IV SUMMARY AND CONCLUSION

Soybean (Glycine max (L.) merrl.) has shown tremendous growth in area and production in the country during recent past. A look on last one and half decade revealed an increase of 749% in area and 1554% in production in the country. It has occupied important place in Indian agriculture as well as oil economy and has revolutionized socio-economic status of soya-farmers. The crop has exhibited a vast potential as 'Kharip' crop in major area of cultivation and as 'Rabi' in Southern plateau of the country by occupying 4.25 million hectares, producing 4.62 million tons of soybean in India. In Maharashtra the area under soybean cultivation is about 4.60 lakh hectares. At present soybean cultivation in Maharashtra is 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.

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 practices, the major being inadequate use of fertilizers. Besides, soybean being luxurient crop, having lush green soft succulent and nutritive dense foliage is attacked by many types of insects and fungal diseases. Yield losses in soybean due to uncontrolled insect pests and fungal disease complex could be upto 50 per cent.

Thus, commensurate with the increase in area under soybean, biotic menaces have assumed serious proportions calling for a comprehensive crop protection umbrella. So far chemical insecticides and fungicides have provided satisfactory control of insects and fungal diseases and are finding increased uses in soybean production. However, due to their 'misuse' hazardous consequences like development of insecticide/fungicide resistance, occurrence

of minor pests as major pests, environmental contamination are inevitable in future. Further, the rural people use the pesticides indiscri-minately, unmeaningful of the concept of time, space and quality. This has posed a great danger to humanity.

According to various reports it appeared that the indiscriminate and unmeaningful use of pesticides has created not only harmful effects on man but also on crop plants on which they are applied (Hussey and Scoopes, 1985). There are also reports that pesticides caused detrimental effect to genetic material (Sharma, 1986).

Since soybean cultivation is being preferred by the farmers due to low input requirement of labour and nitrogenous fertilizers, similarly ability to fix atmospheric nitrogen enables this crop not only to meet its requirement for nitrogen but also to leave 30-60 kg/ha residual nitrogen for succeeding crop, it is thought worthwhile to study the nitrogen fixing ability of soybean under the influence of most widely used organophosphorus insecticide viz. monocrotophos and systemic fungicide bavistin. The nitrogen fixing ability of soybean was studied by analysing nitrogen, protein and amino acid content. Coupled with it the enzymes of nitrogen metabolism viz. nitrate and nitrite reductase were also studied. The other parameters studied include germination, growth, stomatal regulation, pigments, polyphenols, and mineral status, with a view in mind that the study will provide basic clue to envisage judicial use of pesticide and their possible effect on the above mentioned parameters.

Method of approach :

Germination study was conducted with surface sterilized soybean seeds of variety MACS-13 in petridish using different concentrations of monocrotophos and monocrotophos in combination with bavistin. The concentrations selected were below, at and above recommended levels. Similarly the plants were raised in an earthen pots were allowed to stabilize for one month. Then they were subjected to pesticidal treatment by employing foliar application upto runoff point. The concentrations selected for foliar spray were below, at and above recommended doses. The plant tissue was analysed for different physiological parameters after two consecutive foliar sprays at an interval of 15 days. The plant age at the time of analysis was 50 days. Dried plant material was acid digested and the acid digested extract was used for analysis of mineral content.

The results are discussed under the light of available upto date literature.

Conclusions :

1. None of the concentrations of monocrotophos and monocrotophos in combination with bavistin facilitates seedling growth when germinated in respective concentrations of the pesticides. However, lower concentration favours germination per cent.

2. Increasing concentrations of pesticides largely affect the root length.

3. The reduction in shoot length may be due to more transportation of pesticides to the meristematic zone of shoot apex through root system. However, to support this staement needs further investigation.

4. Recommended concentrations of monocrotophos and monocrotophos in combination with bavistin favours leaf area expansion.

5. Nodule formation, nodule diameter, leaves per plant and pods per plant greatly influenced by the foliar application of 0.15% (v/v) monocrotophos.

6. Stomatal study carried out with the help of steady state porometer reveals that soybean plant is amphistomatous in nature and transpire maximum through lower surface.

7. The increasing concentrations of monocrotophos and monocrotophos in combination with bavistin affect transpiration rate by increasing diffusive resistance for water.

8. Highest value for CO_2 resistance at high dose of pesticide clearly indicates that the concentrations above recommended doses affect the stomatal regulation and possibly develop constraint in the gaseous diffusion process.

