CHAPTER - V

SUMMARY AND CONCLUSIONS

The population bloom in third world countries has created problems for food, fodder, clothing and shelter. To meet the ever increasing demand for food, scientific agriculture needs greater awareness. In today's intensive agriculture, pest and disease problems have been made worse. An important reserve for raising productivity and increasing gross output of agricultural products is the elimination of losses of the harvest due to pests, plant diseases and weeds. The adoption of crop protection procedures through use of pesticides therefore become essential. Use of pesticides is inevitable and constitutes an integral part of crop management practices. During the last four decades, the consumption of pesticides in India has increased from 154 MT in 1953-1954 to 54135 MT in 1999-2000. But in addition to their large merits, they have also created some serious global problems like environmental pollution, destruction of nontarget organisms, phytotoxicity, latrogenic diseases, loss of biodiversity etc. These problems come into existence particularly after green revolution.

In India in general and Maharashtra in particular due to lack of proper extension activities and insufficient literature supplied with pesticides, the illiterate rural people use pesticides indiscriminately. The excess use of pesticides for seed treatment and foliar spray causes harmful effects on plants and other living organisms including human beings. They have physiologically advantageous or depressive side effects on plants by influencing various physiological and biochemical processes of crop plants.

Glycine max(L.) Merr. is a oilseed crop with large number of cultivars. It is an important global crop providing high (38-45 %) protein content and high (20 %) oil content. At present, this wonder crop is suffering a lot by over 273 types insects and a large number of fungi, bacteria, viruses and root knot nematodes. An attempt is made to study the effect of fungicide Mandy M- 45 (Mancozeb 75 %) and the insecticide Anth (Chlorpyriphos 50% + Cypermethrin 5% EC) on seed treatment and foliar spray on *Glycine max*(L.)Merr. An attempt is also made to correlate this with biochemical changes after the treatment to seeds and foliar spray. The fungicide Mandy M- 45 (Mancozeb 75 %) and the insecticide Anth (Chlorpyriphos 50% + Cypermethrin5% EC) are commonly used by farmers to control fungal diseases and insect pests of soybean. Mandy M- 45 (Mancozeb 75 %) is a contact fungicide successfully used against rust of soybean. It inhibits enzyme activity in fungi by forming a complex with metal containing enzymes

including those involved in production of adenosine triphosphate (ATP). Anth (Chlorpyriphos 50%+ Cypermethrin 5% EC) is a broad spectrum insecticide used to control insect pests of soybean like tobacco caterpillars, white flies, jassids, thrips etc.

Healthy seeds of *Glycine max*(L.) Merr. were used for wet treatment of Mandy M-45 (Mancozeb 75 %) and Anth (Chlorpyriphos 50% + Cypermethrin 5% EC). In order to select a proper range of concentrations, a wide range of concentrations from 0.025 % to 2 % for both the pesticides was utilized along with two exposure periods of 6 h and 12 h. The treated and untreated seeds (25) were allowed to germinate in dark at 27 ^{0}- 30 ^{0} C in replicates of three in petriplates lined with moist filter paper. The number of germinated seeds was recorded after every 24 h upto 72 h. Growth analysis was carried out after 7 days growth of seedlings. From these results, the proper exposure periods and the promoting and inhibitory concentrations of both the pesticides were identified for further studies. These concentrations were 0.25%, 0.5%, 1.0% and 2% for both the pesticides with 6 h and 12 h exposure periods. Growth analysis was carried out after seven days growth of seedlings. Different biochemical constituents such as proteins, polyphenols, carbohydrates (reducing sugars, nonreducing sugars and starch) and some selected minerals and enzymes were determined from these seedlings.

Healthy seeds of *Glycine max*(L.) Merr. were used for wet treatment of both the pesticides using selected exposure periods and concentrations. The plants raised from these seeds in earthen pots were used for foliar sprays of both the pesticides after 10 days of growth of seedlings. Analysis of different biochemical parameters such as proteins, polyphenols, carbohydrates (reducing sugars, nonreducing sugars and starch) and some selected minerals and enzymes were carried out on 11 th day of growth. Growth analysis was carried out on 15 th day of growth. The significant findings are as below.

