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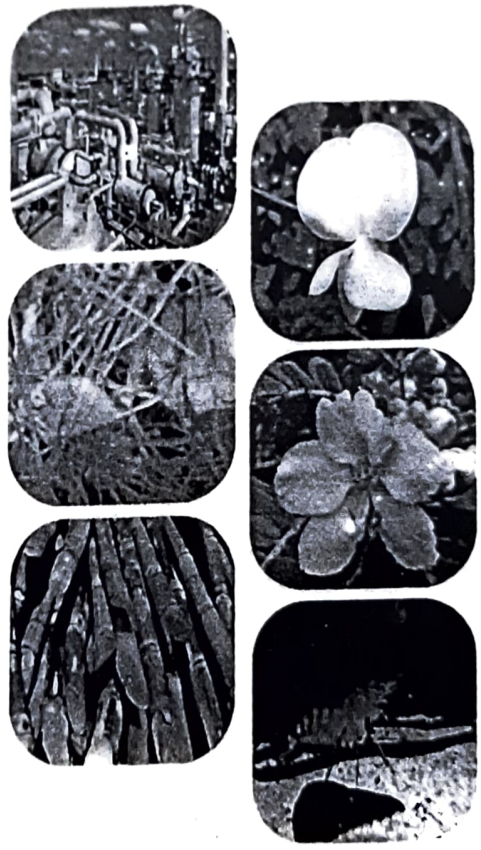

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WATER MANAGEMENT IN PROBLEM SOILS

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ABSTRACT:

Some soils have serious physical and chemical limitations to cultivation. They are problem soils. These soils need special management for satisfactory crop production. Physical limitations can be managed by irrigation, drainage, mulching, manuring, tillage, and soil conservation measures such as terracing, contouring, and cover crops whichever is appropriate. Use and disturbance of soils on steep slopes and in wetlands should be avoided because of the risk of their degradation. They should be left under natural conditions. Saline soils are managed through adequate irrigation, leaching, draining, and growing salt-tolerant crops. Sodic soil management needs chemical amendments such as application of sulfur and gypsum along with leaching and draining. Management of acid soils involves liming, leaching, and safe disposal of acid-wash water along with cultivating acid-tolerant crops.

KEYWORDS: Water, Management, Problem Soils

INTRODUCTION:

Problem soils have serious physical and chemical limitations to cultivation. These soils need special management for satisfactory crop production. Physical limitations can be managed by irrigation, drainage, mulching, manuring, tillage, and soil conservation measures such as terracing, contouring, and cover crops whichever is appropriate. Use and disturbance of soils on steep slopes and in wetlands should be avoided because of the risk of their degradation. They should be left under natural conditions.

Saline soils are managed through adequate irrigation, leaching, draining, and growing salt-tolerant crops. Sodic soil management needs chemical amendments such as application of sulfur and gypsum along with leaching and draining. Management of acid soils involves liming, leaching, and safe disposal of acid-wash water along with cultivating acid-tolerant crops.

For the management of problematic soils, some general principles has to be considered for proper implementation of the

reclamation measures. The total soluble salt concentrations in the root zone have to be decreased to control osmotic effects on plant growth. Maintenance of total soil moisture tension must be ensured at optimum level so that plant roots can absorb an adequate amount of water. Water flows through the soil in the direction of maximum decrease of hydraulic head and the flow velocity is proportional to the hydraulic gradient.

The design and layout of drainage system are controlled by this principle. The availability of good quality water is of paramount for leaching and drainage of soluble salts.The Salt concentration in soil solution upward movement of salts and their accumulation increase with an increase in the evaporation and transpiration from the surface of the soil and the vegetation, especially when the ground water table is shallow. Increase or decrease of salts in the root zone depends upon whether the salt inputs are higher or lower than the salt outputs. The cations in the soil solution and those adsorbed on exchange complex are in equilibrium with each other. The dispersion and effectiveness of amendments are controlled by this principle.

OBJECTIVES

Following are the objectives of this study:

1. To discuss about water management in problem soils
2. To discuss about various remedial Management practices for problem soil

RESEARCH METHODOLOGY

This is descriptive study based on secondary data. Various Research Journals, Books, Websites & various reports which is related to water management in problem soils and various remedial Management practices for problem soil were study to draw the conclusions.

RESULTS AND DISCUSSIONS

In this Paper water management in problem soils, various remedial Management practices for problem soil, Causes for Salt Accumulation, Quality of Irrigation Water, Classification of Problem Soils, Reclamation of saline soil, Reclamation of alkali soil, Different Management practice for chemical problems of soil, Soil physical problems and its management practices are discussed as follows.

WATER MANAGEMENT IN PROBLEM SOILS

When rocks and minerals undergo 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 semiarid regions they accumulate in the soil. Excessive irrigation and poor water management are the two chief causes of water logging and salt accumulation. Accumulation of salts in soil leads to unfavourable soil-water-air relationship and affect the crop production.

A. Causes for Salt Accumulation

The following are the main causes which lead to development of salty soils (Salinity or alkalinity).

(i) Arid climate

About 25% of earth surface is arid in which salt accumulation is a common problem. In India, about 25 m.ha are salt affected with different degrees of degradation.

(ii) High subsoil water table

When the water table is within the 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.

(iii) Poor drainage

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

B. Quality of Irrigation Water

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

Inundation with sea water

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

Nature of parent rock minerals

The saline nature of parent rock minerals leads to salt accumulation.

Seepage from canals

The continuous seepage leads to salt accumulation.

C. Classification of Problem Soils

The soil problems can also be divided into:

(a) Chemical

(b) Physical.

(i) Soil chemical problems

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

	ESP (%)	*EC (m.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 should be 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.

- Calcium chloride
- Calcium sulphate (gypsum)
- Sulphuric acid
- Ferrous sulphate
- Aluminium 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 practice for chemical problems of soil

Reclamation of saline and alkali soils are not complete unless proper remedial measures are undertaken to restore the soil fertility and structure of the soil. The following are the important management practices to overcome these problems. The saline soil can be easily improved with leaching of salts by using of good quality water and by providing good drainage system.

- Application of gypsum would improve the permeability of soil by making good soil aggregates.
- In acidic soil, 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 and CO 43 in rice may be made.
- Adoption of drip irrigation for possible crops is also recommended to overcome soil physical and chemical problems.
- Liberal application of FYM.
- Application of green manure.
- Excess phosphorous application.
- Proper drainage to keep the soil without adverse effect to plant system.

(ii) Soil physical problems

Fluffy soils, ill drained soils, soils with high infiltration rate, soils with 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 and heavy rain create hardening of soil surface in red lateritic soils with high Fe and Al hydroxides and low organic matter. This results in soil crusting. This leads to poor germination, restriction of shoot and root development and slow entry of water into the soil profile.

Management practice for physical problems of soil

In light soils, shallow depth of water with more frequency should be adopted. To increase the infiltration rate in clay soil, amending the 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 20–50 tones per ha, respectively is advocated. The encrustation problem could be alleviated by incorporating organic matter and adding montmorilonite clay containing silt.

CONCLUSION

Problem soils have serious physical and chemical limitations to cultivation. These soils need special management for satisfactory crop production. Physical limitations can be managed by irrigation, drainage, mulching, manuring, tillage, and soil conservation measures such as terracing, contouring, and cover crops whichever is appropriate. Use and disturbance of soils on steep slopes and in wetlands should be avoided because of the risk of their degradation. They should be left under natural conditions.

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