A. WATER RELATIONS OF PLANTS

3.2. ABSORPTION OF WATER

SYNOPSIS

INTRODUCTION

- Water is the essential component of all living organisms and abundant constituent of most organisms.
- The absorption of water by plant cells, its movement from cell to cell and to different parts of the plant and its movement between the plant and its environment constitute plant water relations.

SOIL WATER

- Soil is reservoir of water for plants. Soil gets its water due to percolation of rain water. Soil water is of four types.

  a.Run-away water :- The type of water which drains away along the slopes due to heavy rain fall is the run-away water. This type of water is not available to plants.

  b.Gravitational water:- Due to the influence of earth's gravity, some amount of water percolates towards earth's crust forming a water table. This type of water is called gravitational water, which is not available to the plants.

  c. Hygroscopic water:- A thin film of water found around the soil particles is the hygroscopic water. This type of water is adhered to soil particles due to strong surface forces. This type of water cannot be utilized by plants.

  d. Capillary water : - The water present in the small pore spaces of soil as thin columns is called capillary water. This water is of great importance to the plants because, it is this water that is available to the plants for absorption.

WATER POTENTIAL

- To perform work or to move energy is required
- **'Free energy'** is the energy available in a system for conversion into work
- The chemical potential of a substance is the free energy with which a substance will react or move.
- In 1960 R.O. Slatyer and S.A. Taylor introduced the concept of '***water potential***' to explain the water movement in thermodynamic terms.
- The symbol of water potential is ψ, the greek letter psi
- The water potential of pure water is arbitrarily set at zero.
- When water is bound up in some way or has materials dissolved in it, the potential energy it possesses less than that of pure water and its water potential is less than zero (Negative value)
- Chemical potentials are generally expressed in energy units
- Physiologists have traditionally expressed the water potential concept in pressure
- Thus the water potential is expressed in atmospheres or bars (1 atmospheres = 1.01 bars or conversely 1 bar = 0.981 atmospheres) or more recently as Mega pascals (1Mpa = 10 bars).
- All the factors that contribute to the water potential are called components of ***water potentials***.
- In a cell three factors contribute significantly to water potential. They are i) Osmotic potential ii) Pressure potential and iii) Matric potential.
- **i) *Osmotic potential :*** The quantum by which water potential gets lowered on account of solutes is'described as the osmotic potential or solute potential.
- Thc sign for osmotic potential is π (Greek letter pi) or $\psi\pi$.
- The osmotic potential is always ***negative***.
- The outwardly directed pressure by the contents of the cell on the cell wall is known as ***turgor pressure***.
- The quantum of change in water potential owing to pressure is termed as ***pressure potential***.
- The sign for pressure potential is ***P*** or ψP .
- The pressure potential in plant cell is usually ***positive***.
- In plasmolysed cells, pressure potential is almost ***zero***.
- The matric factors do not dissolve in water but develop attractive affinity with water molecules.
- The quantum by which the water potential gets lowered on account of matric forces is the ***matric potential***.
- It is represented as ψm or T (Tau). Matric potential is always ***negative.***
- Matric potential (T) accounts for all the forces causing the imbibition or holding water in a matrix of any sort.
- Within living, fully hydrated cells, the influence of matric potential to water potential is ***negligible***.
- Water potential in plant cell *is* equal to algebraic sum of osmotic potential and pressure potential.
- $\psi = \pi + P$ *or* $\psi\pi + \psi P$
- **Diffusion :** The spontaneous process of movement of ions and gases from the region of a higher concentration to a region of lower concentration is called '***diffusion***'