Can cress roots detect irritations and how do they react on it?

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1. General introduction about roots

Roots are important for the absorption of water, this water contains relevant mineral material. The roots make also sure that the plant is stable. Very often the roots are used a storage for reserve assets. There are different types of roots, ones are mostly for the structure and the frame of the rootstock. The others are for the water and nutrient absorption.
To the anatomy of a root: the arrangement of the cells in a root is root hair, epidermis, epiblem, cortex, endodermis, pericycle and lastly the vascular tissue in the centre of a root to transport the water.
The guttation can appear by two reasons. The first one is at night because there is no transpiration and the roots are still absorbing water. The roots push the water to the leaves and because there is no sun, so there is also no photosynthesis and the water must go on the surface of the leaves and build little droops. The second way of guttation is when the ground is wetter and warmer than the air, but in the air rules a high air humidity. The water can not disappear in the air and so the water build droops on the surface of the leaves.

The interests of the physiology in the roots is the anatomy of a root and also the transport and absorption of water. The biochemistry is interested in the way the roots store their nutrient and the mineral material. For the economy the roots are important because they deliver the leaves with water so they can make photosynthesis and they make the air we breathe and the Glucose we can eat. If the roots were harmed or the ground isn`t good for them to grow they have a big influence on the economy.

http://de.wikipedia.org/wiki/Wurzel
http://en.wikipedia.org/wiki/Root

2. Materials and Methods

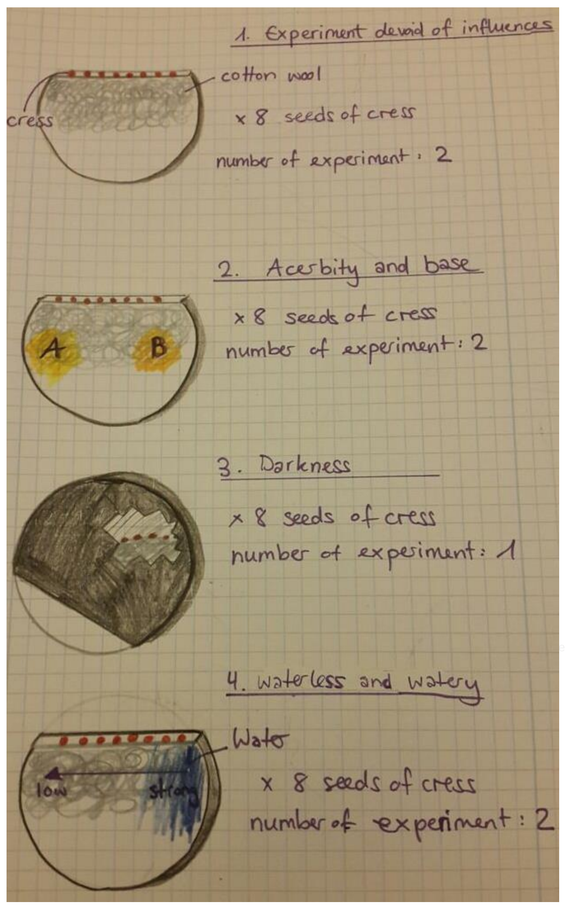
Experiment	Independent variable	Dependent variable(s)	Controlled variables
moisture	Rising from the left to the right side.	Length and growing direction of the roots	▪ light intensity (sun) ▪ preparation of the compounds ▪ alignement of the compounds (vertical)
PH-value	PH-value, rising from alkaline (left side) to acidic (right side)	Length and growing direction of the roots	▪ light intensity (sun) ▪ preparation of the compounds (vertical) ▪ moisture
Light incidence	Direction and intensity of the light incidence	Length and growing direction of the roots	▪ Light intensity (sun blocked off with paper) ▪ preparation of the compounds ▪ alignement of the compounds (vertical) ▪ Moisture

For all experiments we used petri dishes that were as thin as possible, which we cut with a glowing wire (see pictures). With two drops of glue we attached the first layer of cotton to the petri dishes.

After that we regularly placed 8 cress seeds at the upper edge of the cotton and covered them with water. For moistening we use tap water because distilled water would not correspond with natural circumstances (also look at osmosis).

For the first experiment with moisture we moistened the cotton and the seeds to the right heavily and only lightly on the left. Through that we created a linear moisture rising from right to left.

For the second with the PH-value, we used a pipette to put three drops dilute HCl on the edge of the right side and three drops dilute NaOH on the left side. We moistened by drizzle water on the spots with acid respective base, with the result that a linear rising of the PH-value form the left to the right.



