

CHAPTER - IV

SUMMARY AND CONCLUSIONS

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SUMMARY AND CONCLUSIONS

Safflower has been recognised as a crop of economic importance since many centuries as it is a source of oil, food, fodder and dye. The safflower stand in middle position in cultivation among other oil seed crops. The area, production and yield of safflower is increased during the last decade. Safflower is generally grown in rainfed area as being a fairly drought resistant crop. But the physiology of this crop is not studied well. Eventhough safflower is drought resistant a short period of water stress affects several metabolic processes. The varietal difference are also observed in safflower. In the present investigation the significant results are obtained which are summarised under the water stress studies in the two safflower varieties, Local and JLSP-88.

Soil salinity is one of the major problems in agriculture. In India about 12 million hectares of land is commonly affected by salinity and alkalinity out of which Maharashtra occupies about 1.4 million hectares. Thus, it is necessary to study the behaviour of different crops under the effect of salinity. Safflower is a moderately salt tolerant crop (Weiss, 1971). Many workers have studied the salt tolerant nature of safflower with respect to yield but

very few attempts have been made to study its physiology and hence in the present investigation an attempt has been made to study the effect of salinity in the two safflower varieties Local and JLSF-88. The significant findings are recorded under salt stress studies.

A) Water Stress Studies :

As a result of water stress in the two safflower varieties, Local and JLSF-88

1. The average plant height is affected more in JLSF-88 than Local variety. In this respect shoot and root length show different responses. The shoot length is decreased due to water deficit condition on the contrary, the root length is increased in both safflower varieties. Thus, the shoot, root ratio is lowered. The variety JLSF-88 is affected much more than Local variety due to water deficit.
2. The leaf thickness and leaf area, changed more remarkably in Local variety than improved JLSF-88. The leaf thickness is decreased by 50% at eight days water stress during heading stage in Local variety. While JLSF-88 show less effects. The leaf area, a photosynthetic area is also decreased more in Local variety than JLSF-88 indicating drought resistant nature.
3. The decrease in moisture percentage is the initial phase

of drought condition. The moisture percentage as well as R.W.C. decreased over control in both varieties. However JLSF-88 shows good response over Local variety. The water retention is about 60-70% indicating their drought resistant nature in both varieties.

4. The Titratable Acid Number (TAN) in both varieties is enhanced considerably over control due to water deficit condition. The results are more significant in JLSF-88 than Local variety, indicating its drought tolerance nature. Water stress increases polyphenols in both varieties.
5. The significant increase in chlorophylls found in both varieties. The JLSF-88 accumulates more chlorophylls over control than local variety. However chlorophyll 'b' increased in JLSF-88 and reduced in Local variety. High chlorophyll contents show the high capacity of photosynthesis in JLSF-88. The chlorophyll 'a': 'b' ratio is decreased in both varieties.
6. The mineral content is also important in plants. The drought affects the mineral balance in most of the plant parts. The sodium and potassium content decreased in both varieties under stress conditions which probably because of reduction in dry matter. The increase in potassium:sodium ratio found to be more remarkable in JLSF-88 than Local variety. This suggests that JLSF-88 is superior to Local variety with respect to selective absorption of K over Na and its retention during water stress period.

7. The calcium content is reduced more significantly in Local variety than JLSF-88. But the calcium level is maintain in JLSF-88 indicates its adaptation towards drought resistant nature. The decrease in magnesium is a common feature in both varieties, however the JLSF-88 is superior to Local variety for maintaining magnesium during drought period.
8. The iron and copper content in Local variety increases initially and then decreases. However in JLSF-88 both elements are increased. The zinc level in both varieties is decreased. The manganese level also decreases slightly in both varieties. The chlorides decreased sharply in JLSF-88 due to water stress as compared to the Local variety hence variety JLSF-88 appears to be sensitive to chlorides.
9. The peroxidase activity enhanced due to water stress in the both varieties. However the JLSF-88 show considerable increase in activity at initial level and then sharply decrease to control level with further increase in water stress period, indicates the increase in oxidation process more fastly in Local variety than JLSF-88.
10. The Local variety, show more pronounced increase in acid phosphatase activity than JLSF-88 under the water deficit conditions, which involved in breakdown of non-specific phosphate compounds. Thus it seems that water stress enhanced catabolic activities much faster in Local

variety than JLSF-88.

B. Salt Stress Studies :

1. The plant growth with respect to average plant height and shoot length decreased in both varieties of safflower of the present investigation. A stimulatory increase at 0.025% NaCl was observed in JLSF-88. However the root length is enhanced with the NaCl treatment. Due to which shoot/root ratio found to be declined. These observations indicate that improved JLSF-88 variety shows salt tolerant nature.
2. The leaf thickness increases with increased NaCl treatment. This leads to the development of succulence in both varieties with NaCl treatment, this increases the capacity of salt tolerance. However leaf area decreases with higher concentrations of NaCl which ultimately decrease photosynthetic area. Reduction in leaf area is a salt sensitive mechanism developed in safflower.
3. The leaf moisture content increases over control and brings about the dilution effect of toxic effects of NaCl treatment. This leads to development of salt tolerance in both varieties. This indicates that the water retaining capacity is increased under NaCl treatment.

4. Among the cultivars studies, JLSF-88 showed higher values of TAN than Local variety. Local variety shows increased TAN value at higher NaCl treatment.
5. The leaves accumulate more polyphenols at low NaCl concentration over control in both safflower varieties which gradually decrease with progressive NaCl treatment indicating salt tolerance mechanism in both the varieties. ✓
6. Photosynthetic pigments are accumulated in both safflower varieties due to NaCl treatment. Improved variety JLSF-88 is found to be rich in chlorophylls, 0.1% NaCl concentration is a stimulatory dose. However Local variety show chlorophyll 'a' even at high concentration of NaCl, and the chlorophyll 'b' decreased at high levels of NaCl. The chlorophyll 'a' : 'b' ratio in Local variety is increased over control dose to NaCl treatment because of reduction in chlorophyll 'b'. ✓

The carotenoid, content is increased at low NaCl treatment in both safflower varieties. However JLSF-88 accumulate more carotenoid over control under salt stress than Local variety is adaptation of variety JLSF-88 to water deficit conditions. ✓

7. The inorganic constituents in the leaves of two safflower varieties show different behaviour under NaCl treatment. The sodium content increases and potassium decreases in the leaves of two safflower

varieties due to NaCl treatments. Local variety is very sensitive to NaCl salt as compared with JLSF-88 variety. The ratio of potassium to sodium decreased with increasing NaCl concentration in both varieties. The ratio decline remarkably in Local variety than JLSF-88 which is more tolerant to NaCl treatment.

8. The calcium content increases over control in both safflower varieties. The increased calcium content in JLSF-88 over control is an adaptive feature, while in Local variety it is lacking. However a significant increase was observed at 0.2% NaCl concentration. This suggests that calcium plays an important role in salt tolerance mechanism in JLSF-88 as compared to Local variety. Magnesium content is reduced considerably with 0.05% and 0.04% NaCl in Local variety while in JLSF-88 magnesium content is highly reduced. The magnesium retention under NaCl treatment is superior in JLSF-88. Iron content is reduced in Local variety at 0.2% NaCl treatment is probably because of higher concentration of calcium. However in JLSF-88, both calcium and iron content reduced at 0.2% NaCl treatment over control. The copper content slightly increases in both varieties under NaCl treatment. In Local variety slight increase in copper content is recorded at 0.05% and 0.2% NaCl treatment while in JLSF-88 copper content is maximum at 0.1% NaCl treatment. Zinc content

in Local variety is reduced due to NaCl treatment on contrary it is increased in JLSF-88 at 0.025% NaCl treatment. Manganese content in Local variety is not affected by NaCl treatment. While slight stimulatory effect recorded in JLSF-88 at 0.05% NaCl treatment. The reduced plant height is correlated with chloride accumulation. Both the safflower varieties accumulated high chloride with increasing NaCl treatment.

9. The activity of enzyme peroxidase increases with increasing NaCl treatment except a slight decrease at 0.2% NaCl treatment in JLSF-88. The increasing activity is a adaptive feature against the NaCl toxicity affect found in both safflower varieties.
10. The activity of enzyme acid phosphatase show different pattern in both safflower varieties. The activity is more or less constant in JLSF-88 except at 0.1% NaCl treatment. However the enhanced activity of enzyme acid phosphatase due to NaCl treatment found in Local variety.

In conclusion it can be said that safflower varieties show considerable changes in the growth, organic constituents, inorganic constituents and activities of enzymes peroxidase and acid phosphatase due to water stress and NaCl treatment. It appears that improved safflower variety JLSF-88 is superior to Local variety under these stress conditions.