V SUMMARY AND CONCLUSIONS

Plants are often attacked by pathogens causing a considerable reduction in the yield. Pesticides are used to protect the plants from various disease-causing organisms from ancient time. However the beneficial use of pesticides is followed by many drawbacks. Residual occurrence of the pesticides, especially insecticides, has been detected in air, water, milk, vegetables, fruits, oils, fishes, eggs etc. Consumption of such contaminated food materials causes harmful diseases to human beings and animals. The nonselective and liberal use of these chemicals, particularly the stable organochlorine compounds, has created many problems. An appreciable amount of these compounds, when used on standing crop, remains in soil in the form of residue. These residues can affect the germination and growth of the seed sown in the next season.

In the present investigation biochemical effects of two widely used insecticides viz. Endosulfan and Methyl parathion have been analysed during germination and growth of jowar seeds. Endosulfan is an organochlorine compound whereas Methyl parathion belongs to organophosphorus group. Jowar seeds were germinated in different concentrations of these pesticides along with a control set, maintained simultaneously in distilled water. Germination percentage and seedling growth was measured after every 24 h upto 96 h of germination. Starch content was estimated everyday. Activities of hydrolytic and respiratory enzymes were also determined every day upto 120 h

of germination. Results are summarised in the following pages under different headings.

1) Germination percentage :-

Germination percentage decreased gradually at the higher concentrations, while a slight stimulation in germination percentage was observed at lower concentrations of both the pesticides. The overall effect of pesticidal treatment on germination was inhibitory in nature.

2) Seedling growth :-

Development of seedling in presence of Endosulfan and Methyl parathion was studied from 48 to 96 h of germination.

a) Root and shoot growth :- Length of the shoot decreased with increasing concentrations of Endosulfan throughout the duration of experiment. The rate of shoot development was affected as compaired to that of control. In Methyl parathion treated seeds also a retardation in shoot development was evident with increasing concentrations. The rate of shoot growth was much less as compaired to untreated seeds.

Radicle development was slightly stimulated at lower Endosulfan concentrations, however the rate

of growth decreased with increasing concentration of pesticide and the germination hours. Methyl parathion treatment exhibited a retardation in root growth at all the concentrations studied.

b) Root/shoot ratio : Root to shoot ratio was higher than that of control in seeds treated with Endosulfan, after 48 h of germination. A decrease in this ratio was observed with the progress in germination in both the treated as well as untreated seeds, due to improved rate of shoot growth. Effect of Methyl parathion was more toxic than Endosulfan. At lower concentrations of Methyl parathion root to shoot ratio was higher than that of control and it was less at medium and higher concentrations of pesticide during all the stages of germination.

c) Percent phytotoxicity : Phytotoxicity of Methyl parathion increased with increasing concentrations and duration of germination. Lower and Medium doses of Endosulfan were found non-toxic and stimulatory for seedling growth as revealed from the negative values of phytotoxicity. However toxic effect increased gradually with the progress in germination. Higher concentrations of Endosulfan were toxic from the begining and the phytotoxicity increased with increasing hours of germination.

d) Seedling weight : The weight of seedling decreased gradually with increasing Endosulfan concentrations except for the lowest (0.05%) concentration, where the seedling weight was about 1.5 times the weight of control seedling. In Methyl parathion treated seeds weight was less than that of control at all the concentrations of pesticide. The number of well germinated seeds was also less and the weight of seedling remained more or less constant at lower and medium concentrations of Methyl parathion.

e) Lateral roots : Development of lateral roots was observed only in control seeds and in seeds treated with lower concentrations of Endosulfan, after 72 h of germination. The number of seeds bearing lateral roots and the number of lateral root per seedling increased after 96 h of germination. No development of lateral roots was found upto 96 h of germination, at all the concentrations of Methyl parathion studied.

3) Starch content :- Amount of starch decreased gradually in all the treated as well as untreated seeds with progress in germination. At higher concentrations of Endosulfan the rate of breakdown of starch was very slow as compaired to that at lower concentrations. The effect of Methyl parathion on starch content resembled that of Endosulfan, exhibiting a continuous

decrease upto 120 h at lower concentrations and a steady decrease at higher concentrations upto 96 hours.

4) Enzyme activities :-

Activities of some hydrolytic and respiratory enzymes were determined after every 24 h upto 120 h of germination in jowar seeds treated with Endosulfan and Methyl parathion.

A) Hydrolytic enzymes :-

a) α-amylase : The enzyme activity appeared much affected during early hours of germination under pesticidal treatment. A decrease in α- amylase activity was observed at higher Endosulfan concentrations. Further with the progress in germination the activity increased over control seeds. A continuous increase in enzyme activity was found in seeds germinated in lower concentrations of Endosulfan. An inhibition of α-amylase activity was observed in seeds treated with higher Methyl parathion concentrations whereas at lower and medium concentrations the activity was stimulated.

b) Protease : Protease activity exhibited a distinct increase over control after 48 h of germination, at lower concentrations of both the pesticides. A slight inhibition in the activity was detected at medium and higher

concentrations of Endosulfan during later stage of germination.

c) Acid phosphatase : A stimulation in Acid phosphatase activity was noticed at lower and medium doses of Endosulfan on fourth and fifth day of germination. The enzyme level recorded at higher concentrations of Endosulfan was much less than that of control on fourth and fifth day of germination. In Methyl parathion treated seeds more or less similar pattern of enzyme activity appeared. The peak of enzyme activity shifted behind towards early germination hours with increase in concentrations of both Endosulfan and Methyl parathion.

d) Alkaline phosphatase : Alkaline phosphatase activity increased continuously upto 120 h of germination at lower and medium concentrations of Endosulfan. Higher concentrations of the pesticide suppressed the enzyme activity at all stages of germination. In case of Methyl parathion treated seeds the enzyme activity increased upto 72 h of germination at all the concentrations.

Damaged membrane structure owing to the pesticidal stress may result in increasing activities of hydrolytic enzymes.

B) Oxido-reductases :-

a) Peroxidase : Peroxidase activity was followed upto 2 minutes. Major part of the activity was exhibited during first minute with a decreased rate of reaction thereafter in the control as well as seeds treated with Endosulfan. A stimulation in the enzyme activity occurred at lower and medium concentrations of Endosulfan, after 72 and 96 h of germination. Effect of Methyl parathion on peroxidase activity was more toxic that that of Endosulfan. A suppression in the enzyme activity appeared at all the concentrations of pesticide used.

b) Catalase : A significant increase in catalase activity over control, was the characteristic of seeds treated with higher Endosulfan concentrations. The enzyme activity decreased rapidly after 72 h of germination at lower and medium concentrations of Endosulfan. Similarly a continuous decline in enzyme activity was observed with the progress in germination in presence of lower and medium concentrations of Methyl parathion. Increased rate of respiration in the pesticidal environment may result in higher catalase activity.

Thus the treatment of pesticide exerts a number of harmful effects on germination and seedling growth of crop plants. Osmotic stress developed due to these

chemicals brings about alterations in many biochemical processes of growing seedling. Overall metabolism of the seedling is disturbed. This results in an increased rate of respiration, expressed by the elevated levels of respiatory enzymes.

All the findings summarised so far are discussed in the light of relevant and recent literature referred from time to time during the completion of the work.