Chapter 5

CONCLUSIONS

CONTENTS

5.1 PROMINENT FEATURES OF THE STUDY AREA

Investigation of plant's response to gaseous air pollutants under field conditions was one of the main objectives of the present study. Observations revealed the following prominent features of the study area in relation to its ambient air quality status :

The concentration and combination of pollutants showed a wide range at different zones.

Sources of pollutants were of different types, which included different types of industries, brick kilns automobiles and domestic fuel.

A large number of industries (369) were localized in a small area (5 Km^2) at zone VII and VIII. This created a complex situation causing severe damage to vegetation.

The pollutants concentration showed high fluctuations (with manifold increase) from average concentration. The fluctuation of pollutant concentration, presence of multiple point sources and variety of pollutants decreased the chances of occurence of pollution free periods in the fields. Constant exposure to such conditions resulted in heavy damage to the vegetation.

Seasonal variation in meteorological factors modified the pollutant effects at all the zones.

5.2 FIELD SURVEY OF COMMON CROPS

Field survey done for common crops showed that the extent of damage was different at different zones. Though all the crops showed adverse effects of pollution, the degree of damage varied with different crops. This exhibited differential sensitivity of species and their response to different status of air qualities.

More damage was recorded at windward zones and less at leeward zones at low pollution zones. Near high pollution zones (V, VI, VII & VIII) influence of wind direction was very less. Gradient analysis done at few zones (III & V) revealed that the damage was more at zones nearer to the pollution source than at distant zones.

Tobacco showed lesser damage than the other two species (pigeon pea and potato). Highest sensitivity was exhibited by pigeon pea, severe defoliation was observed at zone VI, under acute exposure in early ages, which resulted in high reduction in net fruit yield. This loss could not be recovered even with the reduction in pollutant concentration at later stages. This clearly depicted the impact of fluctuating concentration of pollutants. Potato was cultivated at few zones only and exhibited reduction in various growth parameters.

5.3 POTTED PLANT EXPOSURE

The study was conducted to know the differential response of different species to same environmental condition and at the same time to know the response of a single species to different levels of air quality. Tolerance or sensitivity of the species was also compared.

The species investigated (tobacco, egg plant and potato) showed additive effect of pollutant combinations. Long term continuous exposure to pollutants resulted in heavy loss to growth productivity and economic yield of the studied species at all the zones (except for tobacco at zone II). Foliar sensitivity was high and any visible or invisible injury to it resulted in reduced dry matter accumulation. Growth analysis of relative growth rate (RGR) and net assimilation rate (NAR) also exhibited adverse effects of pollution stress. More susceptibility of the species was observed when their RGR was higher. Tobacco showed lesser damage in all the growth parameters as compared to the other two species.

Biochemical parameters were also influenced by pollution stress. Chlorophyll content of all the three species was reduced under different levels of pollution. Greater reductions were recorded in egg plant and potato. Tobacco showed comparatively less damage. Lesser reduction in chlorophyll content in tobacco helped this species to become more tolerant. Sugar content of plants was also reduced, which showed that their synthesis was affected. Damage to chlorophyll and reduction in photosynthate both resulted in reduced growth of plants.

The pollutant uptake was observed through the estimation of their elements (sulphur, nitrogen and chloride) in foliar tissue. Positive correlation between sulphur content and ambient SO_2 levels was observed. Nitrogen content was also increased but it did not show linear relationship with the NO_x levels in the atmosphere. Chloride content was increased at zone II and VIII and showed correlation with chlorine concentration in the ambient air.

The net pollutant uptake (during whole life cycle) and rate of pollutant uptake (at different ages) both were different in different species. The net uptake was more in tobacco, while rate of uptake in early stages was more in egg plant. This resulted in higher sensitivity of the later species at early stages which could not be recovered at later stages resulting in more damage than tobacco. It was observed that all the three species were more sensitive during their active growth period . The rate of pollutant uptake was also higher at this stage. This showed a positive relation between rate of pollutant uptake and age of higher susceptibility of the species.

The pollutant uptake per unit area was less in tobacco as compared to the other two species. This helped in dilution of absorbed pollutant resulting in less damage. The tolerance of tobacco was attributed to reduced rate of pollutant uptake in early stages, greater assimilation of pollutant in later stages and lesser absorption of pollutant per unit area. It was

found to be a better scavenger than the other two species as it absorbed more pollutant (net accumulation) and exhibited lesser damage.

In all the three species it was observed that visible injury was very less as compared to invisible injury (growth suppression, reduced metabolism etc.). It was observed that moderately polluted atmosphere can also cause severe damage if combination of pollutants are present in an area. The damages recorded cannot be attributed to a single pollutant, because the toxicity of one pollutant is modified by presence of other pollutants and creates a complex situation.

5.4 ARTIFICIAL FUMIGATION

The study was conducted to know the impact of high concentrations of SO_2 under simulated conditions. It was observed that SO_2 could reduce the vigour of plants causing potential damage to exposed plants. The degree of damage recorded under simulated conditions was less as compared to field conditions (5.3). This showed that sporadic nature of fumigation associated with pollution free period and stress of single pollutant is less harmful than continuous long-term exposures of mixture of many pollutants.

5.5 MITIGATION OF POLLUTION DAMAGE

Two chemicals were used to mitigate the pollutant injury. Ascorbic acid treatment was given under simulated conditions as well as under field conditions. Urea treatment was given to field exposed plants. It was observed that both the chemicals resulted in improved growth of the species investigated. Uptake of ascorbic acid was exhibited by increased foliar content of ascorbic acid. In urea treatment also ascorbic content of plants was increased, which was due to increased chlorophyll content. In both the cases higher ascorbic acid content resulted in reduction of pollutant injury because of its involvement in various metabolic processes specially in SO_2 reduction.

Effect of both the chemicals was most pronounced at the maximum growth rate period. At the same age higher susceptibility was observed in previous experiments (5.3). Determination of higher sensitivity age can help in application of mitigating agent at right stage and in proper utilization of mitigating agents.