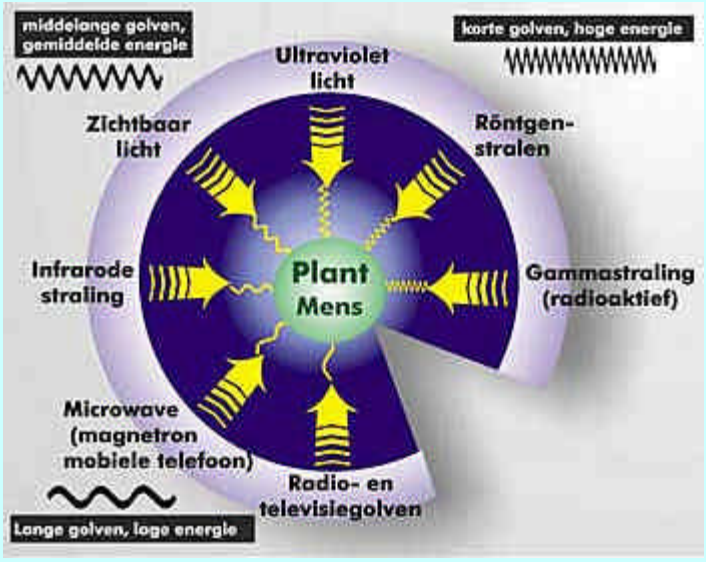
The sense of a plant

It is not easy to describe the senses that plants have. That is because we are also living with a limited perception of life. It is already difficult enough to imagine why a snake can see in the dark by means of infra red sight. An insect with compound eye structure has a different look on life and time. For example, when we go to quickly slap a fly, for the fly, the action is in slow motion.



The entire breadth of the electromagnetic scale

A plant seems to have an even slower outlook on its environment. Well that is what folks who can communicate with plants claim. I would like to show some of the more scientific results, despite the fact that there is still much that is unknown about the secret life and times of plants.
What is sure, is that plants possess an excellent internal communication system from roots to leaf tip. It is also known that plants can receive signals from their environment and that they can also signal back.

What can a plant see?

A plant can perceive a larger area of the light spectrum than we can. Humans use the visible light to give our environment color and contrast. Plants do not possess eyes like ours for taking up the light. They also lack a brain or any other central nerves system in order to rework images. Due to the fact that plants are immobile, they do not need eyes for moving around with.

What is light?

Visible light forms only a small part of the spectrum of so called electromagnetic waves. Electromagnetic waves are constantly streaming out of the sun and the cosmos down onto us, and in return, the earth is constantly releasing radio waves and gamma rays into the atmosphere. The entire breadth of the electromagnetic scale can be seen in figure 1.

Electromagnetic waves move in a similar way to the waves in the ocean. The difference is that electromagnetic waves are not substance bound and so they can travel undiminished through the cosmos before they come to us. Without them, there would be no sunlight or warmth on the earth, nor would we be able to see the stars. Just as light streams down so do other waves, such as gamma and x-rays, it's just that us people cannot observe them.

What is the difference between light waves and other waves?

The only difference between a radio wave and a light wave is the frequency, that is; the number of waves that occur in the same amount of time. The more frequencies, the more energy the rays contain. These rays are measured in wavelengths, which means the distance between two wave crests. Radio and microwaves have a wavelength between half a meter and many kilometres. The

wavelength of light (UV to infrared) lies between 180 and 1200 nanometres. Note: 1 nanometre is 0,000000001 meter or 0,000001 millimetre or 0,0001 micrometer.

Influences of rays on people and plants.

Gamma and x-rays are the most energetic electromagnetic waves. Plants are in a better position to defend themselves against destructive rays than people are. Plants continue to grow undisturbed when exposed to radioactivity that would prove lethal to people. With normal x-rays such as those taken by the doctor, plants do not cast an image, as the x-rays find no bone structure to bounce the rays back. They just pass straight through. With new high tech x-ray measuring meters, it is possible to discern the distribution of minerals in leaves. See figure 2.

Differences in effects of high dosage radiation can be seen in various different plant types. The tobacco plant, for example, can even absorb and store high-density radioactivity, whereas the wheat plant will soon curl up and die under the same.
The effects of long term exposure to radiation (gamma to UV light) can be seen through mutations in all living creatures. In people, these effects manifest in cancer or other disease. Plants on the other hand, will adapt. The number of strains of chrysanthemums is the direct result of artificial radiation.

