V- Summary And Conclusions

Weeds are undesirable or unwanted plants growing where they are not wanted. Due to abundant seed production, vigorous vegetative growth and ability to survive in unfavourable conditions they compete with the crops and spread easily. Most of the weeds have been evolved along with the crops and they are adapted to disturbed habitats created by the activities of man. Growth of weeds in a field affects the yield of crops. Many weeds serve as hosts for insect pests and fungi. In rivers and streams, water weeds reduce the flow of water and eliminate activities such as swimming, fishing and boating. Some poisonous weeds are known to cause allergies to human being.

In ancient time man used very simple tools like sticks to remove weeds. Later on he started using metal hoe and animals. Use of chemicals for weed control started in the 20^{th} century. The discovery of 2,4-D in 1947 is a mile stone in the history of weed control. Today herbicides are widely used to control weeds in major food and fiber crops.

Glyphosate is a non-selective, broad-spectrum, herbicide used in field crops, orchards, plantation and ornamental crops etc. for controlling annuals and perennial weeds. It is absorbed easily by the leaves and translocated to different parts of the plant. Due to non-selective nature it can cause a serious damage to the

crops, if applied without taking proper precautions. In the present investigation an attemp has been made to analyse effect of glyphosate on dicotyledonous and monocotyledonous crops and weeds, namely soybean, wheat, Cyperus rotundus and Celosia argentea. These plants were raised in pots and then subjected to foliar sprays of 300 ppm glyphosate after three weeks growth. The plant material was harvested on the II and the X day after treatment and used for various physiological and biochemical analysis. A control set of respective crop or weed species was also maintained and analysed simultaneously along with the glyphosate treated plants. Results are summarised in the following pages.

1. Water Relations

a) STOMATAL BEHAVIOUR

Porometric analysis revealed an increase in diffusive resistance of wheat and soybean due to glyphosate treatment. Transpiration rate was also enhanced as compared to the control plants. In Celosia transpiration rate decreased a little initially but then increased on X day after treatment. Diffusive resistance remained more or less stable in this weed after the treatment of glyphosate.

b) STOMATAL INDEX

A decrease in stomatal index was observed in the glyphosate treated plants, particularly on the X day after treatment. The values of stomatal indices were affected more in the weeds than in the crops by the glyphosate treatment.

c) RELATIVE WATER CONTENT

Glyphosate decreased R.W.C. in all the treated plants as compared to the control plants. The effect was slightly more in case of Cyperus.

d) OSMOTIC POTENTIAL

A marginal increase in the osmotic potential was observed in all the treated plants on II as well as X day after treatment of glyphosate.

2. **Organic Constituents**

A. TOTAL CHLOROPHYLLS AND CAROTENOIDS

About 40% reduction in total chlorophyll content was observed in the crops soybean and wheat due to glyphosate treatment. In the weeds this loss was less than 20%. Similarly carotenoid content in both the crops was reduced to a greater extent (more than 50%) as compared to the weeds.

B. TOTAL POLYPHENOLS

Phlyphenol content increased in all the treated plants and the accumulation of polyphenols was significant on the X day as compared to the II day after treatment. Maximum polyphenol content was observed in Cyperus (57%) followed by soybean (55%).

C. CARBOHYDRATES

Total sugars and starch content in all the glyphosate treated plants decreased with a parallel increase in the reducing sugars , on both the days after treatment. In soybean and Cyperus though the total carbohydrate content decreased initially, it was restored on the X day after treatment. In wheat and Celosia a continued decline in the carbohydrate content was observed due to glyphosate treatment.

D. SOLUBLE PROTEINS

Protein content was found significantly reduced in all the glyphosate treated plants, particularly on the X day after treatment. Protein degradation was maximum in the weeds as compared to the crops.

E. FREE PROLINE

Glyphosate induced a remarkable increase in the free proline level in the crops and weeds studied.

F. FREE AMINO ACIDS

Chromatographic analysis indicated a higher turnover of amino acids in the glyphosate treated plants as compared to the control plants. The number of total amino acids detected was more in case of glyphosate treated plants.

3. **Mineral Constituents**

A significant decline in nitrogen, potassium and magnesium content was observed in glyphosate treated plants. Phosphorus also decreased due to glyphosate but the amount did not differ much in control and treated plants. A marginal increase in calcium content was observed on both the days after treatment in all the plants treated with glyphosate. An increase in the iron content was also exibited by all the plants on both the days after treatment.

4. **Enzymes**

Effect of glyphosate on some hydrolytic and other enzymes was analysed in the glyphosate treated and untreated plants.

A. **Hydrolytic enzymes**

A two fold increase in α-amylase activity was observed in Cyperus, Celosia and soybean treated with

glyphosate on both the days after treatment. In wheat about 4-5 fold stimulation in α-amylase activity was found in the treated plants. Activity of protease increased twice over the control in all the glyphosate treated plants. Similarly the level of acid phosphatase was also stimulated in the plants treated with glyphosate. Maximum level of acid phosphatase activity was detected in wheat followed by Celosia, on the X day after treatment.

B. **Nitrate reductase and nitrite reductase**

Glyphosate inhibited both the NR and NIR activities in all the treated plants, the effect being more visible on the X day after treatment. Soybean exhibited maximum decline in NIR level which was observed on the X day.

C. **Pholyphenol oxidase and IAA oxidase**

Glyphosate stimulated the activity of PPO in both the crops and weeds. The rate of stimulation was greater in soybean and Cyperus as compared to that in wheat and Celosia. An increase in IAA oxidase activity in glyphosate treated plants indicated an increased metabolism of IAA in these plants. In Celosia a five fold increase in IAA oxidase activity was observed whereas Cyperus exhibited minimum influence on IAA metabolism.

5. **Residual Analysis of glyphosate**

Residual content of glyphosate was detected in all the treated plants on the II and X day after treatment as indicated by TLC

When the effect of glyphosate with respect to the weeds and crops was analysed, it was observed that water relations are more affected in weeds than in the crops. Protein degradation was also higher as compared to the crops. However loss in photosynthetic pigments and increase in the hydrolytic enzyme activities was moderate in the weeds as compared to the crops. Thus a degree of resistance was observed in weeds particularly in Cyperus. Soybean was much sensitive to the glyphosate treatment as indicated by a remarkable reduction in photosynthetic pigments, and increased hydrolytic enzymes and decreased NIR activity.

The results indicate that glyphosate affects the growth and metabolism of all the plants subjected to its treatment. The response may vary with respect to the crop and weed but the overall influence is negative resulting ultimately in the death of the plant. Therefore proper care should be taken while using this herbicide in the crop fields.

All the findings are discussed in the light of recent and relevant literature referred from time to time during the course of work.