (Conway 2001).

For instance calcium and potassium deficiency is because of high sodium concentration and nitrate deficiency usually occurs when sulfate and chlorides are in high concentration (BPMC 1996). At higher pH i.e. above seven, nutrient availability is less. Sodic soils having high pH are usually deficit in nutrient concentration (Denise 2003). The symptoms associated with nutrient deficiencies and toxicities of plants can be described by tip burning, necrosis, chlorosis, dieback and abscission (BPMC 1996).

Nutrient imbalances decrease the transport and availability of nutrients and effects plant growth. Nutrient deficiencies are usually due to the competitive effect among different ions like potassium, calcium and nitrate with sodium and chloride. Reduction in plant development and growth under saline conditions is due to ionic imbalance and specific ion toxicity i.e. Na^+ and Cl^-(Grattan and Grieve 1998).

It is reported that induction of Na and Cl concentrations while decrease in the concentration of other ions Ca, P, N, K and Mg due to rise in NaCl concentration (El-Wahab 2006).

As salinity directly affects the nutrient availability, uptake and its distribution or transport in plant, consequently nutrition imbalance arises. It is repeatedly reported the effect of salinity in lowering nutrient accumulation and uptake in plants (Hu and Schmidhalter 2005; Rogers et al. 2003).

2.4.3 Structure and Permeability Problem of Salts in the Soil

Soil salinity sometimes have negative effect on soil physical properties like soil structure and soil permeability and thus reducing plant growth (Scianna 2002).

Due to certain physical methods like clay swelling or dispersion, slaking and some specific conditions like hard setting and surface crusting, soil structure is disturbed in saline-sodic and sodic soils. These disturbances in soil may limits water and air movement, restricts root penetration, lowers the water holding capacity of plants, delays seed emergence and enhances the problem of erosion and run-off (Qadir et al. 2003). Sodic layer restricts roots emergence if it occurs near sodic soil surface. That's why if sodic clay layer develops on topsoil, most of roots movements are limited along with controlled movement of air and water (Fitzpatrick et al. 2003).

Seed germination is also affected by salinity problem along with but it is reported that salinity problem does not influence seed viability (Conway 2001).

The most important category of degraded soils is salt-affected soils which had severe effects of salinity and/ or sodicity on agriculture production and increasing on a global scale with every day. Approximately, one billion hectares of land is affected with various concentration and nature of salts worldwide (Wicke et al. 2011). The contribution of anthropogenic salinization and sodication is approximately 76 million hectares (Oldeman et al. 1991). These activities are degrading the lands continuously on an estimated rate of between 0.25 and 0.5 Mha annually (FAO 2000). The continuous expansion of salt-affected area is particularly important in South Asia where there is fresh water scarcity at one hand and on the other hand arid to semi-arid climate coupled with low rainfall. The large extent of degraded soils is responsible for the low production of agriculture crops both quantitatively as well as qualitatively. This agriculture product is insufficient to feed the massively increasing population of the world. The core reason of low productivity form these soils is hampering water absorption by plant roots (osmotic deregulation), cell injury (the specific ion toxicity) along with deterioration in the physical properties of these soil (Abrol et al. 1988; Ghassemi et al. 1995; Lamond and Whitney 1992).

Saline soils are important land resources in world agriculture because salt-affected soils are usually abundant in natural resources like light and heat posing great potential to develop agriculture. Reclamation of salt-affected soils is of key importance to mitigate the pressure on every day squeezing agricultural soils. It will help in increasing the cultivated area and reducing the threats to our food security. Several methods have been experimented for the reclamation of salt-affected soils