CHAPTER IV

SUMMARY & CONCLUSIONS

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A class of chemical compounds termed as plant growth regulators influences the growth and development of plants. These organic compounds are either synthetic or naturally occurring other than metabolites, nutrients or vitamins and they act at relatively very low concentrations. Many workers predict that plant growth regulator industry has got a great future, in the light of role of these compounds in chemical manipulation of crop growth and development. An aromatic phenolic acid, salicylic acid is one such plant growth regulator. It is interesting to note here that acetyl derivative of this compound is a very well known drug aspirin which is adminsited for the cure of several human disorders. The involvement of this compound in regulation of varity of metabolic process in plants has prompted the researchers like Raskin (1992) to argue that this compound should be included in the category of phytohomones. In the present investigation and attempt has been made to study the influence of this compound on seed germination. Several workers noticed that monocots and dicots differ considerably in their response to phytohomones such as auxins (in particular antiauxin like 2,4-D). Hence it was thought worthwhile to employ dicot crop seed moong and monocot crop seed wheat for the purpose of present investigation.

Salicylic acid at higher concentrations (above 50 ppm) brought about a marked decline in germination percentage during early hours in both the crops and in this respect wheat was found very sensitive than moong. Salicylic acid caused a decrease in shootlength, Rootlength and fresh weight in both moong and wheat. The shoot growth was more sensitive to SA treatment than the root growth in case of wheat on the contrary in moong there was a greater reduction of root growth by SA treatment than shoot growth. SA is detected in root exudates of many plants and our finding indicate that this compound has got an allelopathic potential. Since it can affect both root and shoot growth. As we have already seen in chapter review of literature there are some reports about stimulation of growth and enhancement of yield by SA sprays. But our observations indicate that at germination stage SA is acting as growth retardant rather than growth stimulator.

It was noticed that SA caused an increase in water uptake during initial phase of seed germination in both the crop and this effect was more prominent in case of wheat. It is reported by some workers that growth inhibitor ABA which generally inhibits seed germination and imposes seed dormancy affect the process of water uptake. Eventhough SA has caused inhibition of seedling growth in both moong and wheat the water uptake is not affected by SA. Thus the hydration and activation of enzyme proteins by the water during seed germination in wheat and moong is probably not affected by SA treatment.

The rate of respiration is significantly reduced by SA treatment in case of wheat. Such effect was seen only at higher concentrations in case of moong. Respiration represents one of the key metabolic processes during seed germination since it provides energy for the developing embryo axis in the form of ATP and serves as source of carbon skeleton for various metabolic processes. The inhibition of respiration by SA would pose limitations on the ATP availability and availability of carbon skeleton in germinating seed. And this can become one of possible reason for inhibition of seedling growth. The activity of enzyme dehydrogenase was considerably affected by SA treatment in case of wheat seeds. In case of moong the dehydrogenase activity appears to be less sensitive to SA treatment since inhibition noticed at higher concentration. In the respiratory process several dehydrogenases are involved and their contribution to the electron transport chain is of paramount importance since the reducing equivalence in the from of NADH, FADH2 are generated in the reactions catalyzed by these enzymes. Thus inhibition of dehydrogenase by SA can affect indirectly the process of respiratory electron transport and ATP transport.

It was noticed that activity of α-amylase was inhibited along with increase in SA concentration in case of wheat seeds. On the other hand up to 100 ppm SA treatment the enzyme activity in moong was not at all affected (or even slightly stimulated) α-amylase plays a key role in the hydrolytic breakdown of the measure carbohydrate reserve during seed germination. This enzyme served as an excellent model for demonstration of hormonal regulation of seed germination. Since gibberlins are found to induce *de novo* synthesis of α-amylase enzyme and ABA counteracts the GA effect. Since in the present investigation although the enzyme α-amylase activity is found to be inhibited by SA (particularly in wheat) the inhibition was not total and hence SA may be influencing the activity of enzyme protein rather than its synthesis.

It was observed that the activity of enzyme acid phosphatase was inhibited by SA treatment in case of wheat though there was no linearity of response along with increase in SA. On the other hand in moong the enzyme activity was considerably stimulated by SA treatment. The lower concentrations of SA have caused increase in alkaline phosphatase in wheat where as at higher concern enzyme activity show decline. On the contrary opposite pattern was noticeable in case of this enzyme in germinating moong seeds. Both acid and alkaline phosphatases are responsible for breakdown of several phosphates in the cells and in this way they provide inorganic phosphorus for various synthetic reactions during seed germination phytin represents one of important phosphorus reserve in wheat and degradation of phytin is also brought about by acid phosphatase. It is evident from present investigation that phosphorus metabolism is disturbed due to SA treatment.

The activity of enzyme nitrate reductase was found to be stimulated due to SA in both moong and wheat especially at higher concentration. Enzyme nitrate reductase catalyses the 1^{st} step of nitrogen assimilation process in higher plants and it is regarded as rate limiting step in nitrogen assimilation. However in germinating seed the promotion of NR in germinating seed may not play such imp role at least during early phase, since nitrogen for various synthetic processes is made available by breakdown of reserve proteins and amino acid interconversion. But positive influence of SA on NR at latter stages of plant growth will definitely improve the nitrogen status and overall productivity.

The activity of oxidative enzyme catalase was found to be inhibited by SA in case of wheat On the other hand the enzyme activity was relatively stable in case of moong. Catalase is an important free radical scavenging enzyme in plant, since it catalyzes breakdown of H_2O_2.

The inhibition of catalase can lead to accumulation of H_2O_2 in plant tissue which can cause free radicle damage in the plants and thus reduce the growth. Such situation may be prevailing in case of wheat. The catalase enzyme in moong appears more tolerant in this respect. It is suggested by some workers that SA is directly binding catalase and causes free radicle stress and oxygen toxicity (Chen *et al.,* 1993). There are several isozymes of different enzymes including catalase in plant system. Only a detail study of catalase isozyme pattern in wheat and moong will throw light on different behavior of contrasting response of this enzyme to SA treatment.

The activity of enzyme peroxidase was inhibited by SA treatment in both wheat and moong. In this respect the enzyme activity in moong appears more sensitive than that of wheat to SA treatment although SA is secondary metabolite. It is found to inhibit the activity of enzyme peroxidase. Which plays key role in secondary metabolism. Besides secondary metabolism peroxidase involves in auxin catabolism and ethylene biosynthesis. Thus inhibition of this enzyme by SA can lead to alteration in several facets of metabolism.

The level of photosynthetic pigments Chl a and Chl b was decreased in all the treatments (except 10 ppm SA) in case of wheat. On the other hand SA treatment caused increase in the level of both the pigments in moong but Chl a/b ratio was reduced by SA treatments in booth the species. Higher doses of SA (50, 100 and 200 ppm) elevated the levels of Viloxanthin, Anthraxanthin, Lutein, Zeaxanthin, Total carotenoid/chl, Xanthophyll pool and Z+A/V+A+Z in wheat seedlings. In moong seedlings the content of Viloxanthin, Anthraxanthin, Lutein, Zeaxanthin, Xanthophylls were increased by 200ppm SA treatment, while β-carotene, total carotenoid and Z+A/V+A+Z ratio (epoxidation rate) increased over the entire range of SA treatment. Under stress conditions the level of Chlorophyll decreases and level of other pigments (particularly Zeaxanthin) increases. In our experiment also due to SA treatment the level of pigments (particularly Zeaxanthin) was increased. The level of Chl decreased in wheat. But it is interesting to note that Chl level increased in case of moong.

It is evident from the foregoing account that SA exerts a marked influence on various aspects of metabolism during seed germination of both wheat and moong. At the same time it is clear that the metabolic responses of monocot seed wheat and dicot seed moong are not identical. Only detailed studies at molecular level will throw more light on this difference.