INTRODUCTION

Potassium is a major component of the earth's crust and is present in substantial quantities in most soils. The range of total K in soils is enormous and depends on the mineral composition of the parent materials, degree of leaching, type and intensity of weathering as well as the mechanical composition of the soils among other factors. Its availability to plants, however, differs and is related in many ways to the physical chemistry and structure of soil minerals. It undergoes various transformations in the soils at different rates. A proper appreciation of different fractions of soil K is thus possible only from an understanding of its dynamics. A good understanding of the various factors affecting K availability should help to improve predictions from soil tests of crop responses to fertiliser K.

That K plays an important role in the life processes of plants is clear from its occurrence in high concentrations at sites where active growth takes place. Among the important functions it performs in plants, mention may well be made of promotion of growth and yield, aiding in the translocation of plant substances, strengthening of plant tissues and prevention of lodging, resistance build-up to pests, promotion of root growth in conjunction with adequate supply of phosphates, regulation of water utilisation by plants and the improvement of colour, flavour, sugar content, strength, keeping quality and weight of various agricultural products. Potassium
stress is known to affect diverse metabolic processes in plants. In several species of plants, K deficiency leads to a reduced level of photosynthesis. Such fall in photosynthesis resulting from K deficiency may be counteracted in green algae by applying K. The deficiency of K results in a decrease in the contents of total as well as of reducing sugars. Its deficiency is known to bring about various effects on nitrogen functions in different species of plants.

The major K bearing minerals in soil are feldspars and micas, the latter appear to be more important as regards the supply of K to plants. When depleted, they can gain K through fixation of a portion of added K. Thus these are capable of serving as both source and sink for soil K. The amount and type of clay appear to be the dominant factors determining the release and fixation of K. The soluble, exchangeable and non-exchangeable forms of K are in equilibrium. Hence removal of water soluble K by leaching or crop uptake causes shift in the position of equilibrium bringing the exchangeable K into solution to replace that removed. Furthermore, as exchangeable K gets exhausted, non-exchangeable K is released even though the release may be an insufficient supplement to crop needs due to limitations in both quantity and rate. Still more intensive removal of K by prior cropping or other means of extraction removes the native non-exchangeable K, opening additional wedges in the clay lattice which leads to potential fixation of the subsequently added K. Conversely, additions of soluble K cause first adsorption on the cation exchange complex followed by fixation of a portion in the
non-exchangeable form. The phenomenon of fixation and release of K in soils is also of great practical importance as it plays an important role in the K nutrition of the plants and the economy of K fertilisers. It is generally considered that K fixation in soil to a moderate degree may not be harmful since it becomes a means of holding the applied K against leaching losses and luxury consumption by plants. But if the K fixation capacities of soils are high, then heavy doses of K fertiliser would have to be applied for the optimum crop production resulting in a rise of production cost coupled with the wastage of K fertiliser.

Literally hundreds of papers have been published on various aspects of K dynamics in soils covering different parts of the world. Various reviews of these works have also appeared (Potash Review, International Potash Institute, Bern, Switzerland). An up-to-date review of these studies has been made in the next chapter of the present thesis. In India, we have got a variety of soil types viz. alluvial, black, red, laterites and lateritic, saline and alkali, desert, brown hill, mountain and foothill, organic peaty and acid sulphate soils with K status ranging from very low to high. Here also, there have been reports of a good number of works to assess the distribution, fixation, release and availability of soil K to crops. The details of these findings have been reviewed in the chapter of review of literature. A cursory glance through such works reveals that in most cases the various aspects of K dynamics in soils of the different parts of the country have been investigated in a somewhat isolated manner. In the present investigation, attempts have, therefore, been made
to study soil K in an integrated manner with respect to distribution, fixation, release and availability. The area of study chosen has been north Bengal (northern region of West Bengal), where rather scanty information is available regarding the distribution of various K fractions in the soils. This region of West Bengal covers a very wide tract of fertile land through which plenty of mountainous rivers flow. These rivers and the frequent flooding by them have brought about some peculiarities in the soils of this region. Different cultivation practices adopted to raise crops from cereals and fruits to cash crops are also quite intriguing. Depending on the heterogeneity of rocks, the alluvium deposited on north Bengal soils also vary in nature, and possess non-specific characteristics. It has also been reported that these soils respond to K fertiliser particularly for the cultivation of high yielding varieties. This area has immense potential for the development of medicinal and horticultural plants in addition to that for intensive animal husbandry. It is, however, necessary for this purpose to pay a greater degree of attention to the maintenance and improvement of soil fertility. Keeping these objectives in view, a systematic study on the various aspects of K-dynamics and its availability in soils of north Bengal has been considered extremely useful. The results of these studies are expected to help the farmers in the proper assessment of the available K status of the farming soils and also to assist to determine the quantity of K fertiliser to be applied ensuring an optimum crop yield.