Plant water relations

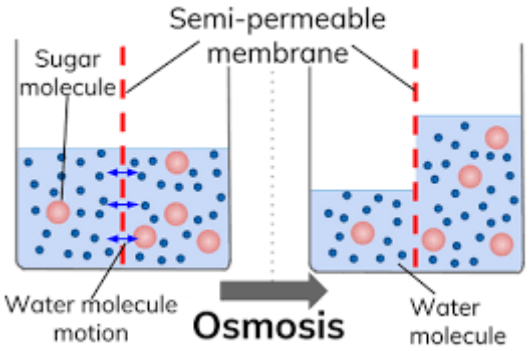
- Water requirement and rates of transpiration vary in plants.
- Water is the limiting factor for plant growth & productivity.

Water Potential:

- Water movement in plants is understood by the concept of water potential.
- Water Potential of water is measure of its kinetic energy.
- Greater the concentration of water in a system, the greater is its kinetic energy
- Between two systems that are in contact with one another water molecules always move from region of higher water potential to region of lower water potential.
- Water potential is denoted by Greek symbol psi or and is expressed in pressure units (Pa-pascals).
- Of pure water under STP is taken as zero and represents the highest water potential.
- Of solutions is always less than pure water. The magnitude of this lowering is due to solute & this is called **solute potential** and are directly proportional to each other and both are inversely proportional to concentration of solute. At atmospheric pressure
- The magnitude of increase in due to entry of water in cells is called **pressure potential**.
- Pressure potential in plant cell is usually positive.
- In xylem, negative pressure potential (tension) plays an important role in ascent of sap.

Osmosis:

- Diffusion of solvent molecules across a differentially permeable membrane (depending on pressure and concentration gradient) is called **osmosis**.
- Cell membrane and vacuolar membrane together are important determinants of movement of molecules.
- Osmotic movement of water in plants is passive.
- Osmosis is demonstrated by **thistle funnel** experiment and **potato osmoscope** experiment.
- During osmosis, water movement between two systems occur until equilibrium is reached. At equilibrium two systems will have the same water potential but not same solute concentration.
- The egg shell is dissolved in the presence of dilute HCl leaving the egg membrane. It is used as semi permeable membrane to demonstrate osmosis in thistle funnel experiment.
- Highly concentrated solution will exert high osmotic pressure.



Plasmolysis:

- Exosmosis in a cell when placed in hypertonic solution resulting in shrinking of protoplast away from the cell wall is called **plasmolysis**.
- During plasmolysis, water is first lost from cytoplasm and then from vacuole.
- In a flaccid cell as pressure potential is zero.
- Salting of pickles, preserving of fish and meat in salt are good examples of plasmolysis (practical applications).
- Plasmolyzed cell becomes turgid again when placed in a hypotonic solution. This is called **deplasmolysis**.
- Pressure developed in cytoplasm against the cell wall due to entry of water is called **turgor pressure**. The pressure exerted by the cell wall on the cell contents is called **wall pressure**.
- TP is responsible for cell enlargement and cell growth in plants, whereas WP prevents rupture of cell.

Imbibition:

- Imbibition is a special type of diffusion observed in solids resulting in increasing their volume.
- Imbibition pressure in plants help the seedlings to emerge out of seed coat.
- Imbibition pressure developed due to swelling of wood is useful in splitting rocks and boulders.
- Imbibing capacities of different organic substances are different. **Proteins** have high imbibing capacity than **carbohydrates**.
- Affinity and water potential gradient between the adsorbent and liquid is compulsory for imbibition.