

Unit- 1
Plant physiology
Lecture -4

Transpiration

is the release of water in vapour form through the aerial parts of plant.

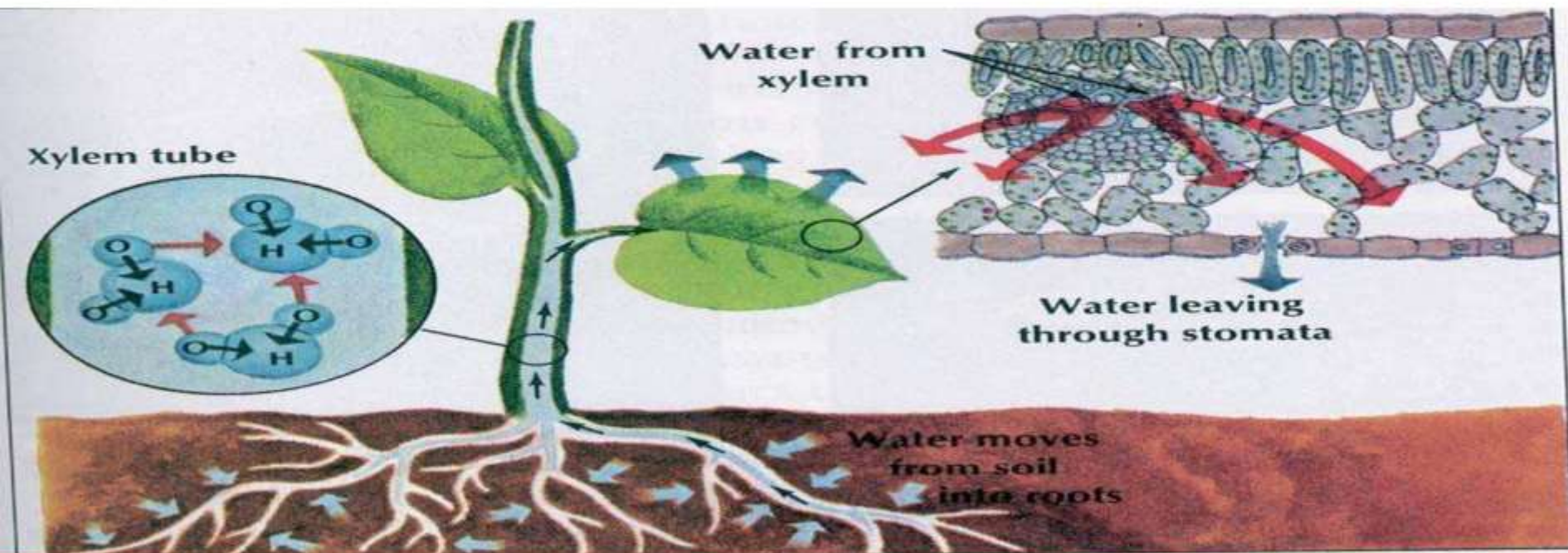
*Prepared by
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Declaration

The source of Data/Text used in the preparation of power point presentation were Google, E-Books, Books and Journals. It is used for teaching purpose only.

Transpiration: Definition

Transpiration: is the process of water movement through a plant and its evaporation from aerial parts especially from leaves.



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Types of transpiration

On the basis of the passages through which plants give out water in the form of vapor transpiration is of three types:

Types of Transpiration

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graph TD; A[Types of Transpiration] --> B[Cuticular]; A --> C[Lenticular]; A --> D[Stomatal];
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Cuticular