A. Germination Percentage :

1. At 6 h exposure period, all concentrations of Mancozeb stimulated germination, while at 12 h exposure period seed treatment, 100 % germination was scored upto 1 % concentration Higher concentration viz. 2 % caused reduction in germination percentage as well as delay in the seed germination was observed
2. A negative response was observed for all the concentrations of Anth (Chlorpyriphos +

Cypermethrin). Germination was greatly reduced and delayed by higher concentration of Anth (Chlorpyriphos + Cypermethrin) at 12 h exposure period. Germination was reduced to 10 % after 24 h at 12 h exposure period but recovered and reached upto 80% after 72 h.

B. Seedling Growth :

1. At both the exposure periods i.e. 6 h and 12 h stimulation in root length was observed with all the concentrations of Mancozeb.
2. Shoot growth was influenced by exposure period of the treatment rather than the concentration of Mancozeb. The seed treatment with 6 h exposure period of Mancozeb caused decrease in shoot length while 12 h exposure period seed treatment positively influenced shoot length.
3. The seed treatment with all the concentrations of mancozeb at 6 h exposure period positively influenced R/S , while negatively affected with 12 h exposure period.
4. All concentrations of Mancozeb with both the exposure periods stimulated rootlets over control.
5. At 6 h exposure period seed treatment only 0.25 % concentration increased fresh weight, while all concentrations of Mancozeb with 12 h exposure period seed treatment increased fresh weight over control.
6. In the case of seed treatments of Anth (Chlorpyriphos + Cypermethrin) with both the exposure periods, only 0.5 % concentration is stimulatory while higher concentration significantly caused reduction in root and shoot length over control
7. At 6 h exposure period seed treatment, all the concentrations of Anth (Chlorpyriphos + Cypermethrin) positively influenced R/S ratio. While at at 12 h exposure period seed treatment, higher concentrations are stimulatory to R/S ratio.
8. In general both the exposure periods and all concentrations of Anth (Chlorpyriphos + Cypermethrin) caused increase in RLN number except negative effect highest concentration at 12 h exposure period.
9. Seed treatment of all the concentrations of Anth (Chlorpyriphos + Cypermethrin) with both the exposure periods increased fresh weight over control.

C. Organic Constituents :

1.Mancozeb significantly reduced total sugars and starch content in soybean germinating seeds treated with 6 h exposure period. At 12 h exposure period, the total sugar content in general increased with increase in concentration of pesticide while no marked change has been observed in starch content.

2.Mancozeb seed treatment with both the exposure periods caused decrease in reducing sugar content.

3. Mancozeb seed treatment with 6 h exposure period caused increase in protein content over control. While at 12 h seed treatment, only 2 % concentration increased protein level.

4. Concentration wise increase in polyphenol content was observed with the seed treatment of Mancozeb at both the exposure periods.

5.Total sugars, reducing sugars, starch content and total carbohydrates increased with increase in concentrations of Anth (Chlorpyriphos + Cypermethrin). But at highest concentration viz. 2 % slight decline in reducing sugars was observed.

6.As per increase in concentration of Anth (Chlorpyriphos + Cypermethrin) seed treatment, accumulation of proteins in soybean seeds was recorded at both the exposure periods.

7.Total polyphenols increased with increase in concentration of Anth (Chlorpyriphos + Cypermethrin) which indicated a stimulation in secondary metabolism due to pesticide treatment.

D. Enzyme studies :

1.Protease activity inhibited with increase in concentration of Mancozeb and Anth (Chlorpyriphos + Cypermethrin) with both the exposure periods viz. 6 h and 12 h.

2. Concentration wise reduction in acid phosphatase activity was observed with the seed treatment of Mancozeb at both the exposure periods. While seed treatment with Anth (Chlorpyriphos + Cypermethrin) caused stimulation upto 1 % at both exposure periods, only higher concentration reduced activity over control.

3. No significant trend was observed in the Nitrate reductase activity with both the pesticides and exposure periods.

4. Seed treatment with both the pesticides viz. Mancozeb and Anth (Chlorpyriphos + Cypermethrin) and exposure periods viz. 6 h and 12 h not caused marked increase or decrease in catalase activity.