Sketch of our experiments

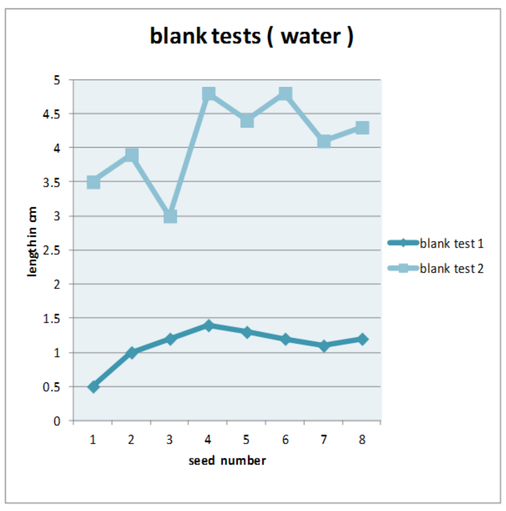
Our grow–up system

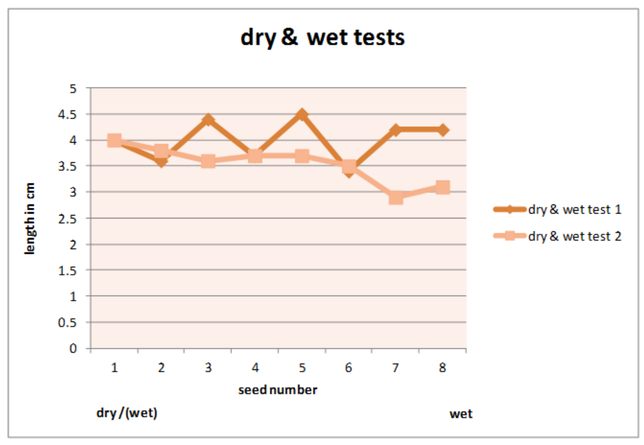
For the third experiment with the „reversed“ light incidence, we builded a light permeable paper cap and placed it on to the petri dishes so the only light entering would come skewed from the bottom. Previously we moistened the cotton.

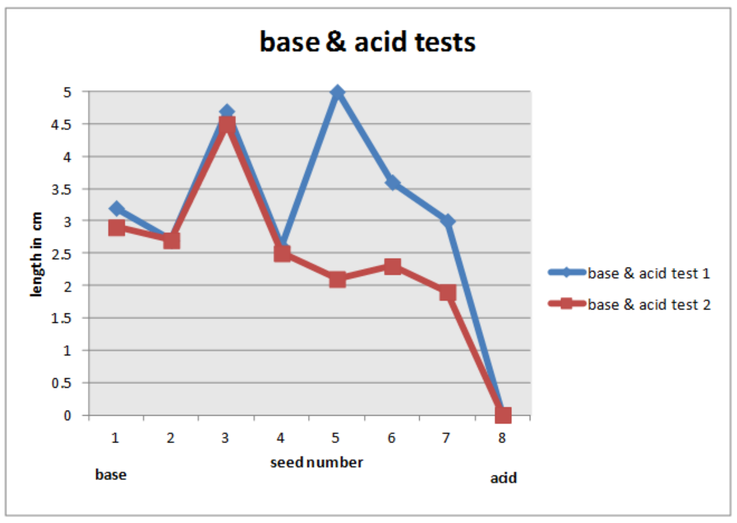
In the end we glued the petri dishes close and glued them vertically onto a stand, so we could put them in front of a window.

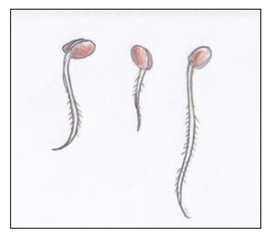
The experiment started on Wednesday afternoon, on Thursday afternoon, Friday afternoon and on Monday morning we added as much water as vaporized during the day. The measurements were taken on Monday afternoon. We measured the length and angel variance from the perpendicular of each root with a triangle.

