INTRODUCTION

Human beings need pulses in their regular diet. From earlier days it was observed that non-leguminous crops grew more vigorously alongwith leguminous crops, indicating that leguminous plants provide extranourishment to other crops. Pulses fix atmospheric nitrogen due to which soil gets enriched with 'N'. Pulses are rotational crop due to which soil becomes alive and productive. Leguminous crops contain high level of protein (40 per cent), which is not only a component of human diet but also helps to maintain the body health and a source of energy to human beings.

In the course of development of agriculture there has probably been some kind of selection pressure on diets which met human dietary needs most efficiently. A well nourished community with a balanced diet would outstrip one with poor nutrition and its culture. Among the top six grain legume crops in terms of production (soybean, peanut, drybeans, chickpea, pigeon pea and cow pea) Cajanus cajan is the world's top-most crop, growing well in temperate climatic region. Psopocarpus tetragonolobus L.DC. is minor grain legume growing in tropical area.

Pulses are an important component of diets, in some parts of the world, in others they make a negligible contribution to human dietary needs. The production and consumption of pulses is a shortage of animal protein and it is significant component of the diet found

in old and new world. Very high consumption of pulses is common in Red Indians. In South America kidney bean is widespread.

Pulses are used in different ways:

(1) **Age:** Pulses are very easily prepared and given to infants as well as children and adults.

(2) **Soil Class:** Pulse fruits are protein rich and cheap.

(3) **The Nature of the Community:** Different amounts of pulses are used in rural or urban communities.

(4) **Alternative Protein Source:** Protein intake is self-regulating, its caloric value is nearly equivalent to animal proteins.

Pulses and other legumes form an essential part of the Indian diet, and are grown commonly as pure crop, in relation or mixed with cereals. The present critical situation in world food supplies demands that all our agricultural resources are to be utilized for pulse growth. Pulses are rich in proteins, minerals and vitamin B. This source, however, has not been exploited very effectively by man. If there is tc be any significant expansion of pulse Crop-production in the tropics, where it is most needed, new and informed approaches must be developed to solve outstanding problems.

To study physiological changes during pod development in pulse crops an important role to play in guiding the efforts of agronomists, plant breeders, plant physiologists and others who are actively

engaged in the business improving efficiency of production.

There are numerous minor grain legumes which are cultivated on smaller scales and converge attention from the scientist community.

Pod Development in Legumes:

Legume fruit consists of seeds and Pod cover. Anatomically and physiologically Pod cover of pod resembles those of leaves and as storage organ. A well developed system of relations between Pod cover and developing seeds may nave an evolutionary advantage.

Pericarp protects the embryo against external change and maintain a favourable micro-climate. Nutrients first have to accumulate in pericarp and then transferred to seeds. During initial phase of of embryogenesis seeds are very small and then they grow slowly. Pericarp accumulates starch and amide that are degraded and transferred into seed during subsequent stage of antogenesis.

During 2nd embryonic stage the cotyledons grow by cell enlargement and rapidly reach their final size. During stage one embryogenesis, anabolic processes prevail in the pericarp cells and during 2nd developmental period catabolic process is seen. This results in a small but statistically significant decrease in the pericarp dry weight and concomittantly in the loss of approximately 3/4 of the previous maximal carbohydrate and nitrogen content (Boulter and Davis, 1968; Flinn and Pate, 1968; Mumtz, 1973; Mumtz et al., 1976; Pate et al., 1977).

The final stage (3rd stage) of embryonic development of seed is the resting stage. In this stage, loss of water showing down of all metabolic activities are seen. Seed and pericarp die and finally the pod opens and seeds are set free.

During the last 25 years work was done on investigations of various leguminous species. In this thesis we have to study physiological changes during pod development. The process of development is very important phenomenon in the life history of plants as it is directly correlated with yield. Obviously, it forms an important stage in the economically important plants also. In the present investigation an attempt is made to study the pod development in some leguminose plants. The growth and development of pods, right from fertilization to maturity is studied at different stages. The carbohydrates, nitrogen and mineral metabolism is studied at various stages during pod development. An attempt is made to correlate these studies with the growth and development of pods.

Among the tropical pulse crops Cajanus cajan (L.) and Psopocarpus tetragonolobus (L.) D.C. (winged bean) has to face with certain adverse conditions such as mineral deficiency and attack of various diseases. To get better yield and improve seed capacity it is necessary to study their physiology. Many advances are applied to produce economic amount of seeds. The aim of these studies is to contribute to our existing knowledge of physiological studies during pod development. To study this Cajanus cajan and Psophocarpus

tetragonolobus (L.) plants at different developmental stages are taken.

Pulse crops are the major source of proteins have been various stages of growth and development. Chapter-I of this dissertation explains a brief review of the origin, history, cultivation, uses and seed compositions. In this chapter attention is paid on reviewing the literature available on Cajanus cajan (L.) and Psophocarpus tetragonolobus which are the most important pulse crop of India as well as the State of Maharashtra.

It is very essential to study physiology of pod development. To get better yield, study of physiological changes during pod development is necessary, and if it is affected by diseases or environmental conditions, the adverse condition could be controlled. Mineral content, proteins, nitrogen, carbohydrate, photosynthesis and various chemical compositions should be studied.

