

INTRODUCTION

The soybean is an important crop plant and is the World's most important source of food, oil and protein. It is a plant with intriguing characters; it is a short-season crop, responsive to photoperiod, with the nitrogen nutrition of a legume; its seed is rich both in protein and oil, with uses more diverse than most grains. It succeeds on nearly all soils that supply adequate water.

A. Origin :

Soybean food crop is believed to be of South East Asian origin. It is reported in China from prehistoric times. The first record of this plant appears in *Materia Medica*. (The ancient book "Heavenly former" written by Chinese Emperor Sheng-Nung in 2838 B.C.) mentioned this plant as "Sou" from which present name Soybean appears to have been derived.

Soybean [*Glycine max* (L) Merrl.] evolved from *Glycine ussuriensis* a wild legume native to Northern China. It has been known and used in China since the eleventh century B.C. It was introduced to Europe in 18th Century and into the United States in 1804 as an ornamental garden plant in Philadelphia. In 1905 the first commercial plant for extraction of oil from the seeds was developed but it was not until around 1926 that it became an important crop in the United States and in Brazil, Paraguay and Argentina and its cultivation is being extended in Southern Europe and later on in almost all over the world.

B. Food, oil and industrial value of Soybean :

Soybean is economically the most important legume in the world. It is nutritious and easily digested, and is one of the richest and cheapest sources of protein. It is

currently vital for the sustenance of many people and it will play an integral role in any future attempts to relieve world hunger. Soybean seed contains about 17 to 22% oil and about 63% of meal, half of which is protein. Besides edible oil it produces de-oiled flour with as high protein as 55-60%. Its use in fast food and nutritious soft drink is also catching up. Modern research has developed variety of Soybean oil use. It is processed into margarine, mayonnaise, salad creams and vegetarian cheese etc.

Contribution of soybean in the oil seed basket of world has been maximum and now ranks at the top in world production of edible oil. Soybean along with groundnut and rape-seeds mustard has established itself as a third important oil seed crop in India. India experienced an annual production of about 6 million tonnes of edible oil obtained from about 21 million tonnes of oil seeds during 1988-89. This production provides daily requirement of 18g of oil per person. A target of 25.0 to 26.0 million tonnes of oil seeds has been set by Planning Commission for the year 2000-2001 A.D. for which we have to strive in an integrated manner. It has definite niche, not only for oil but for high quality protein as well.

Industrial soybean is used in resins, plastics, adhesives fertilizers, sizing of cloth, linolium, backing, fire-extinguishing materials, printing inks and a variety of products (Copping et al 1992). Soybean meal has a high protein meat substitute and is used in the developed countries in many processed foods, including baby foods, but mainly as a feed for live-stock.

C. Production and yield :

Soybean is fully grown in China, Japan, Korea and in other Asian countries such as Indochina, Thailand, Indonesia and Philippines. In recent years it has attained a great importance in the U.S.A. which shows highest acreage under this crop covering more than 16 million hectares and rank at the top producer contributing more than 2/3 of world's production of Soybean, China stands next to U.S.A. in acreage which covers more than 8 million hectares producing less than 1/5 of the world total.

In India Soybean is grown in North India, particularly in hills of Assam, West Bengal, Manipur and Nagaland and also in the hilly area of U.P. and H.P. at 5000'-6000' altitude as mixed crop with Maize. It is also cultivated in Kashmir valley. Now it is cultivated in M.P. and Maharashtra and some other states also.

The crop has occupied 4.25 million hectares producing 4.25 million tonnes of Soybean in India. India is among the top three countries in respect of growth rate in area expansion under Soybean the other two being Argentina and Brazil.

In Maharashtra out of 205 lakh hectares cultivable land 27.3 lakh hectares is under oil seed cultivation, Soybean is one of it, which contribute 4.60 lakh hectares cultivation (Patil, 1995).

Department of Agricultural Development of Maharashtra planned to increase area under cultivation upto 7 lakh hectares in 1996-97. Now soybean cultivation in Maharashtra has taking proper shape due to high yield potential and multifold uses. There is steady increase in area under Soybean because it is highly remunerative

crop with less input demand. It has bright prospectus of production in monsoon and post-monsoon season also.

The present national average yield of about 9 quintals/ha which is about half the world average. The reasons for low productivity are mainly non-adoption of recommended package of practices. The major being insect pest attack and fungal diseases. These are also one of the causes of low productivity of Soybean.

Soybean being luxuriant crop, having lush-green, soft succulent and nutritive dense foliage is attacked by more than 273 types of insects (Bhatnagar and Tiwari, 1995). Out of the whole range, only about two dozens insects are of significant importance. These insects are categorised into six different groups on the basis of their feeding habits which are viz. (1) Seed and seedling feeders, (2) Stem bores, (3) Foliage feeders, (4) Sap suckers, (5) Flower and pod feeders and (6) Storage insects.

Soybean is also attacked by large number of fungi however, disease induced losses have remained relatively low in most temperate production centres and are higher in areas with tropical and subtropical environment (Backman and Jacobson, 1992). Soil borne pathogens including Phytophthora rot, charcoal rot and brown stem rot and the Soybean Cyst nematode have caused the greatest losses in temperate regions. As the range of Soybean adaptation has been expanded to lower latitudes with their humid environments, foliage and stem diseases, bacteria, viruses, seed pathogens and root knot nematode have been identified as limiting factors. The major diseases of Soybean caused by fungi are viz. (1) Charcol rot, (2) Collar rot or Sclerotial

blight, (3) Frog eye leaf spot, (4) Pod blight or Anthracnos, (5) Rust, (6) Rhizoctonia aerial blight etc.

Thus insect pest and fungi are mainly responsible for the loss in Soybean yield. The losses in Soybean due to uncontrolled insect pests and fungal disease complex have been reported to the tune of 50% by Bhatanagar and Tiwari (1995).

Soybean which is widely cultivated in Western Maharashtra is facing the biotic stress mentioned above. Since there is close relationship between Phenol Metabolism and defence mechanism in plants against biotic stress and as such polyphenols play an important role in developing defence mechanism in plants against biotic and abiotic stress, resistance to several fungal plant pathogens has been ascribed to higher concentrations of phenolic substances and their oxidation products to increase polyphenol oxidase which generally, but not invariably, results from infection (Mehrotra, 1980). In Maharashtra the Soybean greatly suffer from rust infection which leads to complete destruction of crop at flowering stage. This has prompted to undertake the research pertaining to Polyphenol metabolism in relation to plant age and/or plastochron index. It is hoped that the study will provide a time shedule for the use of agrochemicals to overcome biotic stress effect and hence, it is thought worthwhile to study the endogenous level of polyphenols in Soybean with respect to plastochron index.

Thus the subject matter of the dissertation includes study of the parameters such as total polyphenols, separation and quantification of phenolic compounds and

enzymes involved in phenol metabolism viz. phenylalanine ammonia lyase, polyphenol oxidase and IAA oxidase in relation to plant age and/or plastochron index. The study is also coupled with the other parameters such as total chlorophylls, carotenoids, nitrogen and protein content.

All these aspects have been studied and discussed by referring recent and up-to-date literature. The dissertation has been splitted into three main chapters comprising review of literature, material and method and results and discussion. The extensive literature survey carried out by referring recent journals, review articles, books and monographs is listed at the end of dissertation in the bibliography.