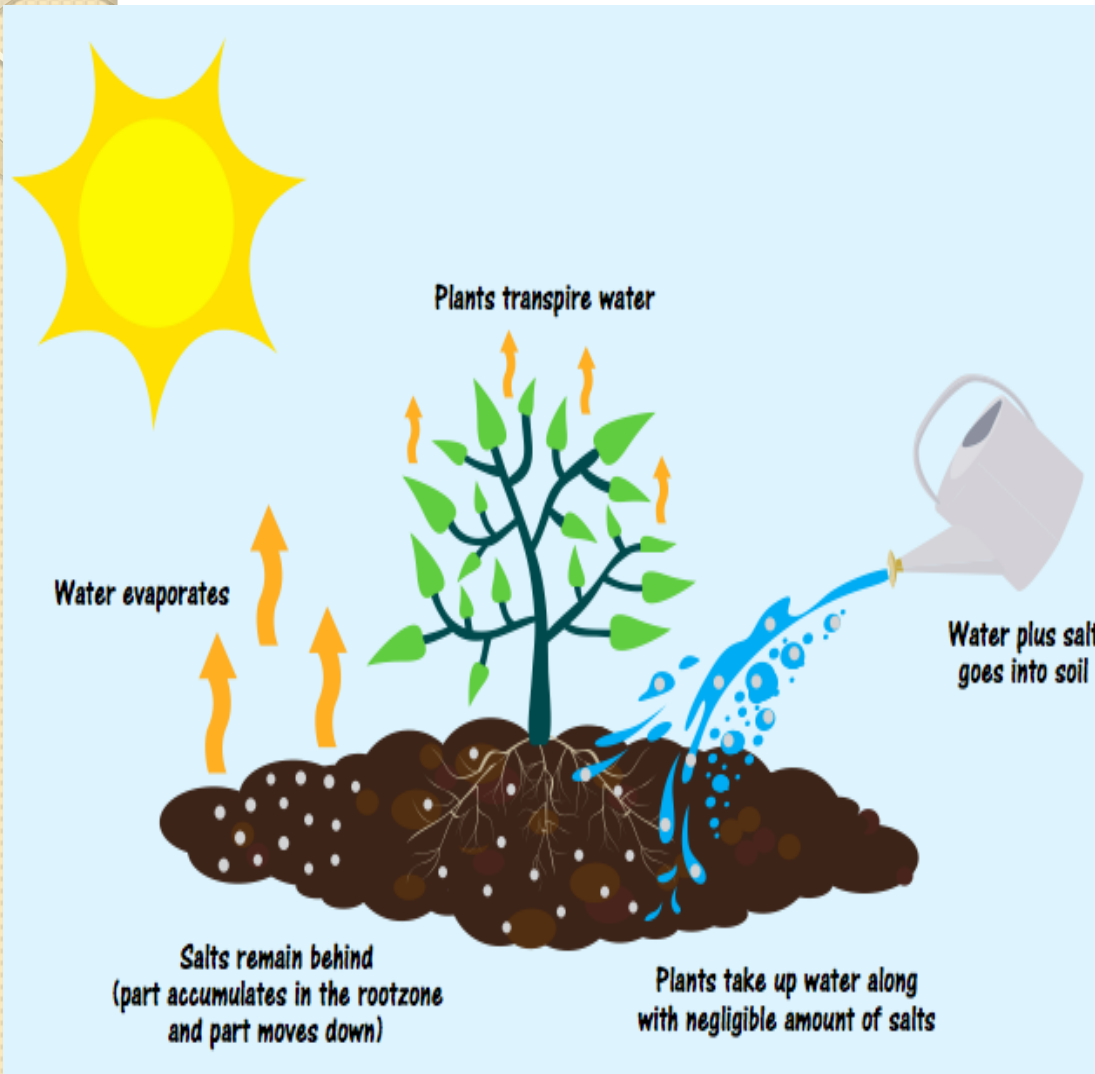


# Quality of Irrigation Water



Lecture note for Soil and Water Management Course  
Prepared by Dr ND Nang

# Definition of water quality

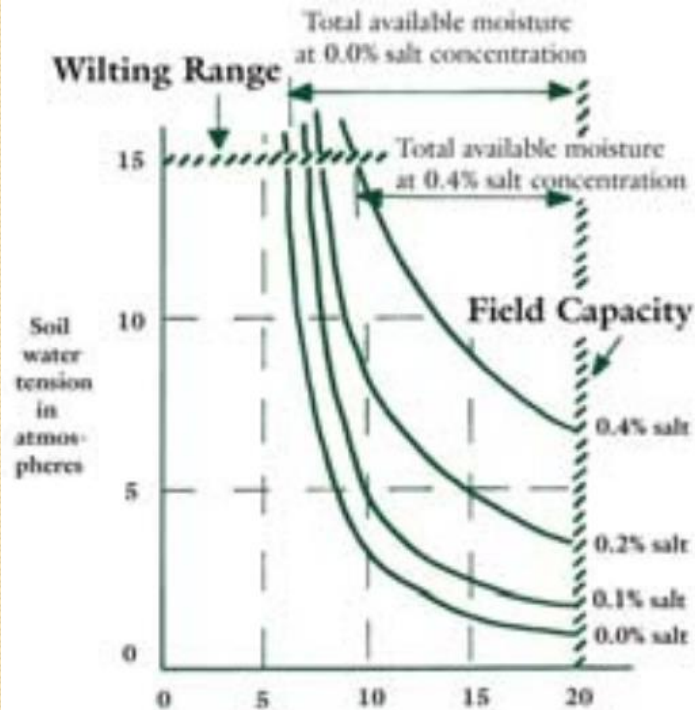


- Water quality refers to the characteristics of a water supply that will influence its suitability for a specific use
- Quality is defined by certain physical, chemical and biological characteristics

# Water Quality Problems

- **Salinity**

Salts in soil or water reduce water availability to the crop to such an extent that yield is affected.



# Water Quality Problems

- **Water infiltration rate**

Relatively high sodium or low calcium content of soil or water reduces the rate at which irrigation water enters soil to such an extent that sufficient water cannot be infiltrated to supply the crop adequately from one irrigation to the next.



# Water Quality Problems

- **Specific ion toxicity**

Certain ions (sodium, chloride, or boron) from soil or water accumulate in a sensitive crop to concentrations high enough to cause crop damage and reduce yields.



# Salinity

- Salts accumulate in the crop root zone to a concentration that causes a loss in yield
- Originate from:
  - A saline, high water table
  - Salts in the applied water

# Salinity

- **Mechanism of salt injury**

The salt concentration in the root zone rise up to 2 to 5 times due to transpiration or by evaporation from the soil surface

- *Osmotic effect*: plant growth depression is attributable to a decrease in osmotic potential
- *Specific ion effect*: concentration of specific ions (Na, Cl, B) is greater than that expected from osmotic effect alone

# Salinity

## Guidelines for interpretations of water quality for irrigation

Potential Irrigation Problem		Units	Degree of Restriction on Use		
			None	Slight to Moderate	Severe
Salinity (affects crop water availability)					
	EC <sub>w</sub>	dS/m	< 0.7	0.7 – 3.0	> 3.0
	(or)				