9. Lower concentration of monocrotophos stimulate chlorophyll synthesis while inhibit at higher concentration.

10. The compatibility of monocrotophos with bavistin found to hinder metabolic activities by entering into tissue system either symplastically or apoplastically.

11. Carotenoid level do not affect much at lower concentration of monocrotophos but affect much at higher concentration, while none of the concentrations of monocrotophos in combination with bavistin favours carotenoid stimulation.

12. Monocrotophos at below and recommended dose stimulates polyphenol level but inhibit at higher concentration. Stimulation of polyphenols possibly help in developing resistance against pathogen attack. But a greatly expanding literature on the mechanism of action of pesticides and on the biological and physiological roles of secondary products will provide a better understanding of these relationships.

13. Nitrogen fixing ability judged by level of nitrogen content, protein content and amino acids clearly indicate that lower concentration of monocrotophos (0.075% and 0.15% v/v) stimulates this ability but the higher concentrations are detriimental. The compatibility of monocrotophos and bavistin do not help in stimulation of protein and nitrogen content over control. In this respect the activity of an enzyme nitrogenase will throw more light on nitrogen fixing ability of soybean under the influence of pesticidal treatrnent, which is in progress.

14. The increased amino acid level at higher concentration can be attributed to the inhibition of protein synthesis or increased protein hydrolysis or decreased use of amino acids as respiratory carbon sources and/or increased amino acid biosynthesis.

15. It is interesting to mention here that the changes in the composition of sugars and amino acids could be important in pathogenesis of foliar pathgens. Such changes induced by insecticides may result in development of itrogenic diseases since the changed chemical environment on the phylloplane may affect the growth of pathogens directly or indirectly altering the activity antagonists in the phylloplane. In this direction such studies concerned with the effects of growth

regulators, fungicides and herbicides on physiology and biochemestry of plants were made but very little information is available on insecticices commonly used in present day agriculture. The present investigation is a part of it, which needs further investigation to relate precisely the role of insecticide in plant growth metabolism.

16. The higher concentration of monocrotophos inhibits nitrate as well as nitrite reductase activity. The chloroplast enzyme nitrate reductase is dependent on photosynthetic electron flow to ferredoxin, which is used by the enzyme as reductant. Inhibitors of photosynthetic electron transport therefore stop or reduce the reduction of nitrite to ammonia ion. Possibly this may be the reason which can be attributed to inhibition of nitrate and nitrite reductase activity due to monocrotophos and monocrotophos in combination with bavistin. As such these pesticides brings reduction in photosynthetic pigments and constraint in CO_2 resistance.

17. The exploratory study on neutrient status level in soybean point out the need for detailed and indepth experiments with pesticides to clarify the mechanism involved in growth response and influence of pesticides on mineral uptake. Our knowledge at the moment does not extend much beyond the simple observations of changes in neutrient levels in various plant parts, that seem to have been brought about by the presence of pesticide. Hence it is not possible to decide whether they are the result of more or less efficient uptake and utilization or whether they indicate changes in requirement. The study on this line is in progress.

The overall message of this dissertation is that the widely used organophosphorus insecticide viz. monocrogophos and a broad spectrum systemic fungicide bavistin though are unfavourable at higher concentrations as a foliar spray, they are useful at the lower concentration. The compatibility of monocrotophos with bavistin is not suitable for stimulating germination and growth. From agronomic point of view , present investigation also convey that the pesticides should always be used either in the recommended concentrations or in the below recommended concentrations or in the below recommended concentrations for soybean. The soya crop inherently can sustain about 20% defoliation by leaf eating insects or by fungal attack, without any significant reduction in yield. It is therefore, advisable to apply insecticides/fungicides only when insect/fungal population exceeds "Economic Threshold Level" (ETL). Little ignorance in the use of concentrations above recommended doses may seriously affect the plant metabolism and will cause environmental pollution by persisting residual problem. Since soybean being a legume crop, fixes atmospheric nitrogen and leave residual nitrogen in the soil for succeeding crop, in order to part with sole dependence on chemical pesticides, an Integrated Pest Management (IPM) approach should be adopted. A feasible and socially acceptable IPM strategy in soybean involve aspects such as sowing time, trap cropping, use of resistant varieties, deep summer ploughing, balanced fertilizer dose and mechanical and chemical control.