Project title: Taking a closer look at drought: challenges in agriculture, because of drought.

- The Four Drought Solvers
- Stedelijk Lyceum Waterbaan
- Antwerpen
- Belgium

Research question

What is the impact of prolonged droughts on agriculture (crop cultivation) in the province of Antwerp?

Main results

Long-term droughts clearly affect farming in Antwerp. This research looked at how soil, plant growth, and farming change when there is very little rain for a long time. Different tests and information were used to find answers.

To begin with, tests showed that dry soil breaks apart in water faster than wet soil. This means wet soil is stronger and healthier. Also, wet soil can hold much more water than dry soil. When

plant growth was tested, it was clear that both too little and too much water are bad for seeds. Plants grew best when given a medium amount of water. Numbers from Mechelen in 2023 showed that when soil became drier, plants grew less.

Looking at past trends, data from 2016 to 2023 showed that Flanders is not getting much drier overall, but in some places, like Mechelen, the soil is drying out more and more. Satellite pictures proved that different soils hold water in different ways. Clay soil keeps the most water, and sandy soil dries out the fastest. More dry areas were found near Mechelen and Antwerp than near Turnhout.

Farmers were also asked about droughts. They said that dry weather harms their crops, but the effect is different for each farm. Most believe that the government is not doing enough because solutions like watering crops are costly. However, farmers are already using ways like adding mulch, planting trees, and changing crops to protect their farms.

In short, droughts make it harder for farmers to grow food because the soil gets worse and plants grow less. While Flanders is not becoming much drier, water for farming is still becoming less available. Farmers are finding solutions, but more support is needed to protect farming from future droughts.

Actions taken to make a difference

According to our research, soil quality and moisture play a very large role in growing crops. Therefore, it makes sense that drought in agriculture can be solved, at least in part,

by improving the soil and keeping it naturally moist without having to continuously water or irrigate it. In fact, that puts even more pressure on water resources. The healthier the soil, the better water can be retained. This became clear in our Slake Test and our Water Absorption Test. Soils can be kept healthy very easily, although it takes knowledge and resources. Covering the soil with organic material, mulching, reduces water's ability to evaporate. Compost and manure also allow water to be retained much better. Using satellite measurements, we have found that clay holds water best and sand less well. Sandy soils could be mixed with some clay soil to ensure better water retention.

It is also important to use water sparingly. Consuming too much water can cause pressure on water resources, and our research has shown that too much water can also be bad for crop growth.

Planting trees and shrubs are also a good way to combat drought, according to the farmers interviewed. This helps keep the soil moist, also because it provides shade. Furthermore, it works against erosion. Underseeding is also a way to keep the soil from drying out too much. In fact, growing ground cover crops between harvests retains moisture in the soil.

Crop rotation and alternating crops can reduce the damage of drought because it allows regular selection of crops that can withstand drought better.

It all starts with awareness of the problem, and small changes together can make a big difference.

Project link:

https://youtu.be/emAalq4cxT8?si=11nWl-cHGl_kv7ly

Presentation:

https://www.youtube.com/watch?v=YgcZKzEbjH0&t=1s

Belgium

What is the impact of long-term droughts on agriculture (growing crops) in the province of Antwerp?

HYPOTHESIS

Before we started doing research and experiments, we thought that droughts can have serious effects on agriculture. We were convinced that the proceeds of an agricultural company can decline a lot when there is a long-term drought. Plants really need water. Without enough water, harvesting cannot be successful.

INTRODUCTION

Drought is an increasing challenge for agriculture in Belgium due to climate change. Dry periods are becoming more frequent and intense, especially in summer, leading to lower crop yields and financial disadvantages for farmers. The soil is becoming depleted, and the demand for irrigation is rising, putting more pressure on water resources. Innovation and new farming methods are essential to ensure sustainable food production.

EXPERIMENTS

We did three different manual experiments in total:
1. The Slake test: The rate at which a piece of soil dissolves in water, dry soil compared to wet soil.
2. Germination: The quantity of germinated seeds and length of the plants at different water amounts.
3. Water absorption capacity of a soil, dry soil compared to wet soil.

