CHAPTER – V

SUMMARY AND CONCLUSIONS

Gujarat has a variety of soils in which different crops are grown but each soil has been posing some or other problems for normal cultivation of crops. Salinity in coastal ground water is a widespread problem in many parts of India and Gujarat. Junagadh coastal area is one of the salinity affected areas mainly due to sea-water intrusion from last two-three decades. The need of the hour is to explore and select salt-tolerant genotypes within a species in comparison to relatively salt-sensitive ones through conventional selection.

A pot experiment was conducted during summer- 2017 to study the “Effect of salinity on bio-chemical parameters, nutrient composition and yield of pearl millet (Pennisetum glaucum L.) varieties” at the Department of Agricultural Chemistry and Soil Science, College of Agriculture, Junagadh Agricultural University Junagadh.

The weather conditions were favorable for crop growth and no severe attack of insect and diseases was observed during the course of investigation.

Apart from the biometric observations related to yield of pearl millet, growth & yield attributes, the studies were also made on quality, biochemical parameters (proline, RWC, chlorophyll a, chlorophyll b and total chlorophyll), content and their uptake and soil available nutrients at harvest of crop. The important findings of this investigation are summarized as below.

Effect of variety

1. The grain yield (g plant$^{-1}$) was significantly affected by various varieties of pearl millet. Significantly the highest grain yield (4.03 g plant$^{-1}$) was observed with variety GHB-538 ($V_1$). The fodder yield not significantly affected by different varieties of pearl millet.
2. The different varietal effect was found significantly on growth and yield attributing characters Viz., plant height, ear head length, No. of total tillers
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plant \(^{-1}\) , No. of effective tillers plant \(^{-1}\) and grain fodder ratio. The highest plant height (96.67 cm) was observed with variety GHB-732 (V\(_3\)). The ear head length, No. of total tillers plant \(^{-1}\), No. of effective tillers plant \(^{-1}\) and grain fodder ratio were significantly highest (20.21 cm, 3.22, 2.36 and 0.56) with variety GHB-538 (V\(_1\)).

3. The test weight was significantly affected by various varieties and salinity level. The higher (0.98 g) test weight was observed with variety GHB-538. The protein content was not significantly affected by different varieties of pearl millet.

4. The significant differences were observed in proline accumulation among varieties. The highest (1.17 \(\mu\)mole gf.wt\(^{-1}\)) proline accumulation was found with variety GHB-538 (V\(_1\)). The proline content in varieties was observed in decreasing order of V\(_1\) > V\(_3\) > V\(_2\) > V\(_4\) > V\(_5\).

5. Among the different tested varieties, variety V\(_1\) (GHB-538) produced significantly higher RWC, chlorophyll a, chlorophyll b and total chlorophyll content than other varieties. In case of chlorophyll a, chlorophyll b and total chlorophyll content, it was also remained at par with variety V\(_3\) (GHB-732).

6. The Na content significantly affected on different varieties at 45 DAS which was found in decreasing order: V\(_4\) > V\(_3\) = V\(_5\) > V\(_2\) > V\(_1\). The Na content significantly recorded the lowest (1.00 %) with variety V\(_1\) (GHB-538). The K and Ca content were not significantly affected by various varieties at 45 DAS.

7. The concentration of nitrogen, phosphorus, potassium and sulphur content in grain and straw of the plant did not significantly influenced by different varieties of pearl millet at harvest of crop.

8. The concentration of Ca was not significantly affected by grain and straw of various varieties of pearl millet. The Ca content in grain was not affected by different levels of salinity at harvest of crop.

9. Significantly the higher Mg content was observed in grain (0.56 %) and straw (0.57 %) which was found with variety V\(_5\) (GHB-558) and V\(_1\) (GHB-538).

