Chapter - V

Summary & Conclusions
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SUMMARY AND CONCLUSIONS

The present study was undertaken to estimate the mineral status in soil, fodder and animal in different seven saline affected villages of Purna river valley of Akola district. The study was also conducted to record the prevalence of mineral deficiency existing in soil, fodder and cows maintained in saline tract area and to establish the soil-fodder-animal relationship in this area. The therapeutic trial was carried out to assess the efficacy of formulated mineral mixture in lactating cow of saline tract area of Akola district.

Mineral profile

Soil samples

A total of 104 soil samples were analyzed for determination of macro and micro-mineral profile from 7 saline affected villages of Akola district. The pH of soil was ranged between 7.8 to 8.6, indicated alkaline in reaction. The maximum salinity was noticed in village Gopalkhed (8.6) and minimum in village Nimbhora.

The overall mean value of soil (%) Ca, P, Mg, Na and K were $0.715 \pm 0.05$, $0.223 \pm 0.008$, $0.191 \pm 0.008$, $0.039 \pm 0.004$ and $0.031 \pm 0.004$, respectively, indicated levels towards increasing trend by virtue of salinity and sodicity of the soil of Purna river valley. The soil Ca content was significantly higher in village Gandhigram (0.916 \pm 0.023) and lowest in village Nimbhora (0.826 \pm 0.011). The maximum soil phosphorus concentration was observed in village Hata and minimum in soil of village Gopalkhed. The concentration of soil Mg in soil of village Andura (0.283 \pm 0.009) was significantly highest and lowest in village Gandhigram (0.140 \pm 0.007). Significantly higher concentration of soil Na was recorded in village Gopalkhed (0.065 \pm 0.003) as compared to rest of the villages and lowest in village Nimbhora. The maximum soil potassium concentration was observed in village Gopalkhed and minimum in soil of village Karanja – Ramzanpur. No prevalence of Ca, Ph, Mg, Na, K in soil was recorded in all the villages, indicated that the soil samples of saline tract area of Akola district contain adequate amount of macro minerals.
The overall mean values of soil (ppm) Cu, Zn, Fe and Mn were 0.497 ± 0.067, 0.792 ± 0.117, 5.882 ± 0.416 and 4.728 ± 0.465, respectively. The highest concentration of Cu (ppm) was observed in soil of village Karanja – Ramzanpur (0.528 ± 0.086) and lowest in village Gandhigram (0.451 ± 0.058). The maximum concentration of soil Zn (ppm) was observed in village Hata (0.852 ± 0.119) and minimum in soil of village Gopalkhed (0.771 ± 0.100). The highest concentration of soil Fe (ppm) was recorded in village Nimbhora (6.538 ± 0.417) and lowest in soil of village Hata (5.338 ± 0.307). The maximum concentration of soil Mn was observed in village Andura (5.163 ± 0.428) than rest of the villages and minimum in village Hingna – Tamaswadi (4.420 ± 0.60). The overall prevalence (%) of deficiency of Zn, Fe and Mn in soil were 44.23%, 12.5% and 2.88%, respectively whereas no prevalence of deficiency of Cu was observed in soil, indicated that the soil of this area contain adequate amount of copper.

Fodder minerals

A total of 71 fodder samples were collected from 7 villages of saline affected area of Akola district and analyzed for mineral status. The overall mean concentration of fodder Ca (%), P(%), Mg(%), Cu (ppm), Zn (ppm), Fe (ppm) and Mn (ppm) in fodder were 0.487 ± 0.061, 0.199 ± 0.021, 0.204 ± 0.041, 32.430 ± 2.167, 26.291 ± 2.307, 191.279 ± 9.637 and 49.064 ± 2.838, respectively. The maximum concentration of Ca (%) was recorded in fodder samples of village Nimbhora (0.557 ± 0.075) and lowest concentration in village Hata (0.368 ± 0.035). The highest concentration of P was recorded in fodder of village Karanja – Ramzanpur (0.223 ± 0.024) and lowest in village Hingna-Tamaswadi (0.157 ± 0.010). The highest mean concentration of Mg recorded in fodder of village Andura (0.246 ± 0.053) and lowest in village Hata (0.157 ± 0.016).

The maximum concentration of Cu (ppm) and Fe was recorded in fodder samples of village Hingna Tamaswadi and minimum concentration of Cu and Fe in village Andura and Gopalkhed , respectively. The lowest concentration of Zinc (ppm) in fodder than critical level (critical value < 30 ppm) was recorded in all 7 saline affected villages of Akola district The maximum concentration of Mn was recorded in fodder samples of village Gopalkhed (51.453 ± 3.675) and minimum in village Hata (47.05 ± 3.153).
The overall prevalence (%) of Ca, P, Mg, Cu, Zn and Mn in fodder of saline affected villages were 12.68%, 12.68%, 15.49%, 5.63, 53.52 and 7.04, respectively, whereas no prevalence of deficiency of Fe was recorded in fodder samples of saline affected villages of Akola district. It is evident from the above findings that the fodder of this area were deficient in Ca, P, Mg, Zn and moderately low in Cu, Mn and adequate in Fe.

Serum mineral profile

A total of 360 serum samples of lactating, pregnant, non-pregnant cows and heifers were collected from 7 saline affected villages of Akola district and analyzed for macro and micro mineral status.

The mean serum Ca level in lactating, pregnant, non-pregnant cows and heifers were 8.965 ± 0.293, 9.321 ± 0.378, 9.544 ± 0.289 and 9.828 ± 0.445 mg/dl, respectively. The serum Ca levels in lactating cows were found to be significantly lower than non-pregnant cows and heifers. The mean serum phosphorus level in lactating, pregnant, non-pregnant cows and heifers were 4.019 ± 0.123, 4.439 ± 0.155, 4.503 ± 0.156 and 4.273 ± 0.146 mg/dl, respectively. The serum phosphorus level in lactating cows were found to be significantly low as compared to the level in pregnant, non-pregnant cows and heifers. The serum Mg in lactating, pregnant, non-pregnant cows and heifers were found to be 2.44 ± 0.11, 1.948 ± 0.062, 2.486 ± 0.212 and 2.506 ± 0.136 mg/dl, respectively. The serum Mg level in pregnant cows were found to be significantly low than non-pregnant, lactating cows and heifers.

The mean serum sodium level in lactating pregnant, non-pregnant cows and heifers were found to be 139.857 ± 0.926, 143.791 ± 1.479, 144.368 ± 1.221 and 143.970 ± 1.612 mEq/l, respectively. The serum sodium level in lactating cows were found to be significantly low than pregnant, non-pregnant cows and heifers. The mean serum potassium level in lactating, pregnant non-pregnant cows and heifers were found to be 4.556 ± 0.271, 4.255 ± 0.086, 4.245 ± 0.079 and 4.198 ± 0.095, respectively. The serum potassium level in lactating cows found to be significantly higher than pregnant, non-pregnant cows and heifers. The serum chloride level in lactating, pregnant, non-pregnant cows and heifers were 96.212 ± 1.114, 97.898 ± 1.520, 97.983 ± 1.274 and 98.459 ± 4.696 mEq/l, respectively. The serum chloride
level in heifer was significantly higher than lactating cows, however, the differences amongst pregnant, non-pregnant cows and heifers were non-significant. The analysis of variances revealed non-significant variation in serum Ca, P, Mg, Na, K and Cl between different villages.

The mean serum Cu level in lactating, pregnant, non-pregnant cows and heifers were found to be 0.776 ± 0.043, 0.745 ± 0.040, 0.746 ± 0.043 and 0.772 ± 0.054 ppm, respectively. No significant difference was observed in serum Cu level between different physiological stages of cows, however, the highest serum Cu level was found in lactating cows and lowest in pregnant cows. The serum Zn level in lactating, pregnant, non-pregnant cows and heifers were 0.589 ± 0.185, 0.578 ± 0.088, 0.568 ± 0.074 and 0.551 ± 0.22 ppm, respectively. The analysis of variances revealed non-significant differences in the level of serum zinc between different physiological stages of cows. The mean serum Fe level in lactating pregnant, non-pregnant cows and heifers were found to be 1.670 ± 0.113, 1.300 ± 0.086, 1.814 ± 0.114, 1.852 ± 0.139 ppm, respectively. The serum Fe level in pregnant cows was found to be significantly low than lactating, non-pregnant cows and heifers. The serum Mn level in lactating, pregnant, non-pregnant cows and heifers were found to be 0.373 ± 0.014, 0.366 ± 0.142, 0.371 ± 0.014 and 0.373 ± 0.0197 ppm, respectively. No significant differences were observed in level of serum Mn between different physiological stages of cows. The analysis of variances for the level of serum Cu and Fe showed significant variation between different villages, whereas non-significant variation was found in respect of serum Zn and Mn.

