CHAPTER - 1

INTRODUCTION
The semi-arid lands are characterized by hostile environmental conditions such as low land and unreliable rainfall, intense solar radiation and high wind velocity. During most parts of the year, the evapo-transpiration far exceeds precipitation, with lack of soil moisture during all or part of the years, being the predominant limitation to vegetative growth. The semi-arid regions of India cover an area of 521,247 km$^2$ (17% of the total area) and the area mostly spread over the states of Rajasthan, Gujrat, Haryana, Punjab, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Uttar Pradesh and Madhya Pradesh (Rogers, 1981).

The semi-arid regions tend to be a relatively fragile area and in many parts of the world it is often subjected to considerable farming demands through increasing populations. Unless used with care and skill, they are extremely prone to desertification—the gradual destruction or reduction of the land's capacity for plant and animal production. Due to increase in human population and their dependence on agriculture, the pressure to expand agricultural production in these areas has been increasing rapidly. The consequences imprudent expansion are often quite damaging to the long term productive capacity of the land. The variability in rainfall patterns contributes to this land degradation problem. In addition to this expansion of agriculture during periods of relatively good seasons resulting in tremendous soil and productivity
losses when dry season returns, further aggravates the degradation. The well adapted traditional production systems in semi-arid regions have been increasingly disrupted due to pressure of human and livestock population, together with unwise development projects, mismanagement of rainfed and irrigated agricultural lands.

The use of trees and shrubs combined with the cultivation of annual plants is a primary mean of achieving sustainability and productivity of land. The integration of woody components and crop plants is done by growing tree as windbreaks and shelterbelts. The term shelterbelt is defined as a wide barrier of living trees planted and maintained for the purpose of protecting a vast area or farm; while windbreak is a narrow (1-2 rows) wind barrier of living trees planted and maintained for protection of inside of the farm. However, in the present studies, the two terms are not distinguished and are used interchangeably, particularly in review of the literature.

The merits of tree plantation in the form of windbreak/shelterbelt have long been understood under the temperate conditions of Europe, North America and the North Mediterranean region (Davis, 1976). These belts were established in order to counteract adverse ecological conditions by reducing wind velocity (consequently its physical and physiological change), evaporation and transpiration. The practice of establishing windbreaks
and shelterbelts in the arid and semi-arid regions is relatively recent (IDRC, 1985; Puri et al., 1991).

In India, unfortunately no well-organised windbreak and shelterbelt programme is being carried out. However, there have been quite a number of plantation screenings along the sides of canals, rivers, railway lines, roads and farm areas. These were raised under Social Forestry Programme throughout India (Khosia and Puri, 1966). Are these plantations giving the benefits of shelter to agricultural crops? It is generally assumed that the technique developed in temperate and mediterranean countries will provide the same benefits in tropics or vice-versa. This presumption has been proved to be wrong in a number of cases. The present study was undertaken to answer these queries. It was also aimed to understand as to how the productivity of agricultural crops and soil is affected due to the presence of windbreak.

The present work was designed to study the effects of windbreaks on cotton and wheat crops considering the following aspects:

- Microclimate
- Effect on agricultural crops
- Biological and physiological effects
- Moisture analysis
- Nutrient analysis