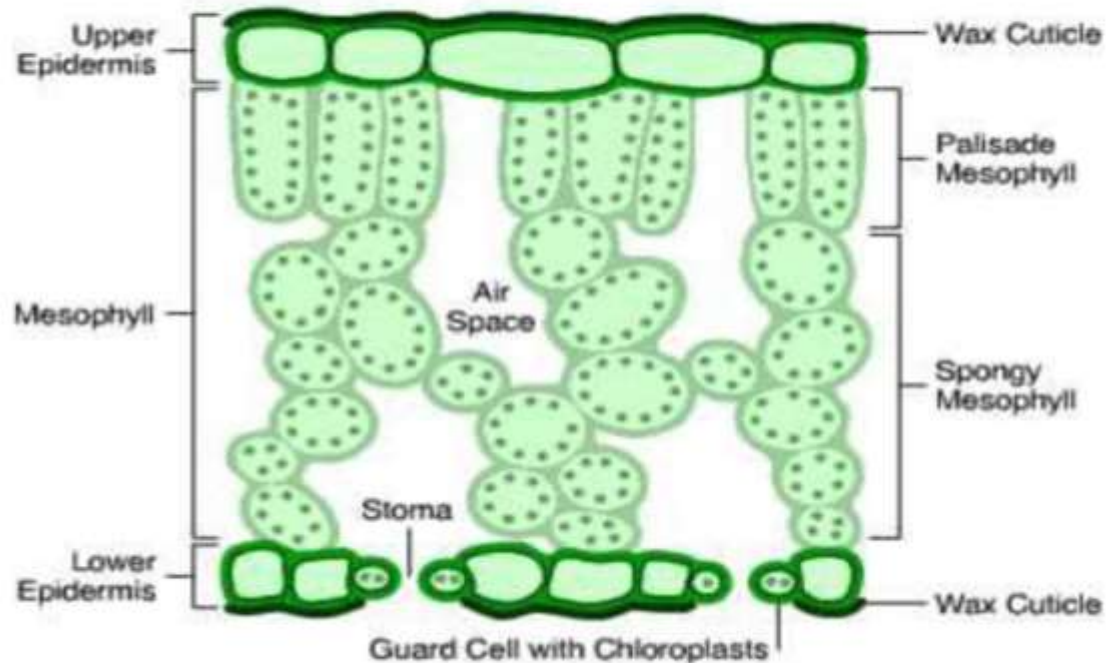
Lenticular

Stomatal

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Types of transpiration

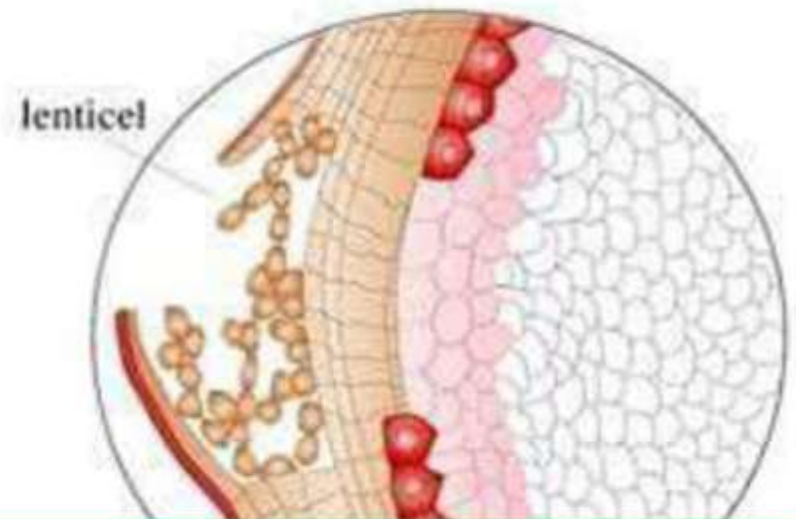
1. **Cuticular Transpiration:** the loss of water through the **cuticle** or **cracks of thin cuticle layer** of leaves and stems is known as Cuticular transpiration. This is a day-night process. In this process, 5-10% water is given out in the form of vapor.



Types of transpiration

2.Lenticular transpiration:

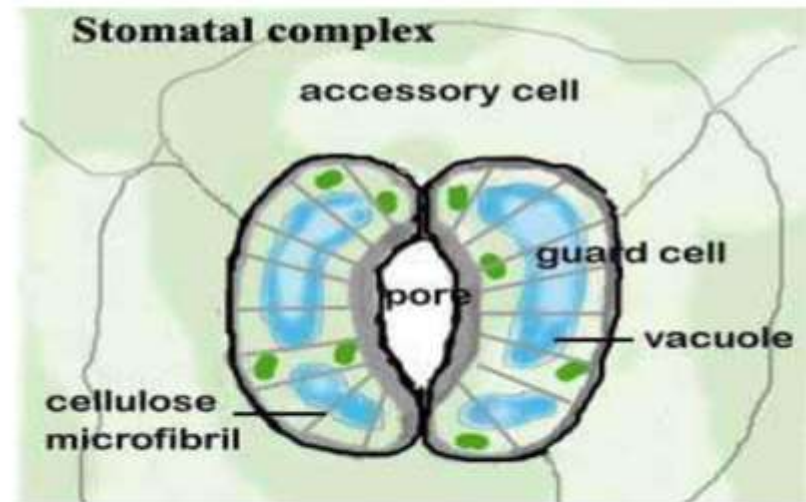
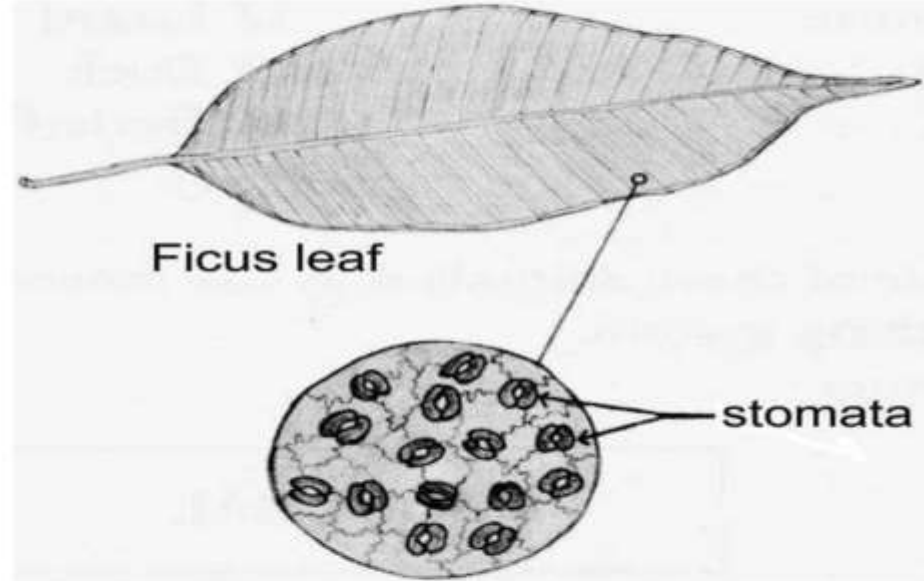
Sometimes transpiration occurs through lenticels, the small opening in the corky tissue covering stems and twigs, and this type of transpiration is said to be the lenticular transpiration. In this process, only 0.1% water is given off in the form of vapor.



Types of transpiration

3. Stomatal transpiration:

- Transpiration that occurs through stomata called stomatal transpiration. This type of transpiration only occurs in its presence of sunlight (in daytime). Because stomata open in the present of sunlight and close in the darkness. plants give out 80-90% water in the form of vapor.



How much water do plants transpire?

During a growing season, a leaf will transpire many times more water than its own weight. An acre of corn gives off about 3,000-4,000 gallons (11,400-15,100 liters) of water each day, and a large oak tree can transpire 40,000 gallons (151,000 liters) per year.



