

When plants try birthcontrol:

A brief introduction:

The root is the lower part of a plant's body which has two essential functions:

the attachment of the plant to the ground and the absorption of water and necessary mineral salts for its nutrition.¹ Roots are essential for every living being, humans included. They're important in many fields such as economy, biochemistry, physiology. This is due to their role in food interests which is the basis in socio-economy².

When plants absorb too much water through its roots, and its dispersion in a gas state is hindered, guttation happens: the exit of liquid water throughout the plants. This phenomenon happens especially during the first two hours in the morning 3 am to 4 am

and thanks to this the importance of roots can be seen. Many endocrine disruptors, for example birth control pills, are found in the environment and are dangerous for the physiology of animals. So we asked ourselves: do human steroid receptors also attack plant cell membranes? If yes, what are the effects it can cause?⁵ By adding the birth control pill we observed this change in the roots, but we believe more studies should be made. Considering the results of the experiment are important for ecology. In fact this entire experiment is based on one simple yet intriguing question: there are many studies out there that prove the effect of phyto-estrogens on mammals, especially on humans. So what if we would do the reverse: letting plants absorb human estrogen?



Design of our experiment:

With this experiment we wanted to discover if there is a certain effect on the roots' growth, by introducing a birth control pill in the water in which the cress seeds were planted.

We cultivated the seeds in four different containers: control experiment, experiment with one and three birth control pill and the last one with fertilizer. We later measured the length of the roots daily in a period of 12 days, for all 4. After 12 days had passed, we extracted 200 plants from each box and then we managed to separate their roots from their upper parts. Both parts were then measured once fully dried out.

The independent variable of the experiment is the birth control pill, that has an influence on the roots' growth, which so would be the dependent variable. Meanwhile the controlled variables would be the constant temperature, light intensity, environment, humidity, pressure... Besides this we also managed to always have the same person measuring the changes throughout the growth.

Data collection, processing and presenting:

Days	Control	1 pill	3 pills	Fertilizer
1	3.7	1.8	1.2	1.0
2	5.0	3.9	4.1	1.6
3	9.3	6.9	5.7	1.5
4	11.8	7.6	7.1	1.7
5	12.5	9.0	9.5	2.0
6	12.7	10.5	12.0	2.2
7	13.0	11.0	12.5	2.2

Note:
These are the measurements regarding the growth of the roots in centimeters.
For all four experiments we measured the length of the roots obtaining 200 measurements. We later calculated the average of the data of the four containers.

Part	Control	1 pill	3 pills	Fertilizer
Root	0.047	0.089	0.050	0.035
Aerial part	0.144	0.337	0.174	0.389

Note:
To see if the plants grew more or less, we separated the root from aerial part and we weighted them. At the end we calculated the mass of 100 plants for both parts.