10. The concentration of Na in grain and straw of the plant did significantly influenced by different varieties of pearl millet at harvest of crop. The Na content was observed the lowest with variety V\(_1\) (GHB-538) in grain (0.29 %) and straw (1.50 %). The concentration of Cu, Fe, Mn and Zn in grain and straw...
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of the plant did not significantly influenced by different varieties of pearl millet. At harvest of crop,

11. The Na⁺/K⁺ and Na⁺/Ca⁡⁺⁺ ratio were significantly affected by various varieties and various levels of salinity at 45 DAS of crop. This Na⁺/K⁺ and Na⁺/Ca⁡⁺⁺ ratio significantly observed the lowest (0.48 and 0.51) with variety V₁ (GHB-558).

12. The Na⁺/K⁺ and Na⁺/Ca⁡⁺⁺ ratio of grain and straw was significantly affected by different varieties and various levels of salinity at harvest of crop. The Na⁺/K⁺ ratio of grain and straw of pearl millet was significantly lowest (0.28 and 1.04) with variety V₁ (GHB-558). The Na⁺/Ca⁡⁺⁺ ratio in grain and straw was also significantly lowest (0.18 and 0.86) with variety V₁ (GHB-538).

13. The uptake of nitrogen, phosphorus and potassium by grain and its total uptake of plant significantly influenced by various varieties of pearl millet at harvest. The uptake of nitrogen, phosphorus and potassium by grain (65.08, 18.64 and 43.51 mg plant⁻¹) and total uptake (159.87, 37.40 and 148.11 mg plant⁻¹) were recorded higher with variety V₁ (GHB-538).

14. The uptake of Cu and Zn by grain was significantly affected by different variety, but Cu and Zn uptake was not significantly affected by straw and its total uptake.

15. The uptake of Fe and Mn by grain and its total uptake were significantly affected by various varieties. The Fe and Mn uptake by straw was observed non-significant with different varieties of pearl millet.

16. The soil available macro nutrient (N, P₂O₅, K₂O and S) and micro nutrient (Fe, Mn Zn and Cu) did not significantly influenced by different varieties of pearl millet.

17. Soil EC₂.₅ and pH₂.₅ did not influenced by different varieties of pearl millet and their interaction effects were also found non-significant.

Effect of salinity

1. The various level of saline irrigation water significantly affected on the grain yield of pearl millet. The maximum grain yield (4.08 g plant⁻¹) observed at S₁ (EC 2 dS m⁻¹) level of salinity. The fodder yield significantly affected by salt concentration. The highest fodder yield observed at S₁ (EC 2 dS m⁻¹) level of salinity.
2. The effect of salt concentration was found on growth and yield attributing character viz., plant height, ear head length, No. of total tillers plant\(^{-1}\), No. of effective tillers plant\(^{-1}\) and grain fodder ratio. The plant height (105.83 cm), ear head length (21.22 cm), No. of total tillers plant\(^{-1}\) (3.49), No. of effective tillers plant\(^{-1}\) (2.25) and grain fodder ratio (0.50) were significantly recorded the highest with salinity level S\(_1\) (< 2 dS m\(^{-1}\)).

3. The test weight was significantly affected by various salinity levels. The higher (1.01 g) test weight observed at salinity level S\(_1\) (< 2 dS m\(^{-1}\)). The protein content was not significantly affected by different levels of salinity.

4. The proline accumulation significantly increased with increasing salt concentration. The maximum (1.22 μmole gf.wt\(^{-1}\)) proline accumulation observed at salinity level S\(_4\) (EC 8 dS m\(^{-1}\)).

5. The different salinity levels produce significant effect on biochemical parameters like RWC, chlorophyll a, chlorophyll b and total chlorophyll content. These parameters are highest at salinity level S\(_1\) (EC 2 dS m\(^{-1}\)). In case of RWC and chlorophyll a content which remains statistically at par with salinity level S\(_2\) (EC 4 dS m\(^{-1}\)).

6. The Na content significantly increased with increasing salt concentration from 1.00 % S\(_1\) (EC <2 dS m\(^{-1}\)) to 1.37 % S\(_4\) (EC 2 dS m\(^{-1}\)), at 45 DAS. The K and Ca content were not significantly affected by various salinity levels at 45 DAS.

