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Reclamation and Management of Salt Affected Soils

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Soil salinity is one of the main plant growth and development problems affecting extensive areas of land in both developed and developing countries. Salinity is common in the region of semi-arid and arid regions where rainfall is low to maintain a regular percolation of rainwater through the soil and irrigation applied without a natural or artificial drainage system. Such irrigation system without proper drainage management the accumulation of salts in the root zone, affecting soil property and crop productivity negatively. Globally, more than 900 M ha of land, accounting for nearly 6% of the world's total land area and approximately 19 % of the total agricultural land is affected by salinity (Ghassemi *et al.*, 1995). Soils containing high amount of soluble salts will interfere with plant growth and development of salt-sensitive crops. Such soils are called saline soils. Plants grown in these soils often appear drought stressed even when adequate water is available because high osmotic potential of the soil prevents the roots from taking in water. These areas often remain wetter compared to the rest of the field, and they usually have a white surface crust when dry. Excess amount of salts keeps the clay like texture in saline soils in a flocculated state so that these soils generally have good physical properties. Structure is generally good and tillage characteristics and permeability to water are even better than those of non-saline soils. However, when leached with a low salt water, some saline soils tend to disperse resulting in low permeability to water and air, particularly when the soils are heavy clays. Leaching may also result in a slight increase in soil pH due to lowering of salt concentration but saline soils, as will be shown later, rarely become strongly sodic upon leaching if there is an adequate drainage system. (Qadir *et al.*, 2014) reported that yield loss 29-70% with the average of 50 % for rice crop occur due to salinity hazards.

Classification of salt affected soils

Classes	pH	ECe (dS/m)	ESP	Local name
Saline	<8.5	>4	<15	Thur, , Khar, Kari, , Pokkati
Sodic	>8.5	<4	>15	Rakkar, Usar, Karl, Chopan
Saline-sodic	>8.5	>4	>15	Usar, Kallar, Karl, Reh, Kshar, Bari

Saline soils; These soils have excess salts present in these soils may be removed by leaching thus bringing them to normalcy. Saline soils are generally recognized by the presence of white crusts of salts on the surface. The important soluble salts content cations viz., sodium, calcium and magnesium and anions viz., chloride, sulphate with low amount of nitrate. Owing to the presence of excess salts and the absence of significant amounts of exchangeable sodium, saline soils often are flocculated and as a consequence the permeability is equal to or higher than that of similar non-saline soils.

Sodic soil; The chief characteristic of sodic soils from the agricultural stand point is that they contain sufficient exchangeable sodium to adversely affect the growth and yield of most crops. For the purpose of definition, sodic soils are those which have an exchangeable sodium percentage (ESP) of more than 15. Excess exchangeable sodium has an adverse effect on the physical and nutritional properties of the soil, with consequent reduction in yield, The soils lack appreciable quantities of neutral soluble salts but contain measurable to appreciable quantities of salts capable of alkaline hydrolysis, e.g. sodium carbonate. Dispersed and dissolved organic matter present in the soil solution of highly sodic soils may be deposited on the soil surface by evaporation causing a dark surface which is why these soils have also been termed as black sodic soils.

Saline-sodic soil refers to a soil having both exchangeable Na^+ and soluble salt in sufficient amounts that cause harmful impacts on all type of crop plants Saline-sodic soils are characterized as the soils that have: ECe > 4 dS m^{-1}, SAR > 13 (mmol L^{-1})$^{1/2}$,pHs > 8.5 and ESP > 15.

Problems of salt affected soils

1) Wilting coefficient of saline soil is very high.
2) Absorption of nutrients are low.
3) Absorption of water is low.
4) Dispersion of soil colloids.
5) Microbial activity reduces.
6) Soil aeration and hydraulic conductivity are low.
7) Some nutrients are produced toxicity.

Management of Salt-affected Soils

General measures for prevention of salinization in reclaimed salt-affected soils aim to protect the soils from the development/reoccurrence of salt build up. These measures include:

1.Measures for maintaining a downward balance of salt and water movement in the soils

2.Measures for reducing the replenishment of ground waters and ingress of salts into irrigated areas

A. Water usage according to weather conditions
B. Control of surplus irrigation
C. Control of seepage
D. Remodeling of ancient irrigation systems
E. Provision of water for domestic purposes
F. Correct planning for rice growing

3.Measures for reducing ground water evaporation

i. Plant cover over the field
ii. Improvement of soil structure
iii. Tree plantation along roads and canals
iv. Use of ground water for irrigation

Management Strategies for Salt-affected Soils

- Leaching requirement
- Crop selection for salt-affected soils
- Balanced fertilization
- Planting techniques
- Chemical amendments

Conclusion

Salt-affected soils are classified into three major categories namely saline, saline-alkali, and sodic Salt affected soils either due to excess soluble salts or due to high exchangeable sodium content have become non-productive, so to restore its productivity, it is highly essential to reclaim these soils using different specific technologies. Another way to combat the salinity/sodicity of soils is saline agriculture approach, i.e. cultivation of salt tolerant plants. Along with reclamation measures, various aspects related to agronomic management do merit.

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