3. Variables

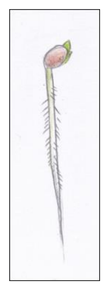




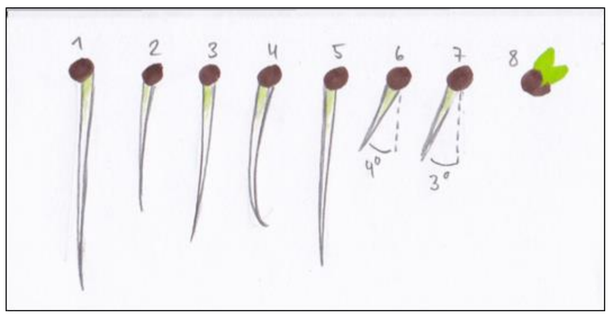




Drawn example of the blank tests.
(test 1 left, test 2 right)

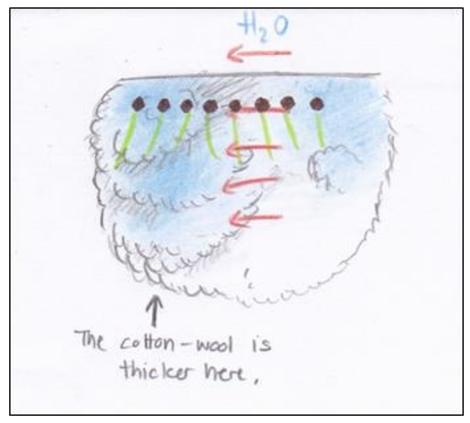


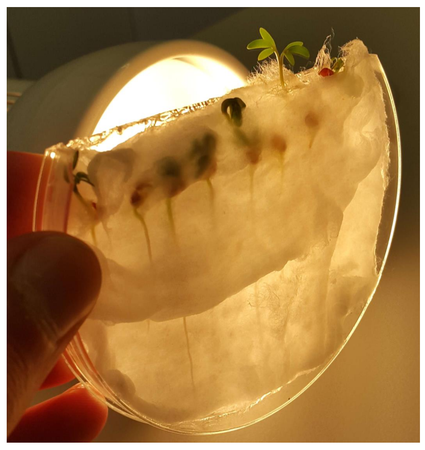
picture to the comment



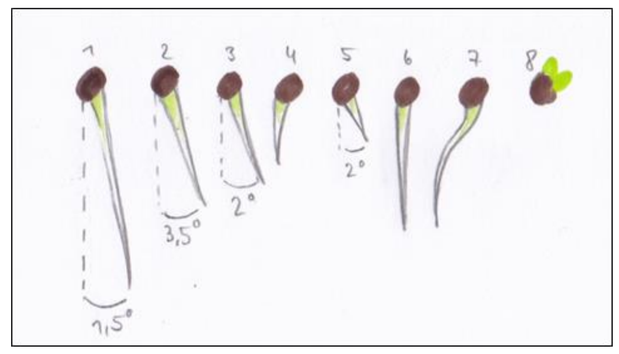
Base & acid tests (test 1)

Our root





Base & acid tests (test 2)



Conclusion and Discussion

Three different tests were made, which have been processed separately from each other and also led to different results. It was investigated, which stimuli cress roots can feel and how they respond to them.

When tested with the acid and the base, it was interesting that in both experiments the roots who were closer to the acid, strongly deviate from this point and grow towards the center. But it was only on the second attempt, that roots who have grown on the basic side grew towards the center (neutral), how we actually expected. The roots at the base part of the second test have surprisingly moved more to the center than the roots on the acid part, except the second outermost root, which tilted the most. To be exactly it tilted 14 ° .
From this we can conclude that the cress roots can perceive the pH levels around the root and can even grow in the direction of better conditions.
The length of the roots in the basic area and the acidic area is about equal, in the acidic part they are somewhat shorter resp. non-existent, because they were most likely etched away.
When tested with the water a clear change in the growth of the roots has been shown at the first attempt. All have moved towards the wet part. Here it is perfectly clear after the first attempt that the roots can perceive the presence of water, and even the direction in which the moist region lies, and can grow towards this region.
On the second attempt, however, the water has unfortunately quite evenly distributed (diffusion) respectively there was to much water on the wet part due to an uneven distribution of cotton, so these results may not be relevant.

When comparing the lengths of these roots we can not identify any trend.
Indeed we have to mention the two blank experiments: In the first experiment with enough water, the roots have not grown very much. In experiment that was nearly dried up the roots are on average about three times as long as in the other experiment. Our explanation is: If the roots already have optimal conditions (plenty of water), they do not have to grow longer because they already find everything necessary where they grow.
If the environment is too dry the roots grow as fast as possible to find water deeper below the ground and create a larger surface to incorporate more water before the plant dies.

At the last experiment with the light unfortunately nothing happened, the seeds didn’t even sprout. This was most likely because the light was too weak. All other controlled variables were fine.