# Chapter I

## INTRODUCTION

Our conceptions of the functions of tillage practices have changed materially over the last 15 years and there is yet much that is not understood. Since tillage is the largest single item that shares the major amount of cost of production, it entails that the energy used should be a minimum consistent with optimum monetary returns. Improved tillage practices accompanied by development in new tillage tools came up through the use of trial and error method. Though various tillage practices and implements have been compared and evaluated in terms of crop yields, a little attention has been paid to the changes that are induced by them. Many a time, excess tillage is given, though it is not essential for the crop yields, for the want of an optima for a crop in question under the prevailing soil-climate complex. If optimum conditions are well defined, the tillage cost may be brought down considerably.

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

" 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 specified climatic conditions. Hence,

there is a need to measure the changes produced in soil by our different management practices".

Tillage studies are now being undertaken to determine how tillage alters soil condition especially in relation to growth and yield of crops. Cook et. al.(1953) introduced the concept of minimum tillage and proved that for some crops the number of tillage operations could be reduced without sacrificing the yield. This work has formed the basis for the two zone concept of row crops (Larson, 1964). More recently, the practice of no-tillage has been introduced for growing some crops successfully under a specified climatic condition (Free et. al.,1963; French and Blake, 1965).

It is necessary to define the requirements of crop root system in detail before drawing any conclusion because of the inability of no-tillage or minimum tillage to achieve its objectives under varying agro-climatic condition. 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 measurements of soil physical environment. It is no secret that physical edaphic factors, namely : soil water, soil aeration, soil temperature and mechanical impedance govern to a large extent the emergence of seedlings, growth of roots and shoots and the final yield of crop. Once the range of each factor for a crop is known, it is not too difficult to provide the desired soil environment to the growing plant. However, it is still a complex problem to obtain this conducive soil condition due to wide variations in soil, climate and crop adaptation.

Wheat was not being grown widely in West Bengal, India. With the advent of irrigation resources, considerable land is being brought under wheat cultivation. However, there is no report on the desirable soil physical environment that should be provided for wheat growth in this region a part of which falls under acid lateritic soils, though earlier Tripathi and Pande (1971) reported the feasibility of wheat cultivation in this agro-climatic region. The present investigation was, therefore, carried out to assess and evaluate the influence of physical edaphic factors as induced by tillage on wheat growth. Since there is a distinct lack of information regarding the optimum soil 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 physical environment as induced by various tillage practices and to find out the response of seeds to changed environment,

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

3) to find out how economically the most conducive soil physical environment can be created for successful wheat growth under the agro-climatic condition prevailing over Kharagpur, and

4) to evaluate the properties of clods or aggregates and to find out the feasibility of the information thus obtained to predict the bulk density of cloddy surface immediately after tillage.

Although considerable research has been carried out on the design parameters of tillage tools, the resultant soil physical conditions are yet to be known fully (Bhushan et. al., 1971). It is a common observation that in spite of tool geometry, soil physical conditions and operating speed also have a profound influence on the cloddiness of the seedbed and draft requirement. Furthermore, the soil fracture during tillage was found to be proportional to the new soil (clods) surface produced. It was, therefore, felt necessary to evaluate the influence of bulk density, soil moisture and speed of operation on tillage tool draft and cloddiness potential of the seedbed which governs the soil physical properties at various growth phases of crop.