Control	1 pill	3 pills	Fertilizer
12.031	12.328	10.3845	1.248

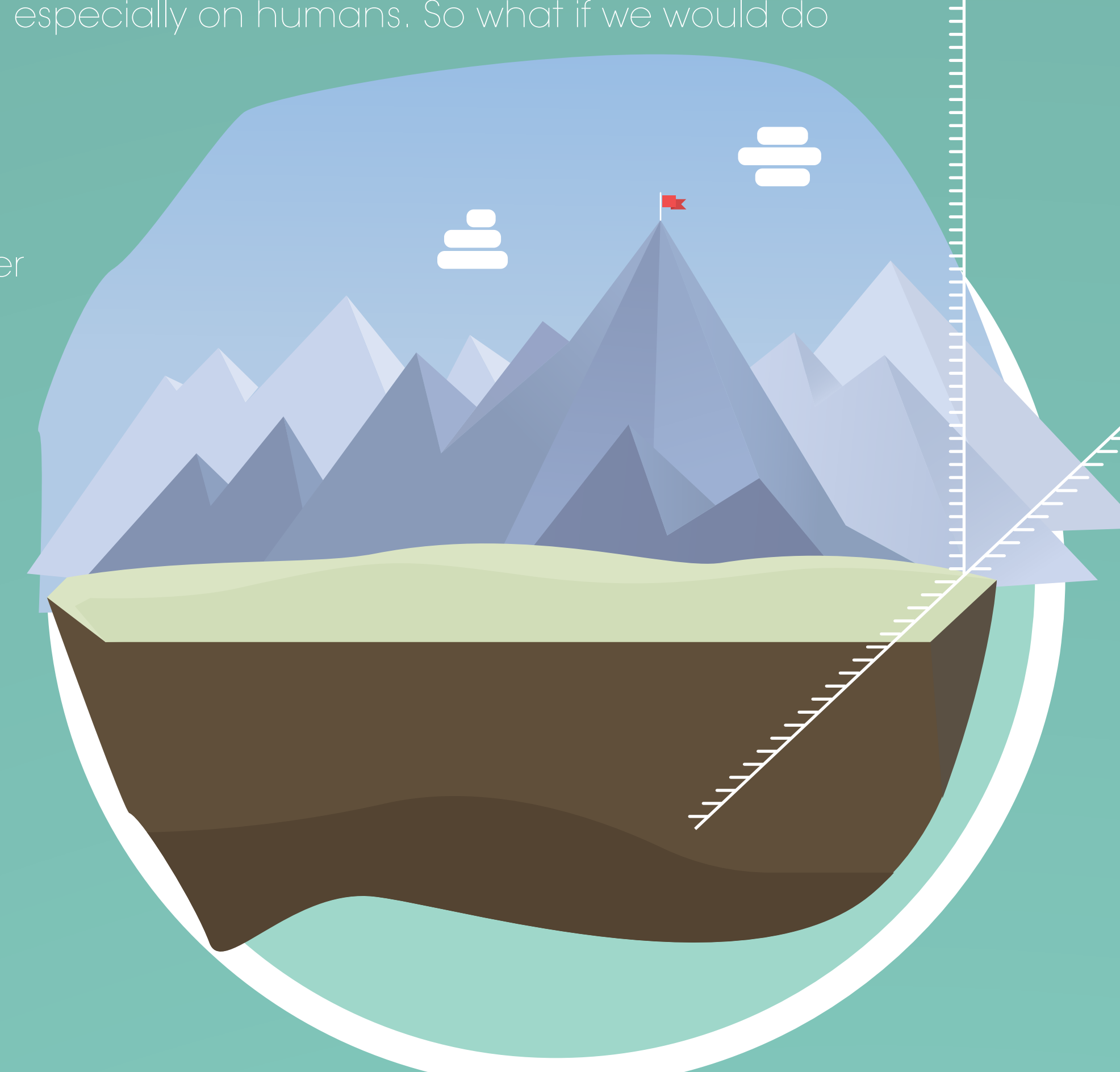
