REVIEW OF LITERATURE

Soybean has emerged as one of the prominent rainy season cash crop in central India and 3rd important oil seed crop in the country, it's cultivation is leaping down southwards in the states of Maharashtra, Karnataka and Tamilnadu, as well as in the eastern States apart from the part of Uttar Pradesh and Rajasthan adjoining to Madhya Pradesh. With approximately 75% share in national area and production of Soybean, Madhya Pradesh has distingushed itself as "Soya-State". Growth rate in area and production of Soybean in India has been spectacular. The future years are likely to exhibit increase in Soybean area stabilizing it at some where around 6.00 million hectares.

Soybean cultivation is being preferred by the farmers due to low input requirement of labour and nitrogenous fertilizers and wider adaptability to climate as well as soil and comparative tolerance to drought and excessive moisture. Over and above, instant market at remunerative price has played prominent role in rapid spread of Soybean in the country.

Ability to fix atmospheric nitrogen enables this crop not only to meet its requirement for nitrogen but also to leave 32 to 60 kg/ha residual nitrogen for suceeding crop. Although Soybean is largely cultivated as rainfed crop it has vast production potential under irrigated agriculture. Ever since the Soybean cultivation attained the commercial status in India, it has been instrumental in improving rural economy and has shown potential to occupy special place in cropping patterns in regions of its cultivation. Presently soybean crop is being cultivated continuously year after year, the principles of sustainable agriculture suggest rotation of this crop with other nonlegumes to optimise yield with reduced risk of yield loss due to weeds, insect pests etc. and adequate use of land resources.

At present this noble crop suffering a lot by insect pest attack, fungal diseases, bacterial diseases and viral diseases and ultimately leading to severe loss in crop production. Consequently, new approaches to major problems are being pursued. The development ard use of resistant varieties is crucial for the production of Soybeans against nematodes, beacteria, viruses and plant pathogens and molecular biology offers new opportunities in this area.

Most of the workers are hitherto engaged to tackle the problems associated with soybean.

A. Seed germination :

The seed germination study in soybean has been carried out by most of the workers. Kawale et al (1989) studied the effect of differnt pesticides on seedling emergence and yield of Soybean. The triacontanol promoted seed germination has also been observed in cowpea and Soybean (Janardhanan, 1992). Increase in the rate of seedling emergence and the length of hypocotyl in benoram treated seeds of Soybean has been reported by Chung and Ju (1993). However, Sundaresh and Hiremath (1993) have reported no significant adverse effect either on seed germination or on the nodulation due to fungicide treatment in Soybean. Similarly effect of different fungicides on seedling vigour and seed viability in Soybean was studied by Pardeshi et al (1989). They reported that seeds of Soybean treated with recommended does of Thiram, Captan and Vitavax, resulted into increase in germination percentage. From this it is quite evident that seed treatment with fungicide can give high germination good and more grain yield in Soybean.

B. Mineral Nutrition

Plant nutrition is by and large concerned with the provision of plants with nutrients as well as nutrient uptake and their distribution in plant. The essential nutrients required by higher plants are exclussively of inorganic nature. The supply and absorption of these inorganic constituent is needed for growth and metabolism. Soybean being a cash crop most of the workers have concentrated their efforts in studying effect of mineral nutrient on growth and metabolism.

Effect of foliar application of phosphate on Soybean leaf surface at the time of flowering and podding period has studied by Sou and Wu (1988) and reported 10% increase in the yield.

Similarly Crafts-Brandner (1992) has also reported that phosphorus nutrition influences starch and sucrose accumulation and activates the enzyes ADP-glucose pyrophosphorylase and sucrose phosphate synthatase during grain filling period in Soybean. He also noticed accelaration of leaf senescence, during phosphorous deficiency and delay in the rate of leaf senescence when the plants have supraoptimum phosphorus level. Effect of nitrogen and phosphorus on grain yield and quality of soybean studied by Turkhede et al (1991). According to them seed yield, protein and oil concentration were found increased, Nitrogen application increased seed protein percentage but did not affect seed oil percentage while phosphorus application had no clear effect on seed protein or oil percentage.

Narayanan et al (1993) reported that iron deficiency in Soybean causes initial interveinal chlorosis of young leaves. Similar results have been observed with potash deficiency in Soybean by Ismunadji and Manchuri (1989). According to Ito et. al. (1994) higher concentration of potasium in soil and leaves lowers disease incidence in Soybean.