E. Mineral Nutrition :

1.The 6 h exposure period and seed treatment with lower concentration of Mancozeb caused decrease in Ca and Mg content, while higher concentrations at 6 h seed treatment and all the concentrations of Mancozeb at 12 h seed treatment caused stimulation in Ca and Mg content with increase in concentration of Mancozeb.At both the exposure periods viz. 6 h and 12 h exposure periods, seed treatment with lower concentration of Anth (Chlorpyriphos + Cypermethrin) reduced Ca content while higher concentrations increased it. The 6 h seed treatment with Anth (Chlorpyriphos + Cypermethrin) caused reduction in Mg content. While 12 h seed treatment caused accumulation of Mg content in treated seeds.

2. The utilization of Cu in the process of seed germination positively as well as negatively affected by both the pesticides and exposure periods.

3. No significant change in Fe content was recorded at the time of seed germination with the treatment of both the pesticides viz. Mancozeb and Anth (Chlorpyriphos + Cypermethrin) and both exposure periods viz. 6 h and 12 h.

4. Seed treatment with Mancozeb with both the exposure periods increased Mn content with increase in concentration while in general decrease of Mn content recorded with both the exposure periods and all concentrations over control.Amount of Mn decreased in all seeds treated with Anth (Chlorpyriphos + Cypermethrin) at both the exposure periods.

6. At 6 h exposure period, seed treatment with lowest concentration of Mancozeb decreased Zn content, while higher concentrations caused accumulation of Zn content in treated seeds as per increase in concentration. At 12 h seed treatment of Mancozeb accumulation of Zn content was recorded. At 6 h exposure period, seed treatment with lowest concentration of Anth (Chlorpyriphos + Cypermethrin) caused accumulation of Zn content, while higher concentrations decreased it in treated seeds. All concentrations of Anth (Chlorpyriphos + Cypermethrin) at 12 h exposure period caused accumulation of Zn content in treated seeds.

II. INFLUENCE OF SEED TREATMENT AND FOLIAR SPRAY :

A. Seedling Growth :

1. The seed treatment with both the exposure periods and foliar spray of Mancozeb caused increase in shoot length over control.At 6 h exposure period seed treatment with foliar spray of mancozeb increased root length, while 12 h seed treatment with highest concentration of Mancozeb caused decrease in root length while other concentrations were positively influenced.

2. Nodule number slightly increased with 0.25 % and 0.5 % concentration of Mancozeb, while higher concentrations of Mancozeb caused marked reduction in it at 6 h exposure period. In general negative response was observed with all concentrations and caused reduction in nodule number by 12 h exposure period treatment.

3. In general, increase in leaves number was observed with increase in concentration of Mancozeb at 6 h exposure period. No marked change has been observed with 12 h exposure period and concentrations of pesticides.

4. At 6 h exposure period seed treatment with all concentrations of Mancozeb slightly increased fresh weight while remarkably reduction was observed with 12 h exposure period with all concentrations..

3. Growth of seedlings positively influenced by the seed treatment and foliar spray of Anth (Chlorpyriphos + Cypermethrin) at 6 h exposure period, only higher concentration caused slight reduction. Similarly 12 h exposure period stimulated shoot length and root length except negative effect of highest concentration.

4. All the concentrations of Anth (Chlorpyriphos + Cypermethrin) at both the exposure periods significantly suppressed the development of nodules as per increase in concentration of Anth (Chlorpyriphos + Cypermethrin). While highest concentration of Anth (Chlorpyriphos + Cypermethrin) i.e. 2 % caused marked reduction.

5. Leaves number was increased with lower concentrations of Anth (Chlorpyriphos + Cypermethrin) at both the exposure periods. Only highest concentration caused reduction in number.

6. In 6 h exposure period, seed treatment with lower concentrations of Anth (Chlorpyriphos + Cypermethrin) increased fresh weight while higher concentrations caused decrease. All the concentrations of Anth (Chlorpyriphos + Cypermethrin) at 12 h

exposure period were highly phytotoxic causing reduction in fresh weight of *Glycine max* L. Merr. after the seed treatments and foliar spray.

B. Photosynthetic pigments :

1. Mancozeb treatment with foliar spray with all concentrations at 6 h exposure period stimulated total chlorophylls. At 12 h exposure period, lowest concentration only increased total chlorophylls. While concentration wise decrease in total chlorophylls was observed with higher concentrations of Mancozeb.