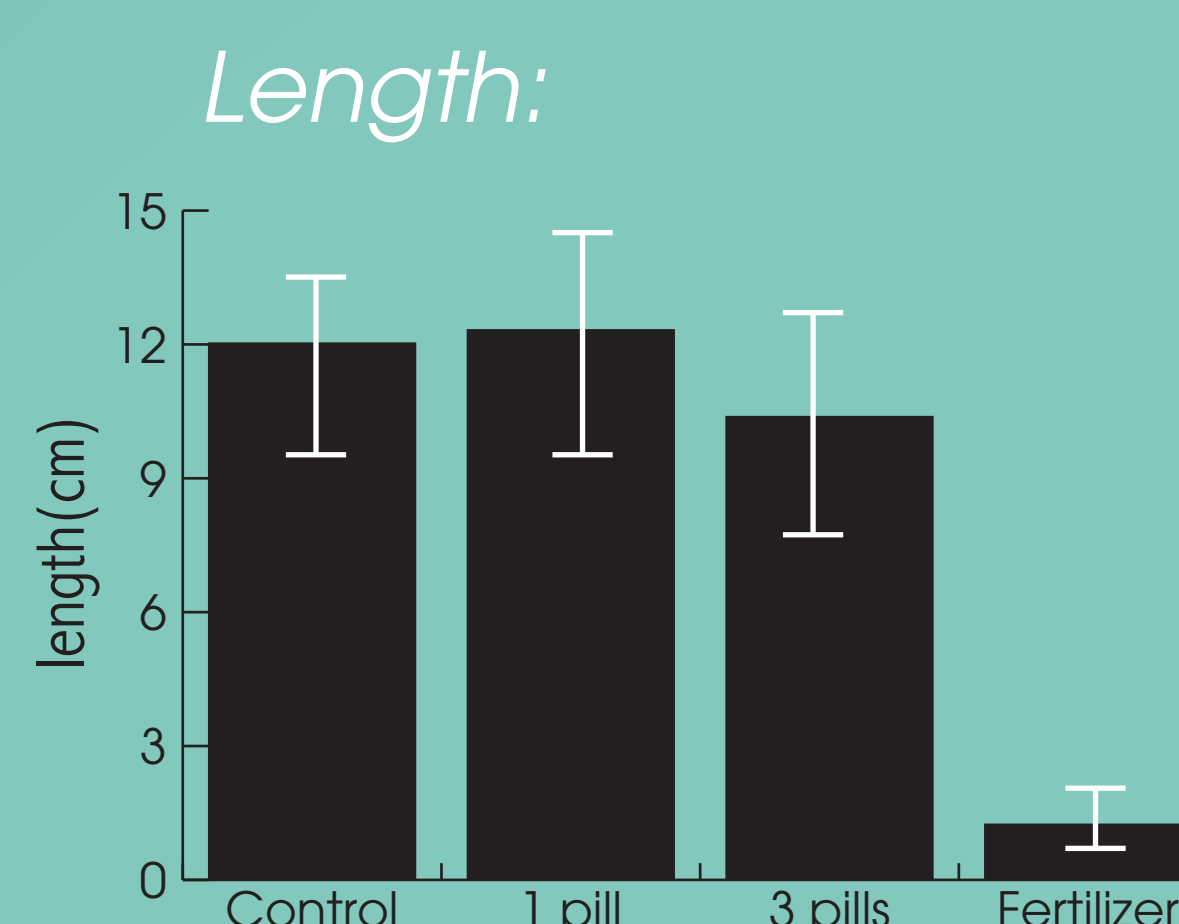
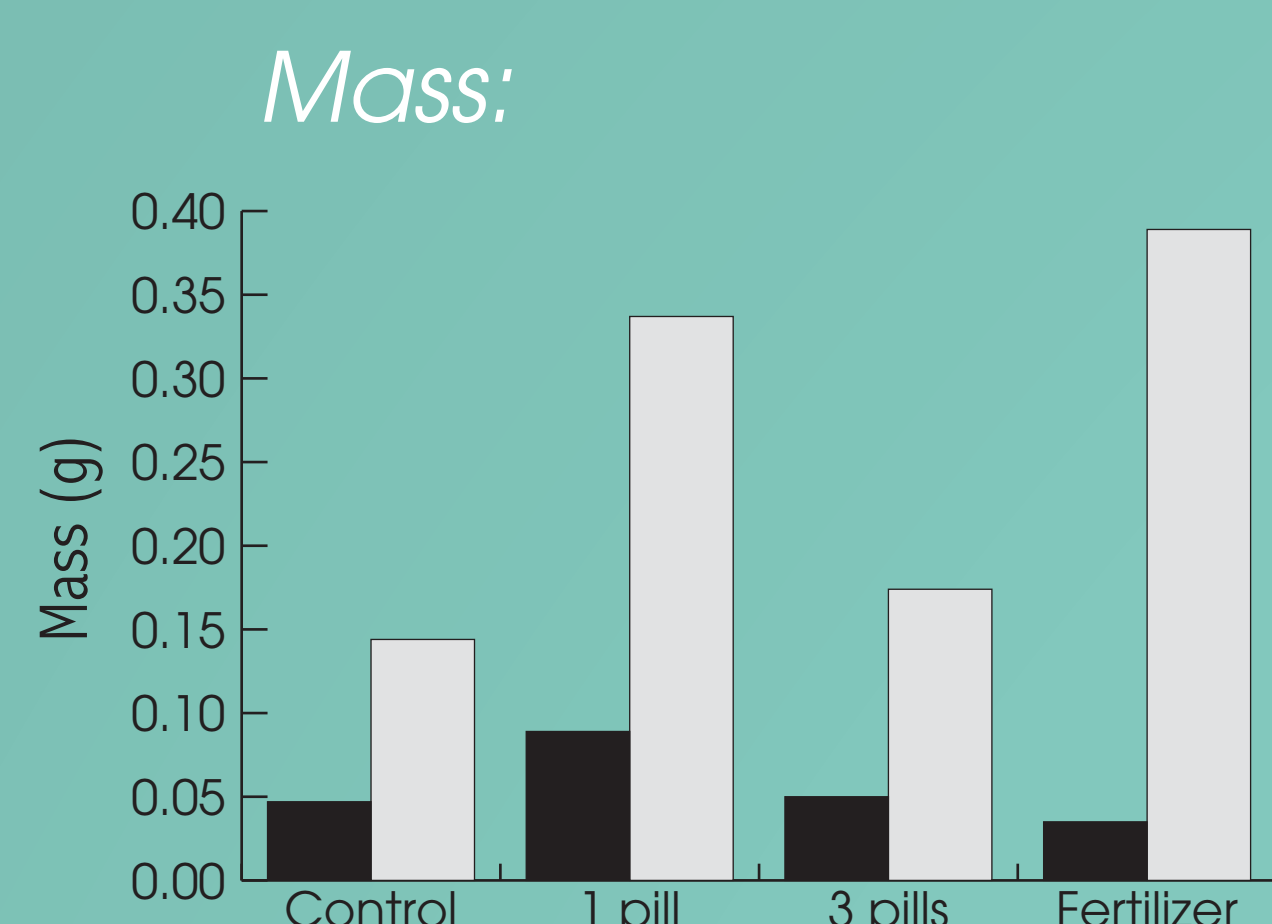