Effect of Molybdenum, Tunguston and Cromium, on nitrogen fixation of soybean nodules and activity of nitrogen reductase has also been studied by Deng (1990). Kandpal and Chandel (1993) have also studied the effect of gypsum and pyrite as source of sulphur on nitrogen fixation, dry matter yield and quality of Soybean. The effect of Mo and B on botanical characters and yield of spring soybean has been studied by Ye et al (1991). Physiological role of Boron in soybean (Schon, 1990) revealed that it increases yield by increasing pod on branches and seed weight per plant. According to Khan (1988) Zn in Soybean was either free or associate with very low MW proteins, peptides or their complexes with phytic acid and Mn concentration (Romera and Gomez 1991) generally greatest in roots and least in stem.

CO_2 - saturated photosynthesis as affected by phosphate stress in soybean, maize, grain sorghum and cotton has been studied by Pfthgrfw et al (1990). Their study reveals that the soybean and cotton plants had 13.2 and 13.4% PN value respectively than their P-stressed counter parts, maize and Sorghum did not give statqstically significant results. When soybean and maize PN were integrated over the measurement period the P-stressed plants had 11.7 and 9.8% lower weighted average PN values respectively than the control. On the basis of this they concluded that P-stress can limit PN when CO_2 and irradiance or saturating possibly due to disruption of leaf sugar partitioning and transport. Deactivation of ribulose 1,5 - bisphosphate carboxylase due to decrease in the level of inorganic phosphate in the leaves of soybean has also reported by Swada et al. (1992). Photosynthetic changes in soybean with and without nitrogen and increased CO_2 concentration studied by Li and Gupta (1993) and reported that the increase in CO_2 level with or without nitrogen had no impact on net photosynthetic rate.

C. Stomatal transpiration and photosynthesis :

Stomata play pivotal role in gaseous diffusion as well as in maintaining water balance in plants. Many workers have studied stomatal transpiration and conductivity in soybean. Lee et al (1990) studied effect of photo-synthetically active radiation and leaf water potential on stomatal deffusive resistance under field condition. Under draught condition stomatal diffusive resistance of upper conopy leaves increased with leaf water potential below 10 bar. Similar observation was also made by Rosa et al (1991). Adaxial stomatal response to water potential tends to be more pronounced than that of abaxial stomata. Under well watered conditions total stomatal deffusive resistance was related to photosynthetic active radiation. High soil hydraulic conductivity caused higher transpiration rate in soybean than low soil hydraulic conductivity (Tanaka 1990). Stoinova et al (1991) studied effect fusicoccin on photosynthesis, transpiration and stomatal state of Soybean leaves. According to them stomata remain more open in the morning and closely shut at mid-day in fusicoccin trated plant than that of control plants. According to Djekoun and Planchon (1992) although maintenance of stomatal opening during water stress appeared to be favourable to photosynthetic activity, the accompanying soil water depletion limits nitrogen fixation by decreasing nodule water content.

Productivity of crop plants is intemately associated with the process of photosynthesis. It is essentialy an oxido-reduction process in which photolysis of water takes place with the help of chlorophyll and light and the electrons generated are used in the formation of reducing power $NADPH_2$, which is finally utilized in the reduction of CO_2 to carbohydrate level. This aspect has also been studied in soybean by many workers. Camhffri et al (1987) studied effect of herbicide on ps-I and chloroplast isolated from soybean and reported inhibitary action on electron transport. Abdel et. al. (1991), reported reduction in photosynthetic rate when soybean plants were sprayed with 25% malthion upto 7 days after treatment but no effect was observed 90 days after treatment. Reduction in chlorophyll, Carotenoids and protein content was found affected due to seven weeks after herbicide treatment in soybean. Similar reports have also been made by Soskic et al (1991). Wang and Yi (1991), Li and Gupta (1993) studied photosynthetic changes in soybean with and without nitrogen and ~~increased thetic changes in soybean with and without nitrogen and~~ increased CO_2 concentration. The study revelled that the increase in CO_2 levels with or without nitrogen had no impact on rate of photosynthesis, Chlorophyll content was increased by 28% on exposure to 450 μl CO_2/litre, in absence of nitrogen. Ratio of chl-a/chl-b was higher in plants treated with nitrogen. The total biomass increased by 18% in presence of 450 μl CO_2/litre, the root shoot ratio increased significantly on the addition of nitrogen.