2. At 6 h exposure period seed treatment and foliar spray, all the concentrations of Mancozeb and lower concentrations at 12 h exposure period increased chlorophyll, while highest concentration caused marginal decrease.

3. The lowest concentration of Mancozeb increased amount of chlorophyll 'b', while at higher concentrations, reduction was recorded in both the exposure periods. Ratio of Chlorophyll 'a' to 'b' was found to be increased with respect to control at both the exposure periods.

4. The seed treatment with 6 h exposure period and foliar spray caused increase in carotenoids. The 12 h exposure period of seed treatment and foliar spray did not significantly influence cartenoid level.While higher concentrations caused marginal decrease.

3.Anth (Chlorpyriphos + Cypermethrin) seed treatments with both the exposure periods i.e. 6 h and 12 h and foliar sprays increased carotenoids.

C. Organic Constituents :

1. Reducing sugars increased with increase in concentration of Mancozeb seed treatment and foliar spray at both the exposure periods.The 6 h exposure period seed treatment and foliar spray caused decrease in total sugars with increase in concentrations of Mancozeb.The 12 h exposure period seed treatment and foliar spray caused concentration wise increase in total sugars in treated plants.

2. At 6 h exposure period seed treatment and foliar spray, lower concentrations of Mancozeb caused reduction in starch content and total carbohydrates,while at the higher concentrations it was increased. At the 12 h exposure period seed treatment and foliar

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spray, the highest concentration of Mancozeb remarkably increased the starch content and total carbohydrates over control.

3. At both the exposure period seed treatments and foliar spray of Anth (Chlorpyriphos + Cypermethrin), all concentrations decreased reducing sugars.

4. The seed treatment of Anth (Chlorpyriphos + Cypermethrin) with 6 h and 12 h exposure periods and foliar spray, the lower concentrations increased total sugars while the higher concentrations caused reduction in it. In general at both the exposure periods and all the concentrations of Anth (Chlorpyriphos + Cypermethrin) caused reduction in starch content and total carbohydrates, except slight increase with lowest concentration of Anth (Chlorpyriphos + Cypermethrin) at 6 h exposure period.

3. Protein content of *Glycine max* L. Merr. was increased with 6 h and 12 h exposure periods and foliar spray of both the pesticides viz. Mancozeb and Anth (Chlorpyriphos + Cypermethrin).

4. Mancozeb and Anth (Chlorpyriphos + Cypermethrin) seed treatment with both the exposure period and foliar spray stimulated the synthesis of polyphenols in *Glycine max* L. Merr.

D. Enzyme Studies :

1. Seed treatment of Mancozeb and Anth (Chlorpyriphos + Cypermethrin) with 6 h and 12 h exposure periods and foliar spray caused increase in activity of enzyme protease over control.

2. The seed treatment with 6 h exposure period of Mancozeb and foliar spray caused increase in nitrate reductase activity at lowest concentration, while all other higher concentrations caused inhibition with compared to control. The 12 h exposure period of seed treatment and foliar spray stimulated the enzyme activity with all the concentrations. Concentration wise reduction in nitrate reductase activity was observed with the seed treatment of Anth (Chlorpyriphos +Cypermethrin) at both the exposure periods and foliar spray.

3. Seed treatment with 6 h exposure period and foliar spray of Mancozeb caused concentration wise inhibition of acid phosphatase activity. Similar trend was recorded with Anth (Chlorpyriphos +Cypermethrin) seed treatment and foliar spray. Both the

pesticides caused increase in acid phosphatase activity with 12 h exposure period seed treatment and foliar spray.

4 The seed treatment of Mancozeb with 6 h and 12 h exposure period and foliar spray caused in general increase in enzyme catalase activity. While Anth (Chlorpyriphos + Cypermethrin) seed treatment with 6 h exposure period and foliar spray caused in general concentration wise inhibition of activity except lower concentration. The 12 h exposure period of seed treatment and foliar spray caused concentration wise increase in activity except the highest concentration i.e. 2 %.

Our studies revealed that, lower concentrations of Mancozeb stimulate seed germination and seedling growth. In general negative effect is caused in germination and growth of seedlings with the treatment of insecticide Anth (Chlorpyriphos + Cypermethrin).The seed treatment and foliar spray of Anth (Chlorpyriphos + Cypermethrin) caused phytotoxic effects with compared to Mancozeb.