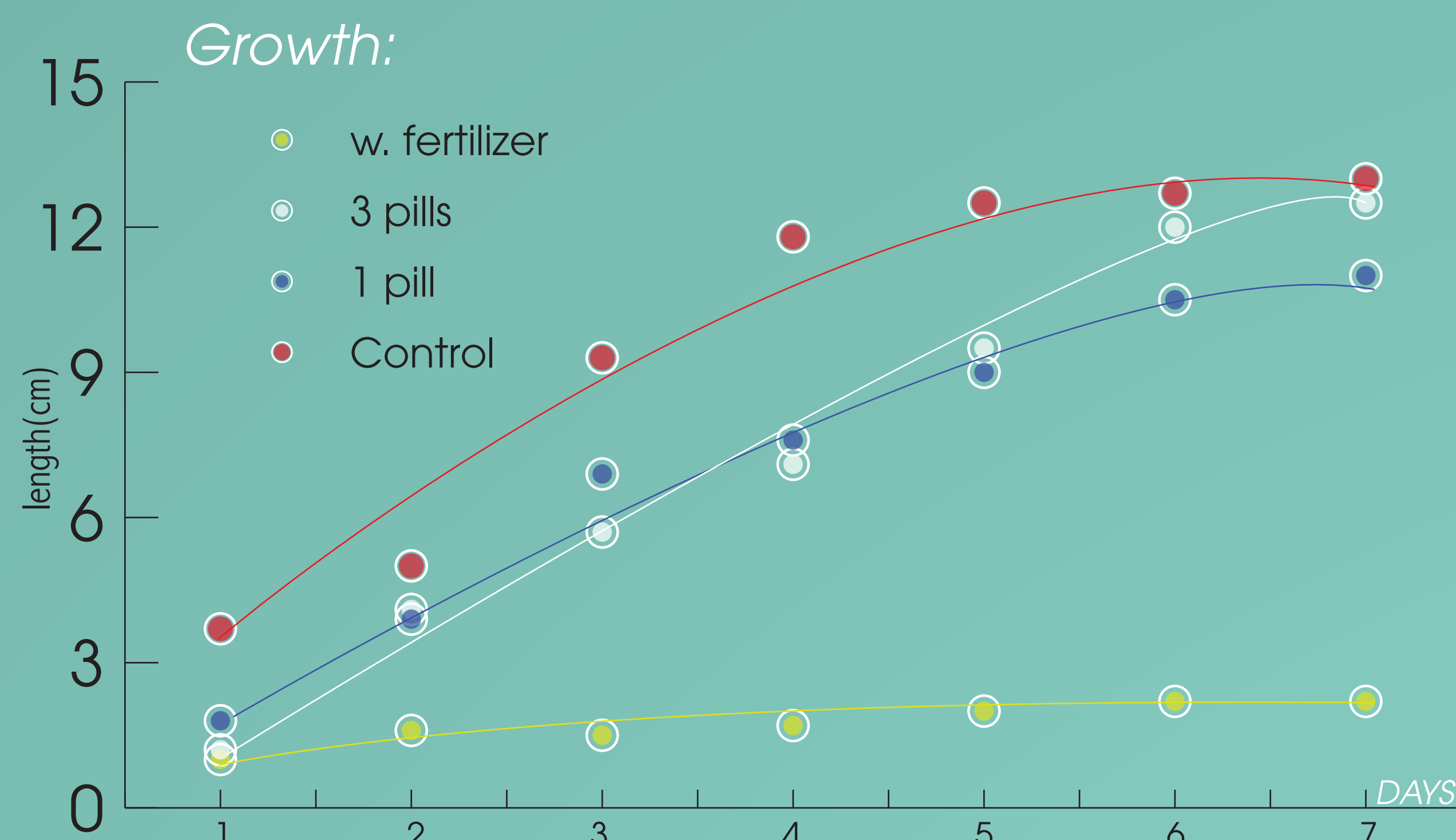