Importance of transpiration to plant

Transpiration is a very useful procedure for plants

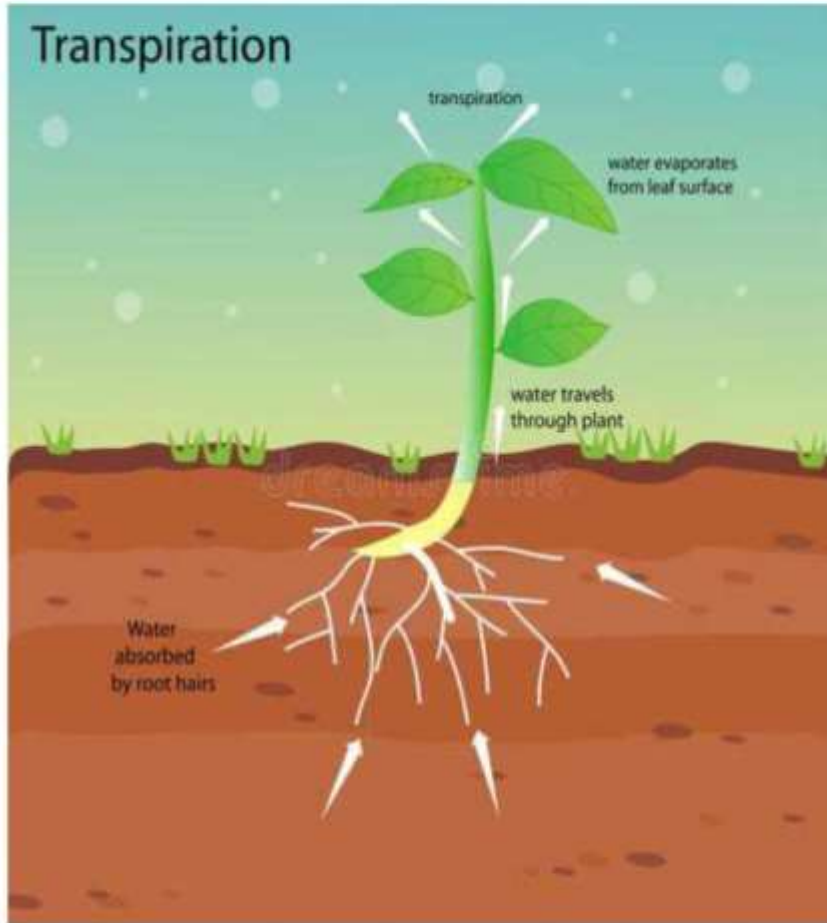
- It creates negative pressure gradient that helps draw water and minerals up through the plant from its roots.
- Helps to keep the plant cool on hot weather- a method of evaporating cooling.
- Supports photosynthesis and encourages the exchange of gases, helping maintain levels of CO₂ and O₂ in the atmosphere.

Importance of transpiration to plant

Transpiration also plays an significant part in Global Hydrological Cycle

- Releases approx 10% of water back in to the environment.
- Produces 90-450 kg of water for each pound of solid material produced by plants.
- Creates water vapor that forms into fog and clouds. Transpiration is also the reason why there is higher humidity in places with lots of vegetation cover.
- Transpiration through plant stomata is the main pathway for water entering the atmosphere over land.
- To a water resources person, transpiration is considered a loss to the watershed. If plants could somehow use less water, the amount saved would remain on the ground to increase recharge.

