

CHAPTER – 1

QUALITY OF IRRIGATION WATER

Saline Soils:

These soils contain soluble salts, mostly chlorides and sulphates of sodium, calcium and magnesium, in quantities enough to interfere with the growth of most crop plants. The soil pH of saturated paste of these soils is less than 8.5, Electrical Conductance (EC_e) more than 4 deci-Siemens/m (dS/m) and Exchangeable Sodium Percentage (ESP) less than 15.

Alkali Soils:

Alkali soils contain salts dominated by bicarbonates, carbonates and silicate of sodium capable of alkaline hydrolysis or have sufficient exchangeable sodium to interfere with the growth of most crops. The soils pH is greater than 8.5, Electrical Conductance (EC_e) of Saturation extract less than 4 dS/m and exchangeable sodium percentage (ESP) of 15 or more.

Saline Alkali soil:

A soil which shows EC of the saturation extract greater than 4 mill-mhos/cm at 25° C and its ESP value is greater than 15. The pH of the saturated soil paste may somewhat exceed 8.5.

Non-Saline Alkali Soils:

A soil which has exchangeable sodium percentage (ESP) above 15 and EC of the saturation extract less than 4 mill-mhos/cm. The pH value of such soils is more than 8.5 and ranges between 8.5 to 10.

Cation Exchange:

Interchange of a cation in solution with another cation on a surface active material.

Cation Exchange Capacity (CEC):

The total quantity of cations which a soil can absorb by cation exchange usually expressed as milli-equivalence per 100 grams. Measured value of the cation exchange capacity depends somewhat on the method used for its determination.

Dispersed Soil:

Soil in which the clay readily forms a colloidal suspension. Dispersed soils usually have low permeability. They tend to shrink crack, and become hard on drying and plastic on wetting.

Electrical Conductivity (EC):

It is the reciprocal of the Electrical resistivity. Quantitatively the electrical resistivity is the resistance, ohms, of a conductor, metallic or electrolytic, which is 1 cm long and has a cross-sectional area of 1 cm². Hence Electrical conductivity is expressed as the reciprocal of ohm-cm or mhos/cm. The terms “*Electrical Conductivity*” and specific electrical conductance have identical meanings. For convenience in units, millimhos/cm (10^{-3} mhos/cm) or micromhos/cm (10^{-6} mhos/cm) are used.

Equivalent Weight:

It is the combining capacity of an element or radical with hydrogen. It is the weight in grams of an ion or compound that combine with or replace 1 gm of hydrogen.

Equivalent weight = Atomic weight/valency

For example: Equivalent weight of Na^+ = $23/1 = 23$

Equivalent weight of Cu^{++} = $40/2 = 20$

Equivalent weight of Cl^- = $35.5/1 = 35.5$

Note: Milliequivalent weight = Equivalent weight/1000

Exchangeable Cation:

A cation that is adsorbed on the exchange complex and which is capable of being exchange with other cations.

Exchange Complex:

The surface active constituents of soil (both inorganic and organic) that are capable of cation exchange.

Exchangeable Sodium Percentage (ESP):

It is the degree of saturation of the soil exchange complex with sodium and may be calculated by the following formula:

$$ESP = \frac{\text{Exchangeable Sodium (milli - equivalent/100 gm soil)}}{\text{Cation exchange capacity (milli - equivalent/100 gm soil)}} \times 100$$

Leaching:

The process of removal of soluble material by the passage of water through soil

Leaching Requirement:

The fraction of the water entering the soil that must pass through the root zone in order to prevent soils salinity from exceeding a specified value. Leaching requirement is used primarily under steady-state or long-time average conditions.

Milli-equivalent (meq): One thousandth of an equivalent.

Milli-equivalent per liter (meq/litre): A milli-equivalent of an ion or a compound in 1 liter of solution.

Molar Solution:

It is the solution having a salt concentration equal to one gram molecular weight dissolved per liter (Molar solution = gram mole mol. wt. per liter)

Parts Per Million (PPM):

The result of a chemical analysis of water are usually report in parts per million of the various substances present in the sample. One part per million (ppm) means one part in a million parts. As commonly measured and used, parts per million is numerically equivalent to milligrams per liter.

Saturation Extract:

The solution extract from a soil at its saturation percentage

Saturation percentage:

The moisture percentage of a saturated soil paste expressed on dry wt. basis.

Sodium Absorption ratio (SAR):

A ratio for soil extracts and irrigation water used to express the relative activity of sodium ions in exchange reaction with soil in which the ionic concentration are expressed in milli-equivalents per liter.

$$SAR = \frac{Na^+}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

Osmotic Pressure:

It is the equivalent negative pressure that influence the rate of diffusion of water through a semi-permeable membrane its direct experimental value for a solution is the pressure difference required to equalized the diffusion rates between the solution and pure water across the semi permeable membrane. Osmotic pressure in atmospheres may be calculated from the freezing point depression (ΔT) in $^{\circ}C$, by the formula:

$$OP = 12.06 (\Delta T - 0.021 \times \Delta T^2)$$