D. Insect pest and disease management :

Pest management in Soybean has largely studied and is mainly confined to preventive and theraputic tactices in insect management (Pedigo, 1992), fungal disease management (Yorinori, 1992, Morton, 1992), Chemical and biological control (Backman and Jacobsen, 1992), use of cultural techniques and genetic resistance (Weaver and Kabana, 1992). The biopesticides prepared by using baculoviruses have also been tried in pest management programme of Soybean (Funderburk et al 1992) and much of the work has also been concentrated on nematode control in Soybean (Riggs, 1992).

In order to develop defense mechanism against pathogen, Gianfagna and Lawton (1995) actively engaged in studying specific activation of Soybean defence genes by the phosphoprotein phosphatase inhibitor. Few workers are also engaged in studying enzymes of the phenyl propaniod path way in soybean infected with nematode and fungal pathogen (Eldens et al 1995). The work on analysis of peroxidase and esterase isoenzymes (Chem et al 1993), the correlation of contents of flavonoid, total phenolate and enzymes in Soybean with resistant level to insect (Zhuang et al 1992), rapid accumulation of anionic peroxidases and phenolic polymers following treatment with Phytopthora megasperma (Graham and Graham 1991), phytoalexin defense reponse (Ebel et al, 1990), differential expression of phenylalanine ammonia-lyase during nodule development (Estar brook and Sen Gupta 1991) effect of oxygen and malate on NO_3 inhibition of nitrogenase (Heck mann et al 1989) in nodules and distribution of superoxide dismutase (Shuang et al 1988) in Soybean leaves is in progress.

The literature survey has also revealed that the work such as physiological responces of an insect resistant soybean line to light and nutrient stress (Elden and Kenworthy, 1995), structural analysis of antioxidative peptides from soybean beta - conglycinin (Chen et al 1995) phenylalanine analogues in soybean (Leubner - Metzger and Amrhein, 1994) conformational changes of lipoxygenase in modified environments (Pourplanche et al 1994,) function of oxidative crosslinking of cell wall structural proteins in plant disease resistance (Brisson et al, 1994), resistance of hard seeded soybean lines to seed infection by Phomopsis, other fungi and Soybean Mosaic virus (Roy et al, 1994), specific activation of soybean defence genes by phosphoprotein phosphatase inhibitor akadaic acid (Gianfagna and Lawton, 1995), enzymes of the phenyl propanoid pathway in Soybean (Edens et al, 1995), heavy metal salt inducing disease resistance and altering specific antigen of soybean leaves, (Purkayastha and Ghosh, 1992), induced resistance in Soybean to Helicoverpa zea : role of plant protein quality (Bi et al, 1994), potential role of ascorbate oxidase as a plant defence protein against insect herbivory (Felton and Summers, 1993), isoliquiritigenin, a stong nodgin and glyccollin resistance inducing flavonoid from soybean root exudet, (Kape et al, 1992), analysis of peroxidase and esterase isoenzyme in soybean (Chen et al, 1993), flavonoid, total phenolate and enzymes in Soybean with resistance level to insect pests (Huang et al, 1992), rapid accumulation of unionic peroxidases and phenolic polymers in Soybean following treatment with Phytopthora (Graham and Graham, 1991), effect of oxygen and malate on NO_3^- - inhibition of nitrogenase in Soybean nodules (Heckmann et al, 1989), and distribution of superoxide dismutase in soybean leaves (zhuang et al, 1988) is in progress.

From the above foregoing literature survey it is very clear that the maximum attention has been paid in emphasizing seedling growth, pest and disease management, mineral nutrition and photosynthesis, nitrogen fixation, stomatal transpiration and the enzymes such as peroxidase, superoxide dismutase and photosynthetic enzymes viz. RuBP Case and PEP Case. It is also clear from the literature that studies pertaining to endogenous level of polyphenols and the enzyme viz. polyphenol oxidase and phenylalanine ammonia lyase with respect to plant age are very limited.

Since polyphenols play an important role in developing defence machanism in plants against biotic and abiotic stress and as such soybean which is widely cultivated in Western Maharashtra is facing such stresses, it is thought worthwhile to study the endogenous level of polyphenols in soybean with respect to plant age.

In the present investigation therefore an attempt has been made to study the parameters such as total polyphenols, separation and quantification of phenolic compounds and enzymes involved in phenol metabolism viz. phenylalanine ammonia lyase, polyphenol oxidase 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.