



Water Salinity: Causes and Management Strategy

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Water salinity is major problem in coastal region across the world making it a global challenge. Day by day this problem has been increased in the area around the coastal due to sea water incursion in aquifer system. Which was adversely affected the agriculture production and soil degradation. Due to which the amount of farm produce in this area is decreasing day by day. Also, due to irrigation with brackish water, the salinity of the soil decreases and the quality decreases.

Introduction

Water that is saline contains significant amounts (referred to as "concentrations") of dissolved salts, the most common being the salt we all know so well- sodium chloride (NaCl) (J.G.Hirapara *et al.*, 2019). Salinity of irrigation water sometimes refers as in total soluble salts(TSS) or total dissolved solids (TDS). (Grattan S., 2002).The total soluble salts (TSS) content of irrigation water is measured either by determining its electrical conductivity (EC), reported as micro Siemens per centimeter ($\mu\text{S cm}^{-1}$), or by determining the actual salt content in parts per million (ppm). Prescribes guidelines of salinity hazards of irrigation water according salt concentration are mention in below table 1.

Table 1 Salinity hazard of irrigation water (Follett and Soltanpour 2002; Bauder *et al.*, 2011)

Hazard	Dissolved salt content	
	(TDS)ppm	EC ($\mu\text{S cm}^{-1}$)
None – Water for which no detrimental effects will usually be noticed.	500	750
Some – Water that may have detrimental effects on sensitive crops.	500-1000	750-1500
Moderate – Water that may have adverse effects on many crops, thus requiring careful management practices.	1000-2000	1500-3000
Severe – Water that can be used for salt tolerant plants on permeable soils with careful management practices.	2000-5000	3000-7500

Causes of water salinity

1. Natural Causes :-

- Weathering of rocks, evaporation and the influx of salt water from the ocean.
- In coastal area, seawater intrusion can cause freshwater aquifers to become saline.

2. Human Activities :-

Human activity such as agriculture, mining and urbanization can also cause the water salinity.

- Especially in coastal area, due to over-exploitation of ground water, water level in aquifer is continuously depleting resulting that intrusion of sea water into aquifer is take place which is responsible for increasing the salinity of ground water.
- Use of chemical fertilizers can lead to the accumulation of salts in water bodies.
- Mining can release heavy metals and other contaminates in to water resource.
- Urbanization can be also responsible for increasing water salinity because of discharge of wastewater and storm water runoff.

Effective Management and utilization of saline water

1. Artificial Ground Water Recharge:

Artificial recharge is the process by which the ground water recharge is augmented at the rate much higher than those under natural condition of percolation (Yadav, A. *et al.*, 2012). Artificial recharge tubewell /open well are a technique in which a surface runoff of the catchment has been filtered & diverted in to open/tube well. A filter chamber is constructed near to the well in which surface runoff is filtered. Due to this technique rainwater mixes with the presented saline water in the subsurface strata and reduces the salinity of the ground water.

2. Drainage :

Drainage practice helps to minimize the salinity problem in irrigated agriculture. Subsurface/ surface drainage system can installed in saline water irrigated areas, due to that a gravitational saline water has been drained out in to the drainage channel which reduce the salinity effect of water in agriculture crop and soil.

3. Irrigation water management:

In area having higher water salinity irrigated proportional mixing of good quality of (if easily available) water with saline water and then using it for irrigation reduces the salinity of water or using a fresh water at early growth stages, including pre-sowing irrigation in conjunction with saline water.

4. Irrigation practice:

With a long-term conventional irrigation method, such as traditional furrow irrigation, flood irrigation, basin irrigation, adopted saline water irrigation will cause soluble salts to cumulate in the soil which will increase the salinity of soil (Li, D. *et al.*, 2022). Drip irrigation is considered the most effective irrigation method for saline water utilization. It provides a uniform, continuous and high-frequency water supply to the soil, facilitating salt leaching from crop roots (Dehghanisani, H. *et al.*, 2006).

5. Mulching practice:

Salt accumulation in the root zone is a major issue while saline irrigation water has been use, which could be controlled through the help of the application of Mulching practice in to the field such as plastic mulch, straw mulch, shredded leaves etc. Mulching will reduce the upward movement of salts and evaporation which helps to reduce the accumulation of salt in to the root zone of crop (Zhao *et al.*, 2014, Chen *et al.*, 2016).

6. Soil /cultural management:

Planting the seed in the centre of the raised bed / ridge may affect the germination as it is the spot of greatest salt accumulation. A better salinity control can be achieved by using sloping beds with seeds planted on the sloping side just above the water line. Alternate furrow irrigation is advantageous as the salts can be displaced beyond the single seed row (Fipps, G, 2003). Application of straw mulch had been found to curtail the evaporation from soil surface resulting in the reduced salt concentration in the root zone profile within 30 days.

7. Other general guideline for use of saline water in agriculture:

- 1) The use of gypsum for saline water
- 2) Additional phosphorous application

- 3) By using 20 % extra seed and irrigating earliest as possible as (within 2-3 days) to improve the germination of crop.
- 4) For soil having either a shallow water table (with in 1.5 m for a crop sown just before the monsoon) or hard subsoil layer.

Conclusion

At now days a salinity of water has been increasing day by day because of sea water intrusion in aquifer due to over overexploitation of ground water. It ultimately reduces the agricultural production. There for is must be necessary to carried out proper management activity through artificial ground water recharge, proper drainage, irrigation water management and practices, mulching and soil management practice etc. Adoption of such type of practices helps to reach a step closer towards global food security through achieving a suitable agriculture production.

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