# Chapter I

## INTRODUCTION

It is well recognised ever since man first cultivated crops that tillage operations are beneficial to crop production. However, since ages few changes have been made in the basic principles of tillage. Improved tillage practices accompanied by development in new tillage tools, came up through the use of trial and error method. Various tillage practices and implements have been compared and evaluated in terms of crop yield without paying any attention to study what changes are induced by a tillage implement and what is the optimum soil physical conditions required for a particular crop. It is also well known that tillage is the largest single item that shares major amount of cost of production. Since an optima for a crop in question under prevailing soil-climate complex is not known, many a times excess tillage is given though it is not essential for the crop yields. This can be avoided, thereby tillage cost may be brought down if optimum conditions are well defined.

Realising the high cost involved in tillage as early as 1943, Joint Committee on soil tilth, established by the American Societies of Agronomy and Agricultural Engineering rightly pointed out that:

"No amount of empirical experimentation will tell us whether sub-surface tillage is superior to ploughing, whether ploughing is superior to disking or what changes are desirable in the design of tillage machinery. Before any progress in this direction can be made we must know what soil physical state is desired for a given crop under a specified climatic conditions. Hence, there is a need to measure the changes produced in soil by our different management practices".

A concentrated research effort to determine the physical necessities of the crop root zone, may produce scientific information which could revolutionize the current task of tillage.

While making an effort in this direction Cook et al.(1963) introduced the concept of minimum tillage which gave birth to two zone concept of row crops (Larson, 1964). More recently, scientists are advocating notillage and have achieved success in the case of some crops under a specified climatic condition (Free et al.1963; French and Blake, 1965).

Since notillage or minimum tillage can not achieve its objective under all conditions, it is necessary to first define the requirements of crop root system in detail, before any conclusion can be drawn. During the last 20 years agricultural scientists and engineers are actively engaged to find out the requirements of crop plant at varying stages of growth in terms of quantitative measurement of soil physical environment. There is no secret that soil edaphic factors, namely: soil water, soil aeration, soil temperature and soil mechanical impedance, govern to a large extent the emergence of seedling, growth of roots and shoots and the final yield of crop. Once the range of variation required in each factor for crop is well known it should not be difficult to provide the desired soil environment to the growing plant to harvest best crop at minimum cost.

The problem is not so easy as has been stated above, rather it is very complex one due to wide variation in soil, climate and crop adaptation. Crops are often grouped into cereals, root crops, fibre crops, etc. and it is assumed that species within groups responds alike to tillage treatments. Yet,individual cereal crops

responds differently to soil physical properties, since the requirement varies greatly. Paddy thrives well even if temperature is high and oxygen supply is limited in flooded soil, whereas wheat needs lower temperature and better aeration. Differences among soil type and climatic conditions are other factors in crop soil managmment. Hence, in tillage research, more attention need to be paid to the specific crop, soil and climate involved.

In West Bengal, in general, and in Kharagpur area particularly wheat was not being grown, thinking it couldnot be grown. In the present project, varying soil environmental conditions were created by the use of different tillage implements and tillage practices and wheat was grown. The physical state of soil water, soil aeration, soil temperature and mechanical impedance, were measured throughout the growing period of wheat crop. Such an attempt will help to assess and evaluate the influence of edaphic factors on wheat growth. Since previous researchers revealed that the clod mean weight diameter is a single parameter which influences physical edaphic factors to a great extent(Bhushan and Ghildyal, 1970b), an attempt was also made to study tillage implement design parameters in relation to clod size. Since there is a distinct lack on the information regarding the optimum physical conditions for wheat growth, the present investigation was carried out to meet the following objectives:

1) to study the changes brought about in the soil environment by the use of various tillage practice,
2) to study the response of seeds to changed environment or in other words, to find out the influence of soil physical properties on seedling emergence,.

3) to study the influence of edaphic factors on wheat crop performance at various growth phases,

4) to find out how economically suitable environment can be created for successful wheat husbandry in Kharagpur.