Transpiration vs Evaporation



Vs



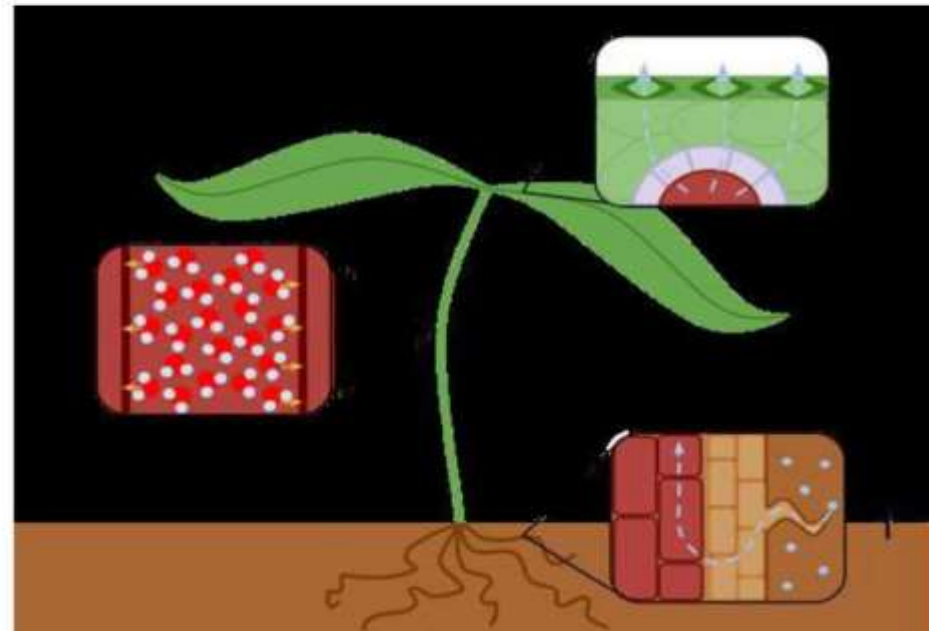
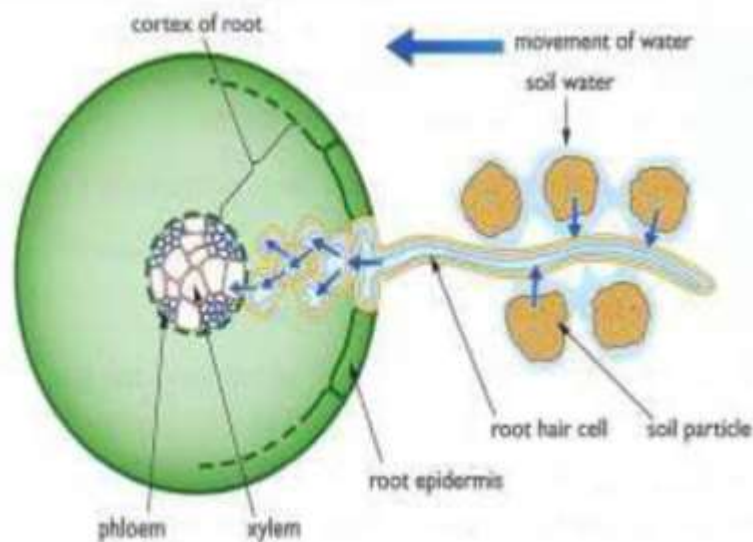
Transpiration vs Evaporation

Transpiration	Evaporation
Transpiration is physiological process which only occurs in plants.	Evaporation is physical process in any free surface.
Transpiration means the water released by plants in the air.	Evaporation means the conversion of liquid into vapours.
Water moves through the epidermis with its cuticle or through the stomata or lenticels.	Any liquid can evaporate. The living epidermis and stomata are not involved.
Living cells are involved in this process.	Living or non-living surfaces can evaporate.
Various forces such as- vapour pressure, osmotic pressure etc. are involved.	Not much forces are involved.
Formation of vapour continues for some time even after the saturation of outside air	Evaporation stops when the air is fully saturated
It is largely dependent upon absorption of water from the soil.	It continues as long as water is available on the surface.

