

## Transport to the top

The stems are the highways to the top. In the stems the blood of the plants flow, the juice. We know now how the roots absorb the water with the nutrition (you can read it in the last three transport-articles).

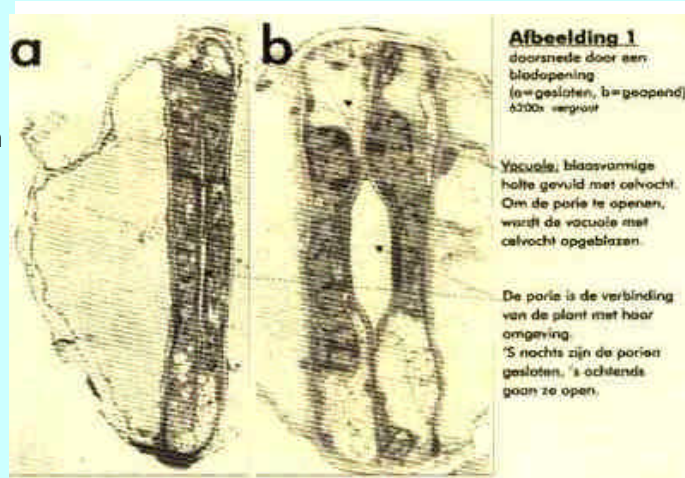
The water flows through the roots by the suction power that are created when the leaves above evaporate the water. If there is a lot of evaporation at the top (hot and dry) the roots also absorb a lot of water. If the evaporation is low, (cool and dense climate) then the roots absorb less water (transport part 1).

The water flows unhindered to the stem, the nutrition-salts on the other hand has to take place in a kind of waiting room to get presorted (transport part 2).

In the middle of the roots the stem-system begins, the central cylinder of the roots, that is connected with the central cylinder of the stems.

On the highway to the top the water and nutrition are one again, but in another composition.

The total direction of the current in the plant is, as we know, caused by the perspiration of the leaves. The perspiration is not only determined by the outer climate. Because of the fact that in a room and also not in nature the climate can be optimal, the plants have an operating system on the surface of the leaves and they react to a too dry or a too dense air (together with different temperatures), these are the pores of the leaves. These pores close at a dry climate, that is very evaporative, and open if the natural evaporation is not enough. So the plant can control the fastness of the rate of current and it let only nature help a bit.



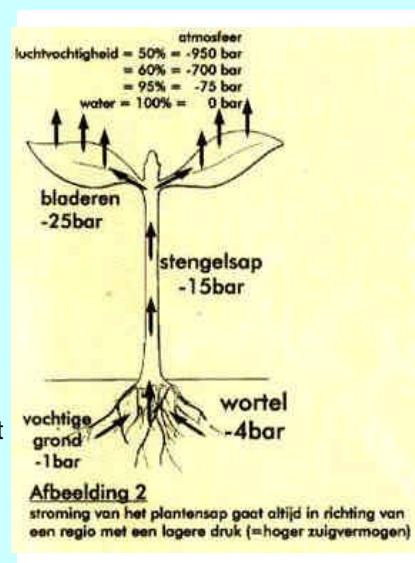
The plant opens and closes the split of the pore by pushing at the two ends (just like a little bag of the weed, where you push at both sides to make the hole more round).

The plant exerts pressure on the corners of the split, by filling the vacuoles (a kind of swim-bladder that is above and under the pore) with liquid. So the pore bends open. If there are splits open, the water disappears out of the leaves shaped like vapour. We call this perspiration.

## Transport motor

The current in a plant is aimed against the gravity, to the top. To get the water at the top, there has to be a kind of a motor. The motor are the pores on the leaves. By these valves the water disappears out of the plant. So a under-pressure is created. It is just like we hear in every day weather forecast about the high and low pressure areas. The air with the clouds of rain (steam) always go from a high pressure area to a low pressure area and that is why the weather is nicer at a high pressure area, no clouds, so sunny and dry. (Nowadays the weathermen do not talk about low pressure areas but about disturbance.)

So it is inside a plant. The plant juice always flows from a high pressure area to a low pressure area. By the complex building of it is not possible to keep the current running up. The plant is divided in pressure zones, that have different powers of absorption. In the upper parts of the plants is always less water pressure (a higher ability to absorb) than in the lower parts. The speed of the juice current depends on the time of the day.

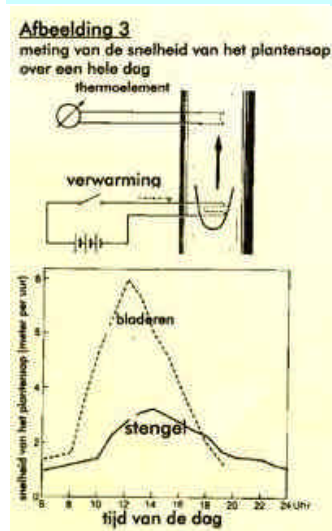


In a stem a heating element is placed that heats the plant juice during a few seconds, the thermos element registers the warm stream of the juice. That is why one can measure the speed of the juice current. By doing the measuring again, one can have an exact survey of the current in a certain piece of the plant during the whole day. When you measure in different places of the plant, you can compare the current in different heights.

### Diagram

When you put these in a diagram, you can see that the curving of the leaves is much higher than the stem. It means that the juice in the upper parts of the plant is flowing faster than in the lower parts of the plants. The speed of the juice current starts climbing fast in the morning (when the sun is completely up). Later on, the juice current is also faster in the lower parts of the plant, but it never reaches the height of the upper part. The speed diminishes earlier in the branches than in the stems and roots. During the night the speed of the current in all parts of the plant are minimal. The resistance of the water in the roots and stem is a lot higher than in the leafs, and the least resistance is the split of the leaf pores. That is the explanation, why the sap of the plant of the upper part of the plant flows faster than the lower parts. If the plant opens the valves, the leafs for a short time, become empty.

What does this mean for the grower?



In the morning in the growingroom means of course: when the lights go on. On that moment, when those are fully burning, the plants begin to open its leaf pores to get a maximal evaporation. This causes a shortage of water in the leafs, an under pressure. The leafs absorb water out of the stems and causes a shortage of water in the stems. This pulls on the water in the roots and these are trying to complete their shortage form out of the ground (plant medium). If the plants wake up in soil that is too dry, it is going to open the splits on the leafs to get the juice current going in spite of the dry feet (we sometimes take a cold shower to activate our blood circulation).

If there is not enough water in the lower parts of the plant to fill up the shortage of water in the leafs, and it is not possible to get new water from out of the ground, than the leafs will hang certainly in the afternoon and if you not quickly water the plants, they can get irreversibly damaged. In spite of the facts that the plants are standing straight after an abundant time watering, the whole time they were hanging they did not make any photosynthesis and the grow did not get any further, they even threw back for one day. So, watch that the plants are not completely dry if the lamps

are turned on. But during the night they certainly must not stand too wet, because the absorption of the water in the roots and the current in the plant is minimal during darkness and the water is not used. Too wet feet can cause all kind of fungous disease fast, and that can make a plant ill.

A second disadvantage of too wet ground (or medium) in the night is that the humidity increases and also the 'morning evaporation' starts with difficulties and the plant does not get a good start.

A good compromise is giving water to the plant in the 'early morning' (for instance 1 or 2 hours after the lights start to burn). This has another advantage, the heat during the day is enlightened by the cooling of the evaporation of the water in the ground. A too big evaporation on the leafs is sabotaged by the increasing evaporation of the water from out of the ground. So in the evening the plant has absorbed a maximal amount of water, but does not stand on a too wet medium during the whole night.