



Sustainable development: plant recycling, Nargile as a model

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Abstract

Plant waste resulting from agriculture in general and from Nargile plant and coconuts in particular constitutes a local environmental problem. When these wastes accumulate for a long period, they attract insects that transmit toxins and diseases to residents in neighboring areas. These unexploited piles also produce methane gas. It is harmful to the environment and is considered one of the gases causing global warming. Some farmers and sellers may burn this waste to get rid of it, which causes more air pollution.

Sustainable development aims to establish thinking in a way that preserves the environment for future generations. Therefore, this study was based on finding mechanisms and methods to preserve the environment by exploiting Nargile waste & recycling it to improve the quality of the soil so that crops grow better & in accordance with GLOBE protocols.

We studied the effect of adding Nargile waste to the soil on soil properties (pH, salinity, and conductivity) and its effect on the growth of crops.

A plan was drawn up to implement the study by choosing the site for carrying out the study, which is the school laboratory, and using two agricultural pots, one of which had Nargile waste added to it and the other without it. Then the specific protocols were applied, the measurements were repeated on three soil samples taken from the two ponds. Monitor the growth of crops, then collect results and data and discuss them within the team.

After applying the protocols and comparing the results between the two planting pots, the team found that the second pot (soil with plant residues) had a lower average pH, while its average conductivity and salinity levels were higher, and the plants grew noticeably faster and better in it, which means that the Nargile waste improved the quality of the soil.

Research Question

- 1- What is the effect of adding Nargile plant waste on soil properties?
- 2- How can we benefit from Nargile plant waste in recycling and achieving sustainable development?

Introduction

Sustainability in education refers to adopting an approach that strikes a balance between meeting the needs of the present and ensuring the continuity of education for future generations. The most important of which is encouraging an environmentally friendly life and raising awareness of the importance of protecting the environment.

The biological natural system was originally a sustainable system, but the increasing numbers of humans and their different patterns of consumption have affected and continue to affect all biological systems. (Joseph Agard et al., 2007)

Dhofar Governorate is unique in its crop of Nargile, or coconuts, which is considered one of the national crops of the Sultanate of Oman and has great economic and tourism importance. It is characterized by its high tolerance to salinity and thirst and its many uses and products, such as Nargile water, oil, fibers, and waste, which are used in many industries, as Dhofar is considered the only home for Nargile cultivation in the Arab region.

The GLOBE team from Ms. Maison's school noticed the accumulation of large quantities of leftover Nargile and coconut fruits that had been consumed in scattered piles around consumer outlets, as well as the presence of large quantities of food processing waste remaining after extracting oils from these fruits without adequate exploitation, and some farmers were resorting to burning this waste to get rid of it.

These and other practices will allow solid waste, such as food waste and fruit peels, to collect insects that transmit toxins and diseases to crowded places. In addition, this waste pollutes the atmosphere with gases released from it, such as methane, which is considered a greenhouse gas, or the smoke resulting from its combustion. The danger of waste lies when it is combined with the water that may reach it, causing water pollution. Its accumulation also distorts the aesthetic and urban view of the areas in which it is located, which has a mental and psychological impact on public health (Environmental News, Al-Ajili, 2016).

In this research, we will study plant waste from Nargile and coconuts and ways to benefit from them in agriculture, use them as fertilizer to improve soil quality, for example, or recycle them in a way that serves the environment and consolidates the concept of sustainable development.



Research Methods

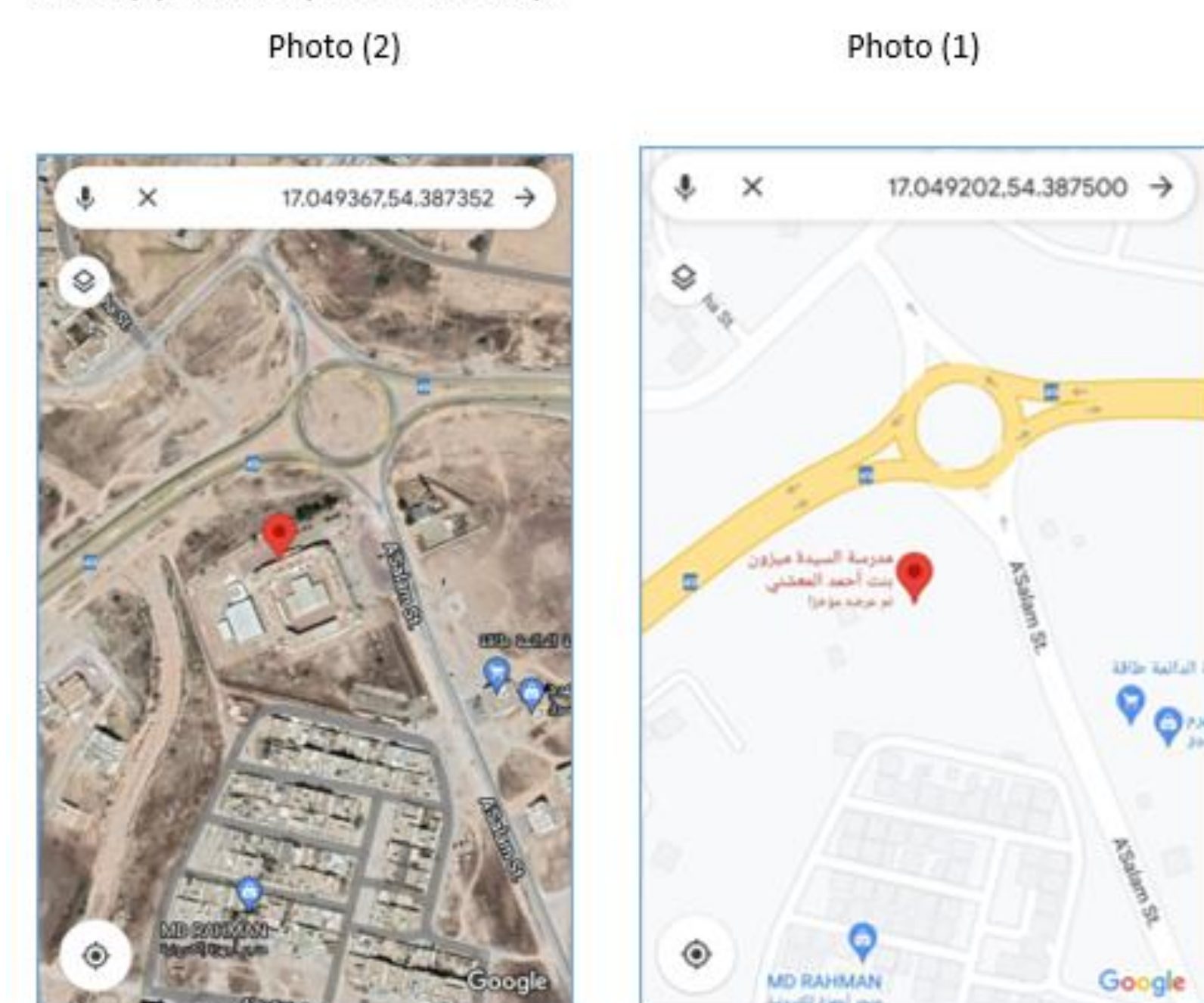
- A study plan has been developed to organize work, fill gaps and redress potential errors.
- 1- Determine the exact location of the study.
- 2- Apply the selected protocols according to the proposed schedule.
- 3- Data collection and analysis.
- 4- