Introduction

Soil salinity is a world-wide threatening problem for the modern agriculture. It is estimated that more than 25% of the land all over the world is considered to be saline to be produce adequate yields of crops. The problem is more serious, particularly in the arid and semiarid regions of the world. In India, this problem is more severe as more than 30% of the land is arid or semiarid where the rainfall is scanty, seasonal and irregular. About 12 million hectares of land in our country is affected by salinity as well as alkalinity (Sharma and Gupta, 1986).

Soil salinity is developed as a result of accumulation of excess amount of inorganic salts, particularly in the upper soil layer. This accumulation usually results from evapotranspiration causing a rise in ground water which contain salts. The salt affected soils, called as halomorphic soils, may be distinguished in two major types, the saline soils and the alkali soils. Saline soils contain an excess of neutral salts such as chlorides and sulphates of sodium and magnesium. Sometimes nitrate is also accumulated.

Plants exposed to saline environment may experience three types of stress. i) The high osmotic pressure of the environment could lead to an "induced water stress", ii) Specific ion toxicities could arise from the high concentration of ions such as sodium and chlorine, sulphate, magnesium etc. and iii) Ionic imbalance could be caused by the high levels of the above ions e.g. potassium uptake or distribution could be disturbed by excess of sodium or high chloride level could influence nitrate or phosphate uptake or utilization.

Salinity puts several problems for a plant growing in that medium. It profoundly influences growth, yield and even the very existence of a plant. Plants growing under such conditions are typically stunted with small and dull bluish green leaves. The anatomical, morphological and metabolic changes are also brought about. These changes may be considered either adaptive features or the signs of damage caused by salinity. Glycophytes which are sensitive to salinity show drastic changes, while halophytes show a better growth, under saline conditions. The major nutritional effects of salinity are particularly associated with cation nutrition and the regulation of ion concentration is relevent to salt tolerance of a plant. As a consequence the ionic imbalance in the salt stressed plants shifts in the ionic interaction with the enzymes and intermediates of metabolism at several levels. Salinity is also known to affect metabolic processes such as photosynthetic CO_2 assimilation, protein synthesis, respiration and phytohormone turnover.

Plants greatly differ in their tolerance to salinity. Recently Greenway and Munns (1980) have categorised plants for their salt tolerance into salt tolerant, moderately salt tolerant and sensitive species. Even salt tolerance of a plant varies depending upon the stage of development of a plant. Several mechanisms have been putforth for salinity tolerance in plants. Osmotic adjustment by accumulation of excess of ions, selective absorption of balancing cations like potassium and phosphorus and accumulation or synthesis of osmotica such as soluble sugars, proline, glycinebetaine and such other compounds. Inspite of several studies, the exact nature of mechanism of salt tolerance in plants, however, is yet not clear.

According to Epstein et al.(1980), besides an engineering approach, development of crops tolerant to salinity is a better strategy for meeting the challenge of salinity problem. They have suggested that there is a very great need to breed economic crops which are salt tolerant. They are of the opinion that by finding or generating strains of crops capable of overcoming the salinity problem, salinity which is a problem now could become a vast opportunity for crop production by tapping the immense wealth of water and mineral nutrients of industrial desalination. In view of the enormous expansion of saline soil and the necessary increase in crop production to meet the world's expanding population, such a breeding programme may well be proved to be of extreme importance.

The present critical situation in world food supplies demands that all our agricultural resources are to be utilized to the full. Pulses and other legumes form an essential part of the Indian diet, and are grown commonly as pure crop, in rotation or mixed with cereals. Pulses are rich in proteins, minerals and vitamin B. This source, however, has not been exploited very effectively by man. If there is to be any significant expansion of pulse crop production in the tropics, where it is most needed, new and informed approaches must be developed to solve outstanding problems.

The study of physiology of individual pulse crop has an important role to play in guiding the efforts of agronomists, plant breeders, plant physiologists and others who are actively engaged in the business improving efficiency of production. It is important to know, e.g. the extent to which the physiology of a crop can be moulded to fit a particular set of environmental conditions or production practices and conversally the extent to which the techniques need to be modified to accomodate unalterably physiological processes. This has been very well observed in soybean and peanut and to some extent in other grain legumes, such as dry bean, chickpea, pegionpea and cowpea. Soybean is the worlds premier crop growing well in temperate climates only. Although extensive research programmes have been launched to adopt the soybean to tropical conditions, results have so far not achieved viable economic returns. It is no wonder then one has to be after such other sources.

In fact there are numerous minor grain legumes which are cultivated on smaller scales and have received, however, a scant attention from the scientific community. Among these are moth bean (P.aconitifolius), horsegram (D.biflorus), lentil (L.esculenta), mung (P.aureus), winged bean (Psophocarpus tetragonolobus) and dhainca (Sesbania spp.).

Growth and development of a plant takes place through several phases such as germination, seedling emergence, leaf growth, flower initiation, flowering, anthesis, pollination, fertilization and seed maturity. Each and every of these events in the life cycle of a plant is important. Germination is the first and the most important phase in the life cycle of a crop plant. The process is sensitive to number of environmental factors such as light, temperature, moisture and soil. This is the phase which is first exposed to soil salinity. Therefore, germination is a vital process to be studied for a crop plant under saline conditions.

Keeping this view in mind and in continuation of the studies in our laboratory, the present work was undertaken. In the present investigation an attempt has been made to study the effect of NaCl salinity on germination and seedling growth in some minor but promising legume crops. The healthy and selected seeds of D.biflorus, Roxb; L.esculenta, Moench; P.aconitifolius, Jacq; P.aureus, Roxb, and T.foenum-graecum Linn. were germinated in the Pettriplates under sterilized conditions and treated with different salt (NaCl) concentrations. The growth parameters studies are germination percentage, hypocotyle length, epicotyle length and root length, biomass (fresh and dry wt) production and water uptake which were assessed for every 24 h till 120 h of growth. The activity of enzymes, peroxidase, catalase and acid phosphatase from the germinating seeds and the seedlings is also determined at various stages of development under normal and salinised conditions. For the analytical purposes the most recent methodology and techniques were employed. For enzyme studies high speed refrigerated centrifuge and UV-VIS spectrophotometry were extensively used.

For convenience and presentation, the Thesis has been divided into different parts. To have an idea of principles and perspectives of the salinity problem as well as the germination process, a brief review of literature on physiology of plants under saline conditions has been given in Chapter I of the thesis, Chapter II describes the culture technique, the methodology of analysis and the methods followed for isolation and assay of enzymes. The important findings of the investigation have been analysed statistically and are discussed critically in the light of up-to-date literature in the form of research papers, articles, reviews, monographs and books. All this has been presented in Chapter III, "Results and Discussion". The topic, the methodology followed, the significant observations and the conclusions drawn have all been summerised in last chapter of the thesis, Chapter IV, "Summary and Conclusion". The literature cited in the form of research papers, research articles, reviews, monographs and books has been arranged neatly and alphabetically in the last part of the thesis "Bibliography".