As far as India's population is concerned, poor people are unable to get proteinous food because of its high expenses. Pulses are said to be rich in proteins and less costly. C.cajan and P.tetragonolobus are known to be poor man's crop as it is chiefly found in rural areas. The pod development makes one of the important physiological processes in C.cajan and P.tetragonolobus as it determines the ultimate yield of the crop. The analysis of pod growth was first studied by Senanayake and Suman Singh (1976).

Literature on the subject critically reviewed by a number

of authors, reveals that studies are mainly based on the green, mature and senescent pod only and its physiological development. Physiological studies during pod development include importance of legumes in human diet, their nutritive value, growth and development of legumes their morphological and physiological studies etc. as given in Chapter-I.

Before investigating the physiological changes during pod development it is necessary to know the knowledge of the material used, how the plants are raised and seeds are collected. All this information is included in Chpater-II. For the convenience, Chapter-II is divided into the following topics:

(A) Material Used for Experiments:

(B) Includes **Methods:** Methods to investigate material and method used for pod development, moisture content, organic constituents, enzymes, inorganic constituents are shown in Chapter-II.

The study of mineral nutrition attracts attention of the several physiologists. Mineral nutrition plays an important role in metabolism of a plant and deficiency of even one of the essential elements causes far-reaching effects on the growth and metabolism of plant. The mineral elements are absorbed at different rates and accumulated in different concentrations according to the specific requirement of the plant.

The foliar application of nutrients to the crop plants to

meet their need has attracted considerable attention of farm scientists and farmers. Although spraying of minor nutrients to correct the nutritional disorders or deficiencies of plants was in vogue since early days, foliar application of major nutrients was not tried on any large scale. But today, with the rapid development of efficient spraying treatments or equipment and availability of various forms of highly water-soluble fertilizers, the practice of foliar feeding with nutrients has spread up so much as to economise the quantity of nutrients. Elements used as soluble substances through soil, fail to overcome the deficiency of these nutrients owing to unfavourable conditions of the soil. Thus, the application of nutrient spraying has become a commercial facility for efficient crop production. All nutrients that are taken by root can also be taken by leaves, stem and fruits.

The seeds and pod covers have been analysed for moisture percentage. Moisture percentage shows loss of water during later phase of pod development.

Results of moisture content during pod development in C.cajanus and P.tetragonolobus are given in Chapter-III.

The organic compounds form very important constituents of living cells. Their study is of special significance in crop plants as they directly control the productivity. The nitrogen metabolism is of special interest in leguminous plants as they are the major source of vegetable proteins. C.cajan and P.tetragonolobus convert

atmospheric nitrogen, which is easily taken by plants.

Mineral nitrogen improved yield when applied from the early stages of development to achieve high yields and protein levels. The soil nitrogen levels are high during the early developmental stages, but as the season progresses, the plants become more dependent on symbiotic N_2 fixation.

Nitrogen content during pod development in seed and pod cover of C.cajan and P.tetragonolobus is given in Chapter-III.

The study of enzymes of N_2 metabolism during pod development is very important. As we know, nitrate is the major source of nitrogen available to the plants. Plant roots absorb nitrate which is reduced to ammonia. This important process is called 'nitrate reduction'.

Two enzymes involved in the process are nitrate reductase and nitrite reductase (Hewitt 1975 and Beevers, 1976). Nitrate reductase in C.cajan and P.tetragonolobus to be higher in nodulating than non-nodulating plants observations recorded on the activity of nitrate reductase nitrite reductase and its consequences on total nitrogen content are included in Chapter III, .

Thirteen per cent of the edible dry matter is protein. On this basis 10 per cent to 12 per cent of diet calories should come from proteins.

Pulse crops have major source of high calories and protein in human diet. The P.tetragonolobus has exceptionally high nitrogen-fixing capacity and high protein content of the seeds, pods, leaves, and roots. The proteins of dry, hard seeds of P.tetragonolobus have comparatively low digestibilities than other legume seeds. The tender pods and mature pods of C.cajan and P.tetragonolobous is eaten. The tubers of P.tetragonolobus are also tasty and eaten. The pods as well as tubers contain high protein value, so it is very essential to put light on the findings of protein content at different growth stages on the physiological point of view. Chapter III can give protein content and changes in protein content during pod development.

To attain and maintain thermodynamic status of living organisms expend energy whose main source is sunlight. During the process of photosynthesis solar photons are captured by chlorophylls to split water-molecules to generate continuous flow of energy which in turn is utilised for the fixation of CO_2. Finally, photosynthesis is followed to the synthesis of carbohydrates and other organic compounds, the food for the biological world. The complex biological process depends on a number of internal and external factors. In respect of many plants it was observed that change in environmental conditions changes the pattern of photosynthesis in plants. This may be a physiological defence against adverse conditions. Chlorophyll synthesis is given in Chapter III.

Carbohydrate synthesis and activities of enzymes α-amylase is observed, studied and discussed in Chapter-III B.

The last chapter of the thesis (Chapter-IV) summarizes the significant findings of the investigations and concludes. The literature cited in the investigation is neatly presented in Bibliography at the end of the process.