

# Chapter I



## INTRODUCTION

Oil seeds occupy a key position in the economy of several nations. Today, these crops are cultivated on about 16.5 million hectares, with a total production of nearly 10 million tonnes. This area constitutes approximately one tenth of the total cultivated area in India. On the oilseed map of the world, India occupies a prominent position, both in regard to acreage and production. However while enormous resources have been expended in recent decades on oilseed crops like soybean, groundnut and sunflower, only little attention has been paid to crops like castor, mustard and niger. This is especially true from the point of view of research. This is mainly due to the fact that the crops like castor, mustard and niger, represent minor oilseed crops cultivated mainly in developing countries like India. Niger seed oil has got good cooking quality and it has several industrial applications. The crop can be taken both as a kharif as well as rabbi crop. In India the chief niger growing states are Madhya Pradesh, Bihar, Maharashtra, Orissa and Tamil Nadu. Number of promising niger 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, groundnut and soybean. However very few attempts have been made so far in case of minor crops like niger. The attempts to understand physiology

of niger crop are so scanty that Asana and Sarin (1968) were unable to mention any significant work on this crop in their publication "Crop Physiology in India". Considering this lacuna in our knowledge regarding the physiology of niger plant, present investigation has been undertaken.

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

Chapter III deals with study of biochemical events during major growth phases of niger plants. The mineral elements play several important roles in metabolic map of the plant and deficiency of even one of these essential elements causes far reaching effects on the growth and metabolism of the plant. Niger crop is generally cultivated in marginal lands with low soil fertility. Besides this the application of fertilizers is generally not practised by poor farmers producing this crop. Hence it becomes essential to study the pattern of mineral accumulation in this crop. These studies are covered in this chapter. Besides mineral nutrients, the fate of various organic constituents like carbohydrates, organic acids, polyphenols, nitrogen and chlorophylls during different growth stages of niger has been also studied.

Senescence marks one of the important events in the life cycle of the plant. In many crop plants like rice, wheat and soybean it has been fairly established that senescent leaves can serve as source and can supply nutrients to the young developing organs. We thought it worthwhile, to see whether similar situation prevails in niger also. The study of biochemical changes during senescence form the core of Chapter IV. These studies cover changes in level of various organic constituents and mineral elements. These studies are further extended to estimation of photosynthetic efficiency of green and senescent leaves using  $^{14}\text{C}$  technique.

The seasonally dry and semi-arid tropical regions of the world are spread over nearly 20 million square kilometers. They cover much of India, parts of south east Asia and Middle East, two wide belts of Africa, areas of South America and much of Mexico and Central America. In all these regions food production is limited primarily by the erratic nature of the rains. Hence in 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. Niger is grown in a more or less semiarid conditions in most parts of India. Hence in the present investigation an attempt has been made to study some of the

biochemical changes which are induced in response to water stress in niger. 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 niger possesses such capacity of proline accumulation under water stress. These studies are represented in Chapter V.

The present study was pursued to have a preliminary idea of physiology of this crop. The significant finding of present investigation are summarised in the last chapter of the thesis. The above investigations represent only one attempt in understanding basic processes in the local variety of niger which is grown on large scale in this area. It must be admitted here that many more such attempts on selection and hybrid varieties of niger are essential to arrive at a definite 'synthesis' with respect to performance of this crop under variety of environmental conditions. Such studies are being carried out in our department and they are further extended to other physiological features like carbon metabolism and enzymatic reactions.