7. The concentration of nitrogen, phosphorus, potassium and sulphur content in grain and straw of the plant did not significantly influenced by different salinity levels at harvest of crop.

8. The Ca content in grain was not affected by different level of salinity at harvest of crop. The Ca content in straw was significantly affected by various level of salinity. The highest (1.79 %) Ca content in straw with salinity level S\(_1\) (< 2 dS m\(^{-1}\)), which remain statistically at par with salinity level S\(_2\) (EC 4 dS m\(^{-1}\)).

9. The Mg content in grain and straw was significantly affected by different levels of saline irrigation water at harvest of crop. The Mg content of grain and straw was significantly found with salinity level S\(_1\) (< 2 dS m\(^{-1}\)).

10. The concentration of Na in grain and straw of the plant did significantly influenced by different levels of saline irrigation water at harvest of crop. The
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Na concentration was significantly lowest found with salinity level S₁ (< 2 dS m⁻¹) in grain (0.21 %) and straw (1.50 %).

11. The concentration of Cu, Fe, Mn and Zn in grain and straw of the plant did not significantly influence by different levels of saline irrigation water at harvest of crop.

12. The Na⁺/K⁺ and Na⁺/Ca²⁺ ratio was significantly affected by various level of salinity at 45 DAS of crop. The Na⁺/K⁺ and Na⁺/Ca²⁺ ratio were found significantly lowest (0.49 and 0.51) with salinity level S₁ (< 2 dS m⁻¹).

13. The Na⁺/K⁺ and Na⁺/Ca²⁺ ratio of grain and straw was significantly affected by various level of salinity at harvest of crop. The Na⁺/K⁺ and Na⁺/Ca²⁺ ratio was significantly lowest (0.12 and 0.84) observed with salinity level S₁ (< 2 dS m⁻¹).

14. Significantly the highest uptake of nitrogen, phosphorus and potassium by grain (66.40, 20.09 and 43.59 mg plant⁻¹), straw (109.01, 21.54 and 119.51 mg plant⁻¹) and its total uptake (175.41, 41.62 and 163.10 mg plant⁻¹) were observed highest with salinity level S₁ (< 2 dS m⁻¹).

15. The uptake of Cu, Fe, Mn and Zn by grain and straw was significantly affected by different salinity levels. These micro nutrient uptakes were significantly higher observed with salinity level S₁ (< 2 dS m⁻¹).

16. The soil available macro nutrient (N, P₂O₅, K₂O and S) and micro nutrient (Fe, Mn, Zn and Cu) did not significantly influenced by different salinity levels.

17. The soil EC₂.₅ was significantly affected by different levels of salinity. The pH₂.₅ was not significantly affected by various levels of salinity.

Interaction Effect of variety and salinity

1. The interaction effect of variety and saline irrigation water found significantly higher grain yield (4.60 g plant⁻¹) with variety GHB-538 (V₁) and S₁ (< 2 dS m⁻¹) level of salinity. In case of fodder yield, combine effect of variety and salinity was not found significant.

2. The combine effect of variety and saline irrigation water found significant in the parameters like ear head length, No. of total tillers plant⁻¹, No. of effective tillers plant⁻¹ and grain fodder ratio was the highest (20.21 cm, 3.22, 2.36 and 0.56) observed with variety GHB-538 (V₁) at salinity level S₁ (< 2 dSm⁻¹). The interaction effect in grain fodder ratio was found non-significant.
3. The test weight was significantly affected by various variety and various salinity levels. The interaction of variety GHB-538 (V₁) with salinity level S₁ (< 2 dS m⁻¹) gave significantly higher (1.20 g) test weight. The protein content was not significantly affected by different variety and different levels of salinity.

4. The combined effect of variety and salinity was significantly affected on proline accumulation with variety GHB-538 (V₁) and salinity level S₄ (8 dS m⁻¹).

5. The combine effect of variety and saline irrigation water on RWC and chlorophyll a content was found with variety V₁ (GHB-538) and salinity level S₂ (< 2 dS m⁻¹). In case of chlorophyll b and total chlorophyll content, the combine effect was found with variety V₃ (GHB-732) and variety V₅ (GHB-558) at salinity level S₂ (< 2 dS m⁻¹), respectively.