The overall prevalence (%) of serum calcium deficiency was 4.17% amongst different physiological stages of cows. The highest prevalence of Ca deficiency was recorded in lactating cows (9.70%) followed by pregnant cows (5.43%). Serum Ca deficiency was not observed in non-pregnant cows and heifers of this area. The overall prevalence (%) of serum phosphorus deficiency was 4.72% amongst different physiological stages of cows. The highest prevalence of deficiency of serum phosphorus was recorded in lactating cows (12.62%) and lowest in non-pregnant cows (1.98%). Serum phosphorus deficiency was not observed in heifers of this area. No prevalence (%) of serum magnesium, sodium, potassium and chloride deficiency was observed in cows of this area.
The overall prevalence of serum Cu deficiency in cows of this area was 1.11%. The highest prevalence (%) of deficiency was observed in non-pregnant cows (2.97%). Serum Cu deficiency was not observed in pregnant cows and heifer of this area. The prevalence of serum Zn deficiency in lactating, pregnant, non-pregnant and heifer were 51.46%, 52.17%, 47.52% and 56.24%, respectively, with overall prevalence of 51.39% in cows of this area. Among different physiological stages of cows, the highest prevalence of serum Zn deficiency was observed in heifer (56.24%) followed by pregnant cows (52.17%) and lowest in pregnant and non-pregnant cows. The overall prevalence (%) of serum Fe deficiency in cows of this area was 3.61%. The highest prevalence (%) of Fe deficiency was observed in pregnant cows (8.70%). The serum Fe deficiency was not observed in non-pregnant cows and heifers of this area. The prevalence of serum Mn deficiency in lactating, non-pregnant and heifer were 1.94%, 2.97% and 1.56%, respectively, with overall prevalence of 1.67% in cows of this area. The highest prevalence of serum Mn deficiency was observed in non-pregnant (2.97%) cows and lowest in heifers (1.56%).

Correlation of minerals in soil, fodder, serum of cows

The correlation coefficient between animal-soil, animal-fodder and soil-fodder for Ca, P, Mg, Cu, Zn, Fe and Mn found to be statistically non-significant, however, the direction between correlation of animal-fodder for Ca, P, Cu, Fe, Mn found to be positive, indicating the direct association between fodder and animal as compared to indirect association between animal soil.

The multiple correlation coefficients between animal-soil-fodder of all the elements found to be statistically non-significant except Zn. The multiple correlation coefficient between animal-soil-fodder for Zn found to be statistically highly significant, indicated that there is a positive association between animal-soil-fodder.

Therapeutic study

The therapeutic trial of formulated mineral mixture was carried out in lactating cows for 60 days to assess the improvement in milk and serum macro –micro mineral profile. No improvement in milk yield was observed on different intervals in group I, received no mineral supplementation. However, in group II (mineral supplemented)
showed improvement in milk yield on day 60 (4.973 l) of post supplementation and recorded 25.04% increase in milk yield on day 60 of treatment, whereas decrease in milk yield was recorded by 3.76 % on day 60 of treatment in group I, having no mineral supplementation, indicated effectiveness of formulated mineral mixture in restoring milk production.

The mean serum Ca and P level improved significantly on day 60 as compared to group I. The serum Mg, Na, K, Cl and Cu level improved apparently on day 60 post treatment in mineral supplemented group (Group II) as compared to non supplemented group (Group I). The serum Zn, Fe and Mn level improved significantly on day 60 in treatment group as compared to control group.

In the present study significant improvement in level of serum Ca, P, Zn, Fe, Mn and apparent improvement in serum Na, K, Cl and Cu level was observed in lactating cows on day 60 of treatment, while in group I, no significant change was observed in the levels of macro and micro-mineral profile on various days of treatment.

The result obtained in the present study revealed to the following conclusions.

1. pH of soil of saline tract area of Akola district is alkaline in reaction.
2. Soil of saline tract area of Akola district is deficient in Zn and marginally low in Fe and Mn.
3. Fodder samples collected from saline affected villages of Akola district were deficient in Zn, Ca, P, Mg and marginally low in Cu and Mn and adequate in Fe.
4. Lactating cows maintained in saline tract area of Akola district were deficient in Ca, P and Zn and marginally low in Cu, Mn and adequate in Mg and Fe.
5. Pregnant cows of saline tract area possessed low level of Zn, Ca, P and Fe, whereas, low in Zn, P, Cu and Mn in serum of non-pregnant cows.
6. Heifers of saline tract area of Akola district were low in Zn and marginally low in Mn.
7. Soil, fodder and animals of saline affected villages of Akola district were found to be highly deficient in Zn.

8. Significant positive association between soil-fodder-animal was found for Zn in saline tract area of Akola district.

9. Supplementation of area specific formulated mineral mixture to lactating cows revealed improvement in milk production with improvement in serum macro and micro mineral profile.

The overall findings are valuable confirmation of effectiveness of area specific mineral mixture in improving mineral status and proved to be better in lactating animals to compensate the requirement for achieving milk production and could be utilized advantageously in this region. Thus, specially formulated area specific mineral mixture may be recommended for lactating cows of saline affected region to meet the requirement for optimum milk production.