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Alterations in metabolites during germination and seedling growth of groundnut (*Arachis hypogaea* L.) genotypes in response to chloride based salt stress

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SUMMARY

Groundnut genotypes were germinated *in vitro* under chloride dominant salt stress (0, 20, 40, 80 m eq/l) in seed germinator at 28 ± 2^0 C. Chloride based salinity decreased the seedling vigour index of all groundnut genotypes, and the decreases were found more in GG-7, GG-20, GG-2 genotypes (susceptible group) at 4 and 8 days after sowing (DAS). With increasing salinity regimes, various metabolites like free amino acid and free proline contents were deposited at higher rate in seedlings of JL-24, GAUG-10, GG-13 genotypes (tolerant group) compared to susceptible ones for better osmotic adjustment. However, chloride based salinity decreased the accumulation of total sugars and free fatty acid contents in the seedlings of all groundnut genotypes at 4 and 8 DAS. The decrease in sugar content was found more in susceptible genotypes than tolerant once. SDS-PAGE of soluble proteins at 8 DAS indicated five protein bands in control (0 m eq/l) of all groundnut genotypes, and, it increased to ten bands in tolerant genotypes with higher salinity regimes (40, 80 m eq/l). Activities of alpha-amylase decreased but that of protease and peroxidase increased under salt stress at both the stages in all groundnut genotypes. This increase or decrease of enzymes activities due to salt stress reflected the level of its respective metabolites in the seedlings of groundnut genotypes.

Key words : Groundnut, Chloride based salinity, Vigour index, Metabolites, Alpha-amylase, Protease, Peroxidase, Salt tolerance

Salt stress is a worldwide problem. In arid and semi-arid regions, soil salinity is a common occurrence. The use of poor irrigation water and salt water encroachment is also increasingly threatening agriculture in humid regions (Syvertsen *et al.,* 1989) From an agricultural point of view, salinity is the accumulation of dissolved salts in the soil water to an extent that inhibits plant growth (Gorham, 1992). Salinity is a major constraint to food production because it limits crop yield and restricts use of land previously uncultivated. Estimates vary, but approximately 7% of the world's total land area is affected by salinity (Flowers *et al.,* 1997). Furthermore, there is also a dangerous trend of a 10 % per year increase in the saline area throughout the world (Pannamieruma, 1984).

Salinity is known to induce imbalance of metabolism in crop plants (Levitt, 1980). Constraints on growth of glycophytic plants in saline environments are categorized into three major factors – water deficit; effect on energy balance; ion toxicity and nutrition imbalance (Gorham *et al.,* 1985; Pasternak, 1987; Ashraf, 1994). Alterations of various cellular processes such as activity of enzymes, photosynthesis and degradation of macromolecules by NaCl are well documented (Levitt, 1980; Saha and Gupta, 1993). Furthermore, general effects of salinity on carbohydrate metabolism, water relations, proteins, enzymatic systems and other physiological aspects have been proved to be controversial and inclusive especially in different types of salinity.

Groundnut (*Arachis hypogaea* L.) is an important oilseed, food and feed crop of India. Salinity is one of the important abiotic stresses which affect all stages of groundnut growth and finally the yield. Understanding the biochemistry of salinity response in groundnut plants may help in identifying genotypes that are better adapted to saline conditions. Hence, the present investigation was undertaken to study the effect of chloride based salinity, created by mixing different salts, on various metabolites, enzymes and proline content during early seedling growth in six genotypes (JL-24, GG-2, GG-7, GAUG-10, GG-13 and GG-20) of groundnut to assess the relative tolerance of these genotypes.

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MATERIALS AND METHODS

Seeds of six genotypes (V_1 - JL-24, V_2 – GG-2, V_3 – GG-7, V_4 – GAUG-10, V_5 – GG-13 and V_6 – GG-20) of groundnut (*Arachis hypogaea* L.) were surface sterilized by soaking in 0.1 % sodium hypochlorite for 2