	TDS	mg/L	< 450	450 – 2000	> 2000



# Water infiltration rate

- Infiltration rate for the applied water or rainfall is appreciably reduced and water remains on the soil surface too long or infiltrates too slowly to supply the crop

# Water infiltration rate

- Mechanism
  - Slaking : Slaking is the breakdown of a lump of soil into smaller fragments on wetting. It is caused when clay swells and the trapped air bursts out
  - Dispersion : Dispersion (the separation of soil into single particles) is governed by soil texture, clay type, soil organic matter, soil salinity and exchangeable cations.

# Water infiltration rate

## GUIDELINES FOR INTERPRETATIONS OF WATER QUALITY FOR IRRIGATION<sup>1</sup>

Potential Irrigation Problem				Units	Degree of Restriction on Use		
					None	Slight to Moderate	Severe
Infiltration (affects infiltration rate of water into the soil. Evaluate using $EC_w$ and SAR together)							
SAR =	0 – 3	and $EC_w$	=		> 0.7	0.7 – 0.2	< 0.2
	= 3 – 6		=		> 1.2	1.2 – 0.3	< 0.3
	= 6 – 12		=		> 1.9	1.9 – 0.5	< 0.5
	= 12 – 20		=		> 2.9	2.9 – 1.3	< 1.3
	= 20 – 40		=		> 5.0	5.0 – 2.9	< 2.9

# Water infiltration rate

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

- SAR : Sodium Adsorption Ratio
- (Na) and (Ca + Mg) are the concentrations of the soluble ions in meq/L

# Ion toxicity

- Toxicity problems occur if certain constituents ions in the soil or water are taken up by the plant and accumulate to concentrations high enough to cause crop damage or reduced yields

# Ion toxicity

## GUIDELINES FOR INTERPRETATIONS OF WATER QUALITY FOR IRRIGATION

Potential Irrigation Problem	Units	Degree of Restriction on Use		
		None	Slight to Moderate	Severe
Specific Ion Toxicity (affects sensitive crops)				
Sodium (Na)				
surface irrigation	SAR	< 3	3 – 9	> 9
sprinkler irrigation	me/L	< 3	> 3	
Chloride (Cl)				
surface irrigation	me/L	< 4	4 – 10	> 10
sprinkler irrigation	me/L	< 3	> 3	
Boron (B)	mg/L	< 0.7	0.7 – 3.0	> 3.0