Mechanism of transpiration

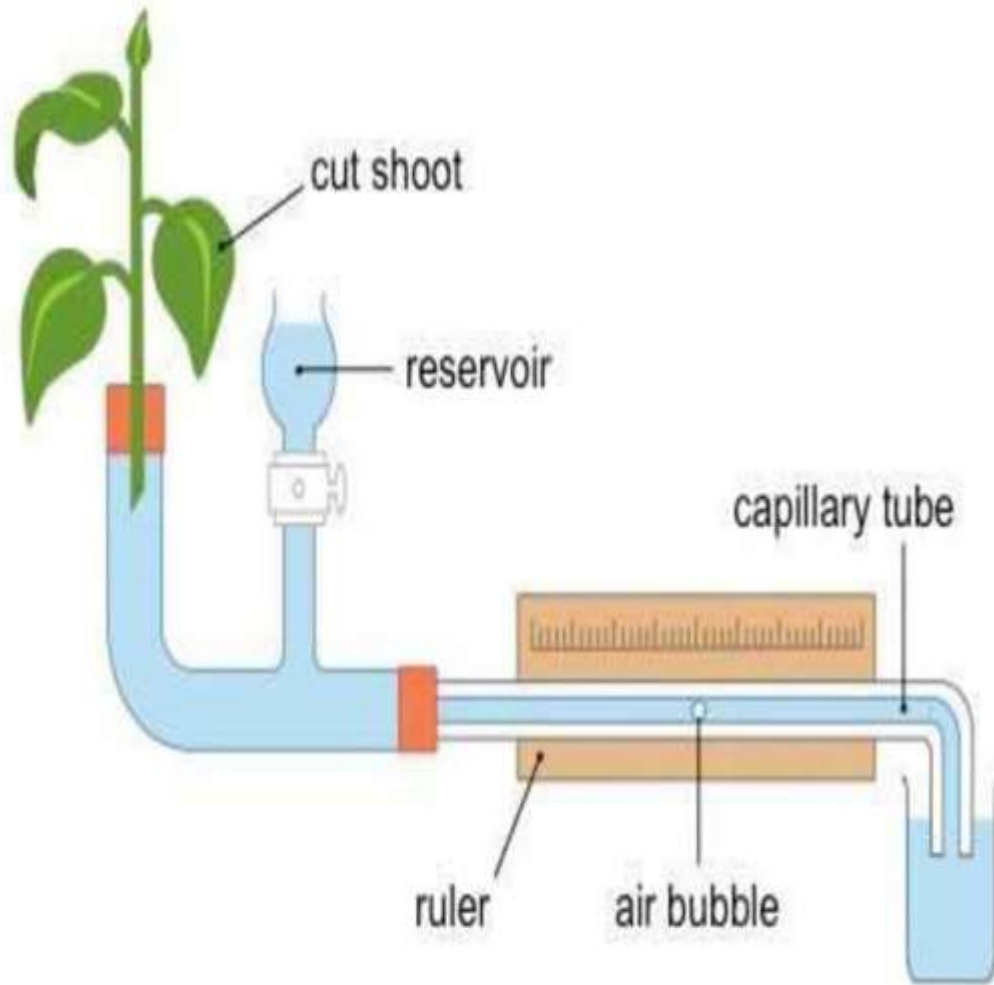
- ❖ Water is passively transported into the roots and then into the xylem.
- ❖ The forces of cohesion and adhesion cause the water molecules to form a column in the xylem.
- ❖ Water moves from the xylem into the mesophyll cells,
- ❖ evaporates from their surfaces and leaves the plant by diffusion through the stomata.

Water enters by osmosis from root hairs and continues until it reaches the xylem vessels.



Measurement of Transpiration

Potometer



Apparatus:

A **potometer** is a device used to estimate *transpiration rates*

Experimental Method:

The distance moved by an air bubble can be recorded every minute and used to indicate the rate of water uptake by the plant

Internal factors affecting on transpiration

- 1. Number of leaves:** More leaves (or spines, or other photosyn. organs) means a bigger surface area and more stomata for gaseous exchange. This will result in greater water loss.
- 2. Number of stomata:** more stomata will provide more pores for transpiration.
- 3. Size of the leaf:** A leaf with a bigger surface area will transpire faster than a leaf with a smaller surface area.
- 4. Presence of plant cuticle:** A waxy cuticle is relatively impermeable to water and water vapour and reduces evaporation from the plant surface except via the stomata.

Internal factors affecting on transpiration

1. Temperature: Transpiration rates go up as the temperature goes up, especially during the growing season, related to open and closed the stomata.

2. Relative humidity: As the relative humidity of the air surrounding the plant rises the transpiration rate falls. It is easier for water to evaporate into dryer air than into more saturated air.

3. Wind and air movement: Increased movement of the air around a plant will result in a higher transpiration rate. This is somewhat related to the relative humidity of the air

4. Type of plant: Plants transpire water at different rates. Some plants which grow in arid regions, such as cacti and succulents, conserve precious water by transpiring less water than other plants.

5. Soil-moisture availability: When moisture is lacking, plants can begin to senesce (premature ageing, which can result in leaf loss) and transpire less water.

Antitranspirant

are compounds applied to the leaves of plants to reduce transpiration. They are used on **Christmas trees, on cut flowers, on newly transplanted shrubs, and in other applications** to preserve and protect plants from **drying out too quickly**. They have also been used to protect leaves from **salt burn and fungal diseases**.



A close-up photograph of green, dew-covered leaves, likely from a plant like a peace lily or similar, with the text "Thanks for your attention" overlaid in yellow.

**Thanks for
your
attention**