CHAPTER VI

SUMMARY

In view of escalation of saline land all over the world resulting in diminishing the area of cultivable land in recent times, investigation on the effect of salinity in crop plants, particularly in oil-yielding crops in view of ever increasing demand for vegetable oil and steep rise in its price, becomes imperative. Since sunflower and cotton are important popular crops next to groundnut, they have been employed as experimental materials. Majority of our crop plants are glycophytes and they have least tolerance to salinity and therefore, before they could be experimented upon in mild saline conditions, it becomes necessary to study their salt tolerance potential most importantly the early part of germination of oil seeds considered to be more sensitive to salinity.

In the present study, the effects of pre-sowing soaking treatment with sodium and potassium chloride salts (0.1 to 3.0%) were investigated on germination and vigour index. Since 3.0% was found to be more lethal for germination, in further experiments, concentrations of salts in the range of 0.1, 0.5 and 2.5% NaCl/KCl for sunflower and 0.1, 0.5 and 2.5% NaCl and 0.1, 1.0 and 2.5% KCl for cotton were used.
The present study deals with the effects of pre-treatment of salts on mobilization of seed reserves coupled with hydrolases, function of leafy cotyledons, levels of different chemical constituents in 30-day old sunflower and cotton plants, relative growth rate, growth and yield parameters of 90-day old plants at the time of harvest and the level of lipid storage reserves in seeds soon after harvest.

As regards mobilization of seed reserves, NaCl and KCl pre-treatment in general promoted the build-up of the breakdown products like free fatty acids, free aminoacids and total soluble sugars at low concentrations (0.1 & 0.5% NaCl and 0.1 & 0.5/1.0% KCl) and at higher concentration (2.5% NaCl/KCl) marginal inhibition was observed in both cotton and sunflower. As regards storage products such as lipids, oil and proteins, both lipids and oils were hydrolysed into simpler substances, whereas there was a steady build-up of proteins more particularly in the embryonic axis of both sunflower and cotton throughout the period of analysis. Regarding assay of enzymes, cotyledon exhibited higher levels of lipase activity than the embryonic axis, whereas catalase activity increased steeply in both the cotyledons and embryonic axis possibly because sunflower and cotton are lipoid seeds requiring catalase for β-oxidation of fatty acids during germination. NRA was
higher in cotton than in sunflower and its activity was least affected by salt pre-treatment. Protease activity was higher in cotyledon than in the embryonic axis and its activity was also not affected by salt treatment. From the overall perusal of the data neither mobilization of storage reserves nor the levels of hydrolases were affected by pre-treatment of seeds with NaCl and KCl.

From the observations on the levels of biomolecules like sugars, proteins and starch, it could be inferred that the cotyledons, although partly synthetic in function, being an organ endowed with the sole function of export revealed a significant reduction in the levels of all the constituents investigated with simultaneous build-up of these compounds in the primary leaves. Particularly in the primary leaves, lower concentration of salt treatment (0.1 to 0.5% NaCl and 0.1 to 1.0% KCl) favoured the accumulation of the aforesaid compounds. At higher concentrations (2.5%), no serious changes in the levels of the compounds could be observed. No doubt, in most plants the cotyledons are ephemeral and transient in nature. But in both cotton and sunflower, the cotyledons were leafy in nature and persisted on the mother plant for a considerable period of time. Because the cotyledons were persistent in nature, they developed more chloroplast pigments, proteins, membranes, etc. and became
partly synthetic in function until primary leaves emerged out and took charge of the functions.

The growth parameter studies of 30-day old plants of sunflower and cotton indicated that low concentrations of salt at 0.1 and 0.5% NaCl promoted growth in sunflower, whereas 0.1 and 1.0% KCl promoted growth in cotton. It is evident from the growth parameter studies that low concentrations of salts were found to induce growth. Regarding the biochemical constituents of 30-day old plants, it was observed that chloroplast pigments as well as other compounds such as free aminoacids, total soluble starch and proteins were not affected. However, the levels of total soluble sugars made some impact in cotton. There was an upsurge in the content of proline at 2.5% NaCl/KCl treatment in both sunflower and cotton and this might suggest a still perceived after-effect of the pre-treatment of seeds with salts. The results on the assay of enzymes revealed that pre-sowing soaking treatment with NaCl and KCl at low concentrations significantly increased NRA by two-fold over the control in cotton, whereas the levels of activity of lipases, catalase and protease were not affected.

RGR of plants measured from 5 to 55 days of growth revealed that sunflower recorded a higher RGR than cotton.
In both the plants low concentrations of salt treatment (0.1 & 0.5% NaCl and 0.1, 0.5 and 1.0% KCl) promoted RGR, compared to the value of the control. At higher concentrations of salt treatment, the RGR was marginally reduced.

As the last phase of the study, growth parameters and yield characters of 90-day old plants of sunflower and cotton were analysed. It was observed that the effects of pre-sowing soaking treatment of seeds with NaCl and KCl at low concentrations increased the height of the plant, total leaf area, dry weight of the plant, number of seeds per capitulum/plant and total number of seeds per plant. Higher concentration (2.5%) of salts was generally found to be inhibitory. Seed analysis for lipid compounds such as total lipids, oil, free fatty acids and glycerol revealed that low concentrations of salt treatment improved these constituents from marginal to significant levels in both sunflower and cotton, whereas at higher concentration a marginal inhibition in the levels of these compounds was always observed.

To sum up, it is evident that low concentrations of salt treatment were found to augment germination, mobilization of storage reserves as well as several growth parameters leading to betterment of economic yield. NaCl at
low concentrations exhibited growth promoting activities like any other nutrient element actively involved in the metabolism of plants. Sunflower was a fast grower of the two. Higher concentrations (2.5%) of salt retarded growth and other related processes marginally.