CHAPTER – IV

SUMMARY AND CONCLUSION

Agriculture has been the backbone of Indian economy. Today we are facing with new set of challenges like increasing human population, declining arable land, water resources, environmental degradation, biotic and abiotic stresses. The main agenda before the plant physiologist is to address the new challenges of agricultural research and to develop strategies to increase productivity and improve quality of crop for fulfilling the demands of tremendously increasing population. Among the several technologies plant growth hormones and growth regulating substances is one of such strategy which plays a pivotal role in increasing agricultural production at an unprecedented rate. It regulates various key plant processes and ameliorates the adverse effects of various environmental stresses. The application of plant growth regulators having several striking economics success, have already been achieved in many species.

Salicylic acid has been implicated as one of the new phytohormone (Raskin, 1992a). Its possible role in thermogenesis, signal transduction and disease resistance suggests that salicylic acid meets the qualifying criterion for a plant hormone. The roles of salicylic acid in plants have been relieved by Raskin (1992 b). In view of its wide spectrum effectiveness on various aspects of plant growth and development, there remains a need to assess the role of salicylic acid on the physiological aspects of groundnut. In this regard present invention has been made to assess the influence of foliar application of salicylic acid on various physiological aspects of groundnut (Cv. W-44 and Cv. SB-11) which has been considered as an important cash crop among all the oilseed crops.

The effect of application of SA on some parameters related to growth was recorded. In both the groundnut cultivars shoot-root length, number of branches and leaves, number of root nodules, leaf area and number of pods per plant increased by the SA treatments. The lower concentrations of SA stimulate height, number of leaves and branches as well as number of pods in both groundnut cultivars while higher SA stimulates leaf area and number of nodules in cultivar of groundnut. Similarly SA increases fresh and dry weights of shoot and root in studied cultivars of groundnut. Thus it is evident from present investigation that the SA plays very positive role in growth performance of groundnut.

The application of higher concentration of SA increased all components of chlorophyll in both cultivars of groundnut. Incase of Cv. W-44 only 100 ppm SA

effectively increased the carotenoid contents while incase of Cv. SB-11 both 100 and 200 ppm SA treatments caused enhancement in carotenoid contents. Chlorophylls are the important photosynthetic pigments and carotenoids are accessory pigments conferring protective mechanism against photoxidation of photosystems. Some workers (Agarwal, *et al.* 2005, Tuna *et al.,* 2007) have putforth the correlation between antioxidant enzymes activities and contents of photosynthetic pigments. According to them, the increases in the activities of enzymes are due to increased contents of chlorophylls and carotenoids leading to the increase in total biomass of the plant. Our findings are also in agreement with these reports.

The several reports revealed the influences of SA on regulation of enzyme activities. However in the present investigation SA influenced nitrate reductase activity differentially in both groundnut cultivars. Incase of Cv. SB-11, higher concentrations (100 and 200 ppm) of SA brought about induction of activity of nitrate reductase. In contrast to it the activity of enzyme was declined by all SA concentrations in Cv. W-44. The nitrogen requirement of groundnut is much higher than cereals, as it contains high proteins and most of the nitrogen requirement is being met through nitrogen fixation in it.Nitrate reductase is the first enzyme involved in the assimilation of nitrogen and its activity is associated with protein synthesis and plant growth. Thus of Cv. SB-11 shows better performance than Cv. W-44, help in nitrogen assimilation of groundnut.

Salicylic acid influenced induction in the activity of enzyme glutamate dehydrogenase more significantly only by 50 ppm concentration in both the cultivars of groundnut. Enzyme dehydrogenase is an important respiratory enzyme catalyzing the electron transport chain, generating reducing potentials NADH and $FADH_2$. Dehydrogenase is fundamental energy yielding enzyme involved in various metabolic processes. Thus increased dehydrogenase activity in response to SA will be participated in respiratory energy generating processes which would helpful for growth of groundnut.

It has been noticed that SA caused an increase in activity of peroxidase enzyme. Successive increase in peroxidase activity occurred with increaseing SA concentrations in both the groundnut cultivars except 50 ppm treatment in Cv. SB-11. But more significant results were obtained with 100 and 200 ppm SA doses. Peroxidase is H_2O_2 degrading enzyme, besides it also carries processes such as auxin cataboloism, suberization, lignifications and ethylene biosynthesis. It has significant importance in defense mechanism. Thus results of present investigation revealed positive impact of

SA on peroxidase in both the groundnut cultivars in development of defense mechanism and helps to mitigate both biotic and abiotic stresses in groundnut.

