SALINITY CONTROL

SALINITY

- Irrigation water even of excellent quality, it is a major source of soluble salts.
- The presence of soluble salts in the soil solution can affect plant growth, depending on the salt concentration and susceptibility of plant or crop.
- **Soil salinity** is appraised by measuring the **electrical conductivity or salt concentration** in soil water extracts.
- The soluble salts present in the soils are mainly chlorides, sulphates and sometimes nitrates of Na, Ca, Mg and K.
- In addition to readily available salts, saline soils may contain relatively insoluble salts such as **calcium sulphate** (**gypsum**) and **calcium and magnesium carbonates**.

- In addition to readily available salts, saline soils may contain relatively insoluble salts such as calcium sulphate (gypsum) and calcium and magnesium carbonates
- In order to reclaim saline soils, it is necessary to reduce soluble salt concentration to acceptable limits and
- This can be done by leaching,provided there is adequate drainage either natural or artificial.

Sodicity: refers to the presence of sodium (Na) ions in the soil solution.

Soil acidity & Alkalinity :Acidity is general term that refers to the amount of hydrogen ions in the soil solution.

Crop growth affected by Salinity & Sodicity

1. *Effect of Salinity on Crop growth*

- **Osmotic effect**
  - As salinity of solution increases, its osmotic potential increases too and reduces the availability of water for crop.

2. *Effect of Sodicity on Crop Growth*

Exchangeable sodium affects plant growth in two ways

- It causes nutritional problems
- Poor soil structure

With the breakdown of soil structure, plant growth is effected by:

- Poor aeration in the root zone
- Reduced water movement
- Water logging in the root zone or on the soil surface

Causes for Salt build-up in Irrigated Soils

The following factors either singly or in association with other factors are responsible for the development of Saline and Alkaline soils

- Use of Saline Irrigation Water
- Deposition of salts on the soil surface from high sub-soil water table
- Seepage from canals
- Arid climate
- Poor drainage
- Back water flow / Intrusion of sea water

SALT BALANCE

- The relation b/n the quantity of soluble salts brought into an area by the irrigation water and
- The quantity removed from the area by the drainage water has been called **“ the Salt Balance “** of the area.

- The ***salt balance in the soil*** is influenced by ***the quantity and quality*** of irrigation water and the effectiveness of leaching and drainage.
- The salt balance of soil is expressed by the following relationship.

$$V_i C_i + S_m - V_d C_d + S_p - S_c = 0$$

where;

V_i = Volume of irrigation Water

C_i =Salt content of irrigation water

S_m = amount of salt dissolved from soil minerals

V_d = Volume of drainage water

C_d = Salt content of drainage water

Sp = Amount of salt precipitated over the soil surface

S_c = The amount salt removed by the crop

- If D_d &D_i are volumes per unit area of equivalent depths of drainage and irrigation waters respectively, the above equation may be written as

$D_d/D_i=Ci/Cd$ Where;

Dd=volume per unit area of equivalent depth of drainage

Di= volume per unit area of irrigation waters

C_d = Salt content of drainage water

C_i =Salt content of irrigation water

Leaching Requirement

Leaching is the process of: dissolving and transporting soluble salts by downward movement of water through the soil.

1.The depth of irrigation water per unit depth of soil, required to produce any specified increase in soil salinity for any given conductivity of irrigation water, can be calculated using the equation

$D_i/Ds=ds/d_w * SP/100 * \Delta EC_e/Ec_i$

D_i=Depth of irrigation water ;D_d=Depth of soil

d_s=Density of soil (bulk density); $d_{w\ =}$ Density of irrigation water

SP=Saturation Percentage of soil ; ΔEC_e=Increase in EC of saturation extract

EC_i=Electrical Conductivity of irrigation water

2. Under High Water Table Conditions, the increase in salinity by the evaporation of ground water, can be determined by:

$\Delta\ EC_e = D_g/D_s x EC_g /SP\ x dw/ds\ x\ 100$

Where;

D_g=Depth of ground water evaporated

EC_g=Electrical Conductivity of ground water

3. The fraction of irrigation water that must be leached through the root zone to keep the salinity of the soil below a specific limit is termed as Leaching Requirement (LR)

$LR = D_d/Di = ECi / EC_d$ …….X

Where;

LR=Leaching requirement as a ratio or as a percent

Ec_i =EC of irrigation water

Ec_d = drainage water expressed in (mmhos /cm)

D_i=depth of irrigation

D_c = Consumptive use

D_d =equivalent depth of drainage water

Con'd…

- The depth of irrigation water, D_i is related to consumptive use, D_c and equivalent depth of drainage water, D_d by the equation:

$D_i = Dc + Dd$

Substitute D_d from eq.(X) into eq.

$LR = (D_i - D_c)/D_i$,

$LR = D_i / D_i - D_c / D_i$,

$LR = 1 - (D_c / D_i)$

$D_c / D_i = 1 - LR$,

Therefore, $Di = D_c / (1 - LR)$

Land reclamation techniques for salt affected soils

Reclamation measure: is a measurement to bringing saline and alkali soils into productive condition.

- In salt affected soils, a water table is often present at shallow depth.
- If so, **first measure** to be taken is to install a drainage system to control the water table.
- The **second measure** is to apply irrigation water to leach the salts from the soil.