Figure 1:
Our lab with the four different containers and our grow-up system.



Figure 2:
A close view of the interaction between a plant and the substrate.



Conclusion, discussion and evaluation:

The graphs show us, besides some contradictions due to unaccurate measurements, that the plants' roots grown with one or three pills are shorter than the ones in the control experiment, meanwhile the aerial part is quite always the same. This could be due to the fact that the pills fertilize by giving a bigger quantity of nutritious substances and so allow the plant to absorb the necessary nutrient with a smaller absorption surface. This is also the reason why plants grown with fertilizer present much shorter roots than the ones of the control experiment.

Another hypothesis that could explain the shortness of the roots would imply that certain substances found in birth control pills would inhibit the function of the cells responsible for the growth of the root itself, causing different damages and later a minor effectiveness. Even if this is not so probable, considering the plants grown with three but especially with one pill present an aerial part with a bigger mass compared to the one in the control experiment, this wouldn't happen if the roots were damaged.

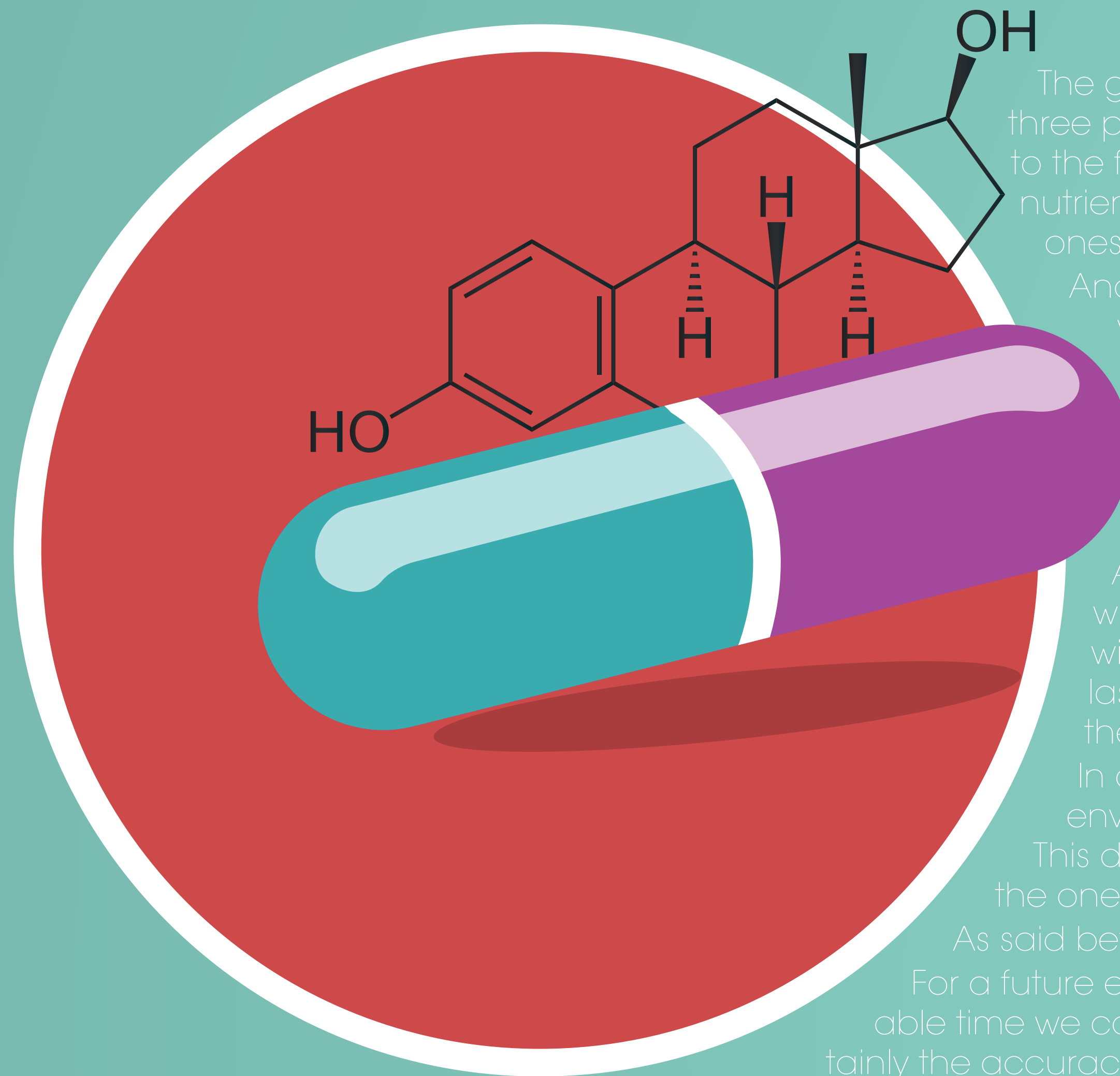
By reading the leaflet of the birth control pill which we used for this experiment, we can notice that it contains 17- β -estradiol, a hormone which, also according to previous experiments⁶, decreases significantly the growth of the roots.

Another thing we can notice by looking at the graphs is that the plants of the control experiment and the ones which grew with one pill have begun to decelerate their growth in the last measurements days, meanwhile the ones which were grown with three pill or with the fertilizer maintained a constant growth during the whole time. This could be due to the fact that the last two would grow in an environment that provided them more nutrients, while looking at the first two it could be possible that the plant, not finding enough nutrients, began to die.

In conclusion we could deduce that the pills used in this experiment could act as a fertilizer for plants and so, if released in the environment, could alterate the natural growth of some plants and consequently cause a decrease of the growth of the roots. This decrease could cause serious damages to the environment, considering that the roots have an essential role, in addition to the one to support the plant, also the one in the ecosystem (for example to stop the mountain from collapsing during floods⁷).

As said before, some imprecision also due to the limited time, it could have changed the results of the experiment.

For a future experiment, we could try this pills on many types of plants and see the effects that are caused on them. Having more available time we could continue the experiment until the plants die by themselves and see if the pill also has an effect on their life span. Certainly the accuracy of the data collection must be one of the most important factors to be able to give concrete answers.



Reference list:

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