The activity of enzyme catalase was stimulated by SA but noticeable increase reported with 100 and 200 ppm SA treatments in Cv. SB-11. However, SA showed inhibitory effect on enzyme catalase in Cv. W-44. Catalase is free radical scavenging enzyme rapidly decomposing the hydrogen peroxide. It also plays important role in photorespiration and symbiotic nitrogen fixation. Thus SA can regulate the activities of antioxidant enzymes and it would increases plant tolerance to various abiotic stresses particularly in Cv. SB-11.

The stomatal transpiration was found to be reduced by higher concentrations (100 and 200 ppm) of SA in Cv. W-44 while incase of Cv. SB-11 higher (100 ppm) as well as lower (5 ppm) concentrations of SA reduced transpiration rate.From our investigation it is clear that SA positively affects the transpiration, in both the groundnut cultivars. Earliar the role of SA in stomatal functioning has been emphasized by Larque-Saavedra (1979), Rai *et al.* (1986) and Aldesuquy *et al.* (1998).They emphasised the function of SA as antitranspirant compound.

Very little work has been carried out on the impact of SA on mineral status in plants. In present work SA caused positive alterations on mineral status in selected groundnut cultivars in differential manner. The accumulation of P by all SA treatment especially by 100 and 200ppm treatments noticed in both cultivars of groundnut. As phosphorus is involved in photosynthesis, respiration, carbohydrate metabolism and N_2-fixation, carbohydrate metabolism its increased levels by SA might be involved positively in growth and development of groundnut.

A higher concentration (100 and 200 ppm) of SA was found to be more effective for potassium accumulation in Cv. W-44, whereas in addition to higher concentrations, lower SA treatments (5 ppm) also caused more accumulation of potassium levels in Cv. SB-11. It is revealed from these results that increased uptake of potassium will influences stomatal behavior, leading to control over transpiration rate.

The application of SA (5 and 100 ppm) was influenced favorable accumulation of calcium in Cv. SB-11 and Cv. W-44. Calcium is very essential for the peg and pod development of groundnut. Its deficiency causes unfilled pod-'pops' formation. In this regard obtained results not only fulfil the demand of Ca but also benifited for reduction in pops formation in groundnut.

Incase of status of magnesium SA was influenced differentially in both the groundnut Cv. W-44 and SB-11. SA found to be increase magnesium levels in Cv. W-44 whereas in Cv. SB-11 magnesium status was less sensitive to SA application. Magnesium activates enzymes involved in various physiological reactions. Its deficiency causes tikka-disease on groundnut leaves. Thus increased levels of magnesium by SA could mitigate appearance of tikka-disease in leaves of Cv. W-44 than Cv. SB-11.

SA was showed stimulatory impact on levels of iron. Both cultivars were found to be increased accumulation of iron in uneven manner. As the iron is one of the most important microelement involved in chlorophyll synthesis, it will increases photosynthetic efficiency of groundnut through increased photosynthesis contents. SA also increased the accumulation of manganese in both the studied groundnut cultivars which might help in mitigating 'Marsh-spot' disorder.

SA treatment was caused positive impact on accumulation of zinc and molybdenum. Zinc is involved in several metabolic reactions in plants and acts as co-factor for enzymes involved in scavenging reactive oxygen species. Molybdenum is an important component of nitrate reductase enzyme. It is clears from it that both Zn and Mo could offers defense mechanism by catalyting activity of SOD as well as improves nitrogen metabolism respectively in groundnut cultivars.

Thus the mineral status of groundnut is positively influenced due to various treatments of SA. As these inorganic elements regulate various important physiological processes, SA elevating minerals would be supportive for growth and development of groundnut.

Incase of Cv. SB-11, lower (5 ppm) as well as higher (100 and 200 ppm) concentrations of SA increased the starch contents. On the contrary opposite pattern was noticed incase of Cv. W-44 (except 200 ppm SA). Total yield of the plants depends upon its carbohydrate status since carbohydrates forms a connection between photosynthesis and respiration.

The N requirement of groundnut is much higher thus, accumulation of N plays an important role in groundnut metabolism.Incase of Cv. SB-11 all SA treatments successively increased the total nitrogen contents. Particularly applications of higher concentrations (100 and 200 ppm) of SA was effectively increased the total nitrogen content and crude proteins in both the groundnut cultivars.While accumulation of N with all SA treatments except 5ppm in Cv. W-44 caused favorable influences on

nitrogen content in groundnut. Thus SA might be improve the stem and leaf growth and mitigate nitrogen deficiencies through the increased nitrogen levels of groundnut.

It is apparant from the foregoing account that mostly higher concentrations of SA exert favorable influence on various physiological processes of groundnut. These findings clears SA fulfilled its role as phytohormone by offering its positive influences on several parameters of both the groundnut cultivars under investigation.