Chapter 1

Introduction

Millets and Sorghum constitute the most important cereal food source after rice in the tropical developing nations particularly in semi-arid tropic of Asia and Africa. Probably the most important character of the millets is their ability to tolerate and survive under conditions of conditions continuous or intermittent drought that results from low and uncertain rainfall.

According to the statistics of the Food and Agriculture Organization of the united Nations, the average annual production of millets excluding sorghum during triennium 1977-79 was 34.3 million tonnes from an area of 53.8 million hectares. In India the estimated area of millets including bajara under cultivation during same period was 20500 thousand hectares (20.5 million) with 9600 thousand tonnes (9.6 million) of production. On the millet map of world, India occupies a prominant position both in regard to hectares and production. The area under cultivation and production of small millets in India during period 1978-79 was 4456.8 thousand hectares and 1932.0 thousand tonnes respectively. The annual proso millet production during the same period was approximately 325 thousand tonnes from an area of 450 thousand hectares.

In the past 20 years considerable progress has been made in sorghum and pearl millet in ceiling to yield by commercial use of hybrids and incorporating resistance to major diseases

and pests. Only little attention has been paid to crops like common or proso millet, finger millet, foxtail millet, little millet and Kodo millet. This is especially true from the point of view of research. This is mainly due to fact that these crops represent minor cereals. However, they have got a promising characteristics of wide range of adaptability. They have the ability to overcome the adverse conditions like drought, high temperature, low soil fertility and diseases and pests.

Common or proso millet is a relatively short duration emergency or quick-season irrigative crop; with low moisture requirements. The grain after hulling makes a nutritious and palatable cereal for unleavened bread or cooked. The millet is grown in U.S.S.R., China, the balkan countries and southern states of India. It is cultivated in scattered localities and hilly tracts of Nothern India also. Few varieties are released in last few years which are outcome of mainly selection. Now it is universally accepted that understanding physiology of the crop species should be an essential pre-requisite for any ambitious breeding programme. This has been very well achieved in crops like sugarcane, rice, wheat, sorghum and groundnut. However, very few attempts have been made so far in case of crop like common or proso millet.

The attempt to understand physiology of proso millet crop are very scanty. Keeping this view in mind an attempt

has been made to try to understand the basic aspects of physiology of this crop.

In order to understand basic problems involved in study of common millet plant, brief resume of current status of literature on common millet is covered in Chapter-II. An attempt has made to take a brief review of morphology, cultural practices, and other features of this crop. An attempt has also been made to take a brief review of physiological studies in common millet.

Chapter-III deals with study of growth and development of plant and biochemical events during major growth phases in proso millet plants. The mineral elements play significantly important role in metabolic map a plant and deficiency of even one of these essential elements causes for reaching effects on its growth and metabolism. Proso millet plant generally cultivated in marginal lands with low soil fertility. Besides this the application of fertilizers is generally not practiced by poor farmers producing this crop. Hence it becomes essential to study the pattern of mineral uptake and distribution in this crop. These studies are covered in this chapter. Besides mineral nutrients the faith of various organic constituents like carbohydrates, organic acids, proline, polyphenols, nitrogen and chlorophylls during different growth stages of proso millet has also been investigated.

The seasonally dry and semi-arid tropical regions of the world are spread over nearly 20 million square kilometers. They covers much of India part of southeast Asia and Middle East two wide belts Africa, areas of South America and much of Mexico and central America. In all these regions food production is limited primarly by the erratic nature of the rains. Hence in the plant physiology the topic of drought resistance is of much importance because it deals with plant growth under water deficit conditions. The early work on understanding mechanism of drought resistance was on non-economical desert plants. However, there are now attempts to elucidate mechanism of drought resistance in crop plants, like Sorghum.

Proso millet is grown in a more less semi-arid conditions in most parts of India. Hence, in the present investigation an attempt has been made to study the mechanism of drought resistance in this crop. For this some of the bio-chemical changes which are induced in response to water stress have been investigated. These changes include changes in nutrient composition and important organic constituents. In last few years a great stress has been given on the role of free proline in drought resistance process and level of free proline has been correlated with drought resistance capacity by several workers. We have also attempted to see whether proso millet possesses such a capacity of proline accumilation under water

stress. These studies are further extended to examine the effects of water stress on stomatal apparatus in this crop plant. All these studies have been incorporated in Chapter-IV.

Senescence marks one of the important events in the life cycle of a plant in many crop plants like rice, wheat and soyabean it has been fairly established that senescent leaves can supply nutrients to the young developing organs. We thought it worthwhile to see whether similar situation prevails in common or proso millet also. The study of biochemical changes during senescence forms the core of Chapter V. These studies include the changes in leaves of various organic constituents and mineral elements. These studies are further extended to changes in activities of some important enzyme systems related to leaf senescence of proso millet plant.

The present study was pursued to have a preliminary idea of physiology of this crop. The significant finding of present investigations are summarised in the last chapter of the thesis. The above investigations represent only one attempt in understanding basic process in the local variety of common or proso millet which is grown on large scale in this area. It must be admitted here that many more such attempt on selection and hybrid varieties of proso millet are essential, to arrive at a definite synthesis with respect to performance of this crop under different sets of environmental conditions. Such studies are being carried out in our Department.