6. The Na content significantly affected by the interaction effect of different variety and saline irrigation water which was found significant lowest with variety V₁ (GHB-538) at salinity level S₁ (< 2 dS m⁻¹). The K and Ca content were not significantly affected by combine effect of various varieties and salinity level at 45 DAS.

7. The concentration of nitrogen, phosphorus, potassium and sulphur content in grain and straw of the plant did not significantly influenced by combine effect of different varieties of pearl millet and different salinity levels at harvest of crop.

8. The interaction of various variety and salinity level on Ca and Mg content in grain and straw was not found significant at harvest of crop.

9. The combine effect of various variety and various salinity levels on the concentration of Na in grain significantly lowest (0.13 %) with variety V₃ (GHB-732) at salinity level S₁ (< 2 dS m⁻¹) in grain of pearl millet at harvest of crop. In case of straw, the combine effect was minimum (1.41 %) found with variety V₁ (GHB-538) at salinity level S₁ (< 2 dS m⁻¹).

10. The concentration of Cu, Fe, Mn and Zn in grain and straw of the plant did not significantly influenced by interaction effect of different varieties of pearl millet after harvest of crop and different levels of saline irrigation water.

11. The Na⁺/K⁺ and Na⁺/Ca²⁺ ratio was significantly affected by combine effect of various variety and various level of salinity at 45 DAS of crop. The Na⁺/K⁺ and
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Na+/Ca++ ratio was significantly found the lowest (0.41 and 0.43) with variety V3 (GHB-732) and salinity level S1 (< 2 dS m⁻¹).

12. The combine effect of varieties and salinity did not produce significant effect on Na+/K⁺ and Na+/Ca++ ratio of straw at harvest of crop. But in case of grain Na+/K⁺ and Na+/Ca++ ratio was significantly lowest with V3 (GHB-732) at salinity level S1 (< 2 dS m⁻¹).

13. The uptake of nitrogen, phosphorus and potassium by grain, straw and its total uptake of plant were not significantly influenced by the interaction effect of different varieties and salinity.

14. The uptake of Cu, Fe, Mn and Zn by grain, straw and its total uptake was not significantly affected by different variety and different level of saline irrigation water.

15. The soil available macro nutrient (N, P₂O₅, K₂O and S) and micro nutrient (Cu, Fe, Mn and Zn) did not significantly influence by interaction effect of different varieties of pearl millet and different salinity levels.

16. Soil EC₂.₅ and pH₂.₅ did not influenced by combine effect of different variety of pearl millet and various level of salinity.

CONCLUSIONS:

On the basis of results, the pearl millet variety GHB-538 showed significantly higher values of yield and yield attributes (plant height, ear head length, total tillers plant⁻¹, effective tillers plant⁻¹ and grain fodder ratio), quality parameters (test weight and protein content), bio-chemical parameters (proline, RWC, chlorophyll-a, chlorophyll-b and total chlorophyll), nutrient uptake (macro and micro nutrient) and lower value of Na+/K⁺ and Na+/Ca++ ratio over the salinity level.

The pearl millet hybrid variety GHB-538 is found better up to EC 4 dS m⁻¹ irrigation water.

Based on salinity indices, out of all varieties, GHB-538 performed better with different salinity tolerance criteria like the highest mean grain yield (3.84 g/plant), as well as maximum salinity index (83.60 %) and higher values of yield at high salinity level (EC 8.0 dS m⁻¹) and EC level (12.22 dS m⁻¹) for 50 % threshold yield and EC level (17.01 dS m⁻¹) for 75 % threshold yield. Being the lower value of regression slope (b) for GHB-538 variety, the yield of this variety is tolerance to salinity levels as
compared to remaining other varieties. The tolerance order of pearl millet varieties to salinity in decreasing order of GHB-538 > GHB-732 > GHB-744 > GHB-558 > GHB-905 against salinity in silty clay soil.