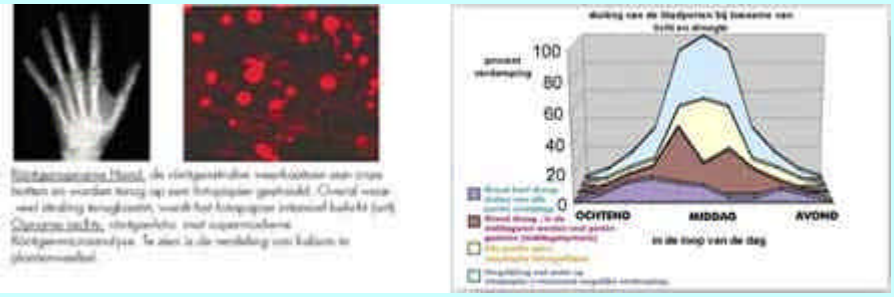
Research has shown that plants that can grow at high altitudes, such as hemp, are very tolerant to the mutagenic rays. These rays are far more intense high up in the mountains, than down in the valleys. This is also the reason that hemp plants can grow under 1000 watt lamps or more, without any damage, as long as the other conditions are also kept at optimum so that they can get used to the light intensity.

Extremely strong light is not absolutely necessary for a good harvest because the basic element CO2 is the most limiting factor when it comes down to metabolism (and with it - the harvest results. Carbon dioxide has to be artificially increased in proportion to the extra light in order to provide an optimal balance for the plants. Very high light intensity absorbed by the plants make them sensitive to water shortages. That means, the plants will close down its leaf pores and will discontinue with photosynthesis and therefore with further growth. More about this aspect in the following article.

Ultraviolet, visible and infrared light

People usually only use light in order to see. One exception to the rule is the synthesis of Vitamin D, which is comparable in a way, to photosynthesis. Sunlight is necessary for this to occur. Children who do not get enough sunshine can develop rachitis or weak bones. This disease came about largely in countries that do not see much sun. It is also known as English disease. Currently, synthetic vitamin D is easily available.

Plants use light to create energy and to nourish themselves. The light reaction that is photosynthesis is not comparable to visual observation, primarily because the light is used by the plants metabolism for the build up and storage of sugars.
In our eyes, light is converted into an electric signal in the eye nerve and then transported to the brain.



1] With new high tech x-ray measuring meters, it is possible to discern the distribution of minerals in leafs.
2] The more light a plant receives, the more sensitive it becomes to disturbances from the excessive heat and lack of water

In the meantime, people have learned that for a plant to be able to do photosynthesis and receive information about its environment, then it needs both the infrared and ultraviolet ends of the spectrum. These are not visible to us. For the best grow and bloom results, artificial lights for plants need to incorporate not only a broad band of red light but also some of the blue light spectrum. The best balance of all the photoactive elements involved has not yet been realised, but it is to be hoped that in the near future, more effective lamps for plants will be developed.

A plants eyes.

Light does more for a plant than just providing fuel for photosynthesis. Plants always grow toward the light. This deliberate movement implies that plants can see light and measure its intensity. Light receptors are to be found in all the green parts of plants. They are comparable to tiny eyes. These receptors, see, measure and compare the light distribution over the entire plant and react to it accordingly. With a light ray that does not come directly from above it, a plant will grow to the side. The mechanism that drives this action is pretty intelligent: the shadowy side of the plant gets the message from the lesser light intake and will make extra grow hormone (auxine) which it then sends to the darker areas. That is why the growth cells on the shady side of a plant are longer and the stalk will turn in the direction of the light.

The part of the plant that is above the soil line also has the tiny 'eye' receptors along the edges of leaf pores. These leaf pores form the only interchange with the outside world. These tiny eyes are able to measure the intensity of ultraviolet light. Should the level of UV rays become too extreme, then these leaf pores close to prevent further transpiration (fluid loss). This also prevents the danger of damage to cells from a too energetic level of UV light. When the leaf pores are closed, no more CO2 (element necessary for photosynthesis) can penetrate and so the action of photosynthesis rests. This can be seen in Nature during midday hours, when the sun is at it's zenith, especially in extremely high and dry regions. The more light a plant receives, the more sensitive it becomes to disturbances from the excessive heat and lack of water. See figure 3.

All this means, that with more light, it is essential to take other factors into account, other factors for the well being of the plant, such as temperature, water, CO2, nourishment and humidity. This of course makes looking after plants in such conditions a bit more complex.

Next time we learn more about those plant eyes under the ground and how important it is that these can see well.