11. WATER MANAGEMENT FOR PROBLEM SOILS

When rocks and minerals under go weathering process large quantities of soluble salts are formed. In humid regions these salts are washed down to the ground water and to the sea. But in arid and semi arid regions they accumulate in the soil. Excessive irrigation and poor water management are the two chief causes of water logging and salt accumulation. An accumulation of salts in soil leads to unfavourable soil water-air relationship and effect the crop production.

The following are the main causes which leads to development of salty soils (salinity or alkalinity)

1. Arid climate

About 25% of earth surface is arid in which salt accumulation is a common problem. In India about 25 million hectare is salt affected with different degree of degradation.

2. High subsoil water table

When the water table is with in capillary range, the water containing soluble salts rises to surface. When the water evaporates the salts are deposited as encrustation. It is estimated that in Punjab annually about 50,000 acres becomes saline because of raising water table.

3. Poor drainage

Due to poor drainage accumulation of water leads to water logging condition which leads to salt accumulation.

4. Quality of irrigation water

Irrigation water containing more than permissible quantities of soluble salts with sodium carbonate and bicarbonates make the soil salty.

5. Inundation with sea water

In coastal area, periodical inundation of land by sea water during high tides makes soil salty. Besides deep bore wells are also the reason for saline soils.

6. Nature of parent rock minerals

The saline nature of parent rock minerals leads to salt accumulation

7. Seepage form canals

The continuous seepage leads to salt accumulation.

Classification of problem soils

The soil problems can also be divided into

a) Chemical b) Physical

Soil Chemical Problem

The salt affected soils can be classified based on their ESP, pH and EC as follows

	ESP (%)	**EC mhos/cm**	**pH**
Saline	< 15	> 4	< 8.5
Saline alkali	> 15	> 4	> 8.5
Alkali/sodic	> 15	< 4	> 8.5

Reclamation of Saline soil

Leaching or flushing with good quality of water provided there will not be water logged condition i.e. good drainage system should be there to flush water.

Reclamation of Alkali soil

By converting exchangeable sodium into soluble salts by adding the following amendments.

1. Calcium chloride
2. Calcium sulphate (Gypsum)
3. Sulphuric acid
4. Ferrous sulphate
5. Aluminum sulphate

Reclamation of Saline alkali soil

The reclamation of these soils is similar to that of alkali soils. First step is to remove the exchangeable sodium and then the excess salts and sodium are to be leached out.

Commonly salt affected soils are referred as problem soils as indicated above. Further, based on pH value it can also be grouped as acid soils where the pH value is less than 7.

Management practices for chemical problems of soil

Reclamation of saline and alkali soils are not complete unless proper remedial measures are under taken to restore the soil fertility and structure of the soil. The following are the important management practices to overcome there problems.

- The saline soil can be easily improved with leaching of salts by using of god quality water and by providing good drainage systems.
- Application of gypsum would improve the permeability of soil by making good soil aggregates
- In acidic soils, lime application should be adequate and excessive leaching should be avoided
- Salt resistant or saline resistant species should be selected for cultivation
- Application of amendments viz gypsum and press mud is found to suppress the sodium and chromium content in plant and soil.
- Growing resistant crops like ragi cotton, barley and rice can be advocated.
- Growing green manure crops like sunnhemp, daincha and kolinji can be advocated.
- Growing resistant varieties like CoC 771 in sugarcane Co 43 in rice may be made.
- Adoption of drip irrigation for possible crop is also recommended to over come soil physical and chemical problems.
- Liberal application of FYM
- Application of green manure

- ❖ Excess phosphorous and application
- ❖ Proper drainage to keep the soil without adverse effect to plant systems.

Soil physical problems

Very coarse, very clayey texture, shallow depth and encrustation in soil surface are the possible physical problems. Too frequent irrigation in clayey soils with very high water retention results in poor drainage, water logging and crop damage. Excess irrigation or heavy rain create hardening of soil surface in red latritic soils with high Fe and Al hydroxides and low organic matter. This leads to poor germination, restriction of shoot and development and slow entry of water into the soil profile.

Water management practices for physical problem of soil

- In light soils shallow depth of water with more frequency should be adopted.
- To increase the infiltration rate of clay type soil, breeding of soil by mixing with coarse textured soil or tank silt at the rate of 50 tones per hectare is advocated.
- Organic wastes like crop residue, farm waste, coir pith, filter cake, etc., at the rate of 20 tones per hectare once in every year can be applied.
- Poorly drained clay soils can be improved by providing tile drains and trenches intermittently.
- To make the soil more permeable and to overcome poor drainage, addition of organic wastes or sandy soil at the rate of 20 tones per ha or 50 tones per ha respectively is advocated.
- Tank silt or heavy soil application is the only way to increase soil depth and water holding capacity. Besides growth shallow rooted crop is advisable.
- The encrustation problem could be alleviated by incorporating organic matter and adding montmorilonite clay containing silt.