

Agronomy: Water

This discussion will cover following six areas:

- Why plants need water
- Water in soil-plant atmosphere
- Water movement in soil
- Water uptake by plants
- Translocation
- Evapotranspiration

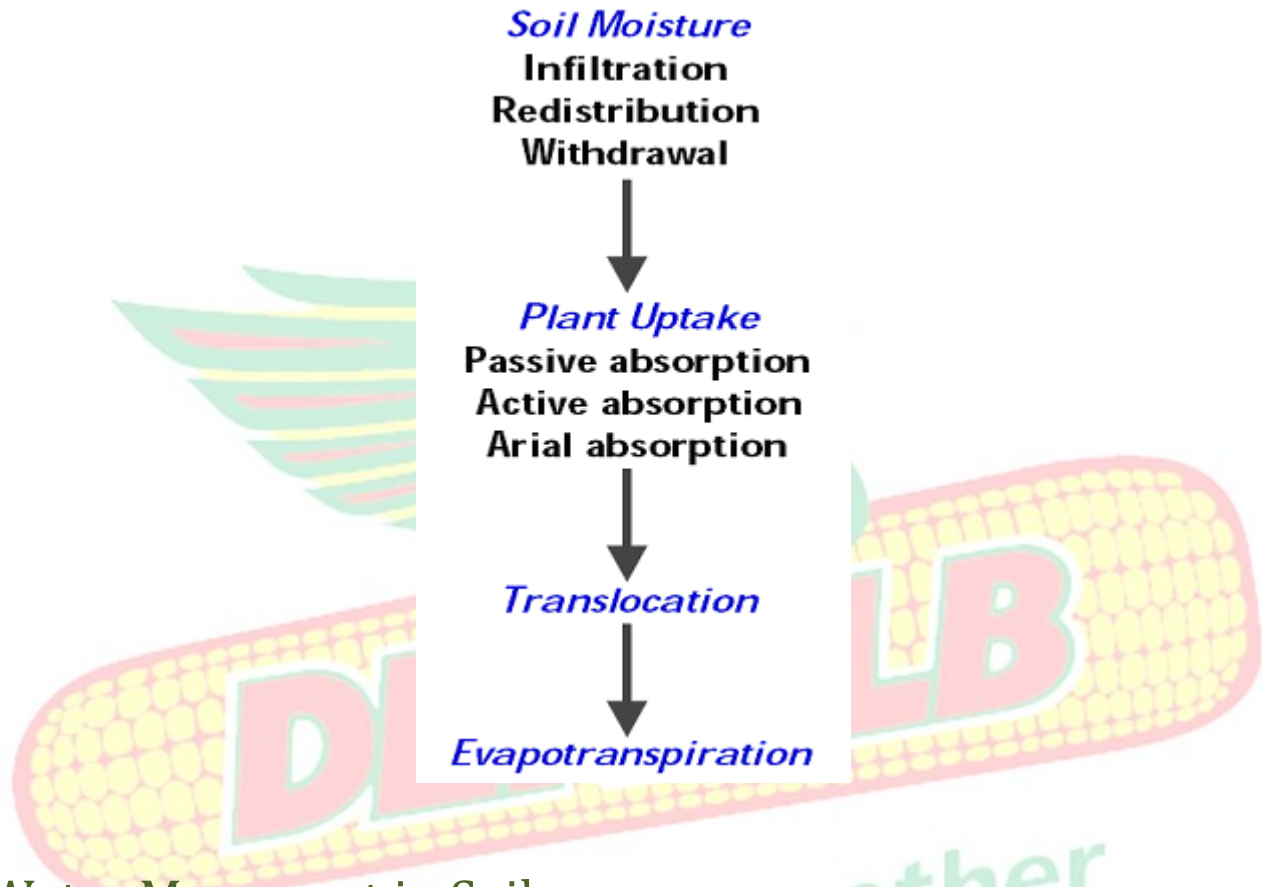
Why Plant need Water

Water is essential for a healthy crop and good yield. Much of Asia depends on monsoons for water. Cropping patterns followed in different regions vary according to the onset of rains and the amount of rainfall that is received. Plants need water because:

- It is an essential part of the plant cell (basic living matter),
- It is an important ingredient in photosynthesis,
- It affects respiration, transport and absorptions of food and minerals,
- Water is essential for cell division (process by which the plant grows),
- Dry soils reduce root penetration by offering high mechanical resistance, and
- It is a vehicle for nutrient uptake.

Water in Soil Plant Atmosphere

Water undergoes the following process:



Water Movement in Soil

Water undergoes three processes in soil:

- Infiltration
- Redistribution, and
- Withdrawal.

Immediately after rain or irrigation, water enters the soil (infiltration). It gradually moves into different layers (redistribution). Water moves from higher potential to lower potential. That is, it moves from an area with higher water content to one with lower water content. The movement may be lateral, upward or downward, depending on differences in water potential in different parts of the soil (withdrawal). Soil is always saturated with water vapour except in the topmost half or one centimeter of soil or in extreme dry conditions.

Movement of water within the soil influences water supply to roots and also contributes to the underground water table. Water moves through pores in the soil in liquid form (flowing under the influence of gravity) and as vapour (under the influence of vapour pressure).

Water Uptake by Plants

Water is absorbed mainly through roots and root hairs. Root systems have an enormous surface area that absorbs water passively and actively.

Passive absorption takes place when water is drawn into the roots by negative pressure in the conducting tissue created by transpiration.

When there is little transpiration, roots of many plants absorb water by expending energy. This is called active absorption. Under normal conditions, active absorption contributes to less than 10 percent of total absorption.

Certain plants are able to absorb moisture from the atmosphere under drought conditions through aerial absorption. This is called negative transpiration because it is the reverse of the transpiration process in which plants give up moisture to the atmosphere. This helps resaturate dehydrated leaf tissues.

Translocation

Water moves through plants with the help of specialized cells known as tracheids. Tracheids are rows of cells with open ends forming continuous vessels. With this system, water can flow from roots to leaves with minimum resistance. The required energy is met by transpiration pull.

Evapotransportation

This is a process by which water is transferred from soil, or water surface, or vegetative cover to the atmosphere. This is a two step process - water is first changed from liquid to vapour and then the vapour is transported from the surface into the atmosphere.

Evapotranspiration accounts for nearly 99 percent of total water uptake by the plant. Leaves absorb a lot of solar energy and exchange gasses with the atmosphere. When the water vapour content of the atmosphere in contact with the leaf is lower than that in the air spaces within the leaf, water diffuses from the leaf into the air. Turgor pressure (pressure exerted by water in leaves) in these dehydrating leaves decreases and this creates an imbalance causing more water to be absorbed by the roots.

Sources and Links

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