We also analysed some satellite images:
4. Analysing the relationship between soil moisture and the amount of photosynthesis on different farms.
5. Analysing trends of dryness over the last 8 years.
6. Analysing the difference in water absorption capacity between three soils: sand, sandy loam and clay.

Lastly we made a survey and sent it up to a few farmers to get information about measures they take to protect their harvests from droughts.

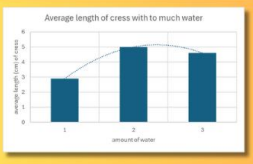
QR code to our presentation of the results:

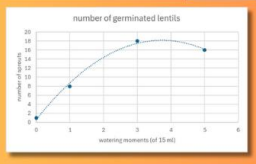
QR code to our proposal to solve the climate problem:

RESULTS

1: After 7 minutes, it was very clear to see that dry soil (left) dissolves way quicker in water than wet soil (right). This indicates that wet soil is healthier and stronger.

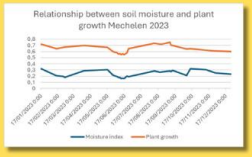
3: Dry soil: 26 grams of 100 grams of water was still present in the ground after a week. Wet soil: 53 grams of 100 grams of water was still present in the ground after a week. This means that wet soil can absorb more water than dry soil.





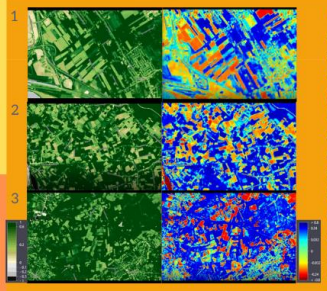
2: We tested how different water amounts affect seed germination and plant growth using lentils and cress. This is shown in the first graph. The plants were divided into three trays:
- Tray 1: 5 ml of water every 2 days
- Tray 2: 10 ml of water every 2 days
- Tray 3: 15 ml of water every 2 days

After a week, we saw clear differences. The plants in Tray 3 (most water) grew slower, while those in Tray 2 (moderate water) grew best. Tray 1 (least water) had poor germination. This shows that both too little and too much water can harm plants.
In the second graph, we have visualised another experiment. Instead of changing the amount of water, we changed the frequency of giving the same amount of water. When the lentils were wattered 3 times, more seeds sprouted than 5 times of wattering. This leads to the same conclusion.



4: In this graphic, we see the relationship between the soil moisture and the plant growth in Mechelen in 2023. We can clearly see that there is a very close relationship. The plant growth always declines just a little bit after de soil moisture did.

5: This graph shows the moisture index for all of Flanders over the period from 2016 to 2023. We can conclude from this that soil dryness is not really increasing in Flanders. If we look at the trend line, we can even see that it is rising slightly. This is a different result than most people would think.



clay > sandy loam > sand

6: Number 1 are satellite images nearby Antwerp (clay). Number 2 are nearby Mechelen (sandy loam) and number 3 are nearby Turnhout (sand). The right images show the NDVI (quantity of photosynthesis) and the left images show the moisture index of the soil. The images are all from 26/05/2017 and it didn't rain that day. In Turnhout, there are way more very dry (red) grounds than in Mechelen and Antwerp. Also, there are more dry grounds in Mechelen than in Antwerp. This proves that clay has the highest water absorption capacity, sand the lowest.

Survey: we could only reach 2 farmers who wanted to complete our survey. Both felt that drought affects their yields, although for one it was little and for the other moderate. Both have already experienced problems due to drought. They feel that the government is not doing enough against it. Measures are difficult due to high costs and limited knowledge. Yet they are already taking measures themselves.
Measures they take: Irrigation, soil improvement, mulching, tree planting, undersowing, crop rotation, sprinkling.

CONCLUSION

To answer our research question, long-term droughts have a visible impact on agriculture in Antwerp. It reduces soil quality, affects crop growth and increases the need to take measures. Plants need a certain amount of water to grow properly, even though too much is not good either. Soil must be moist enough to be fertile. Although droughts do not seem to be increasing directly in Flanders, there is less and less water left for agriculture due to rising consumption. Farmers are already taking measures to limit damage.

Benedict Adepitan, Amin Anannaz, Spoogmai Hassas en Ferre Luyts 4NW, so Explora

Sources: EO browser, Survey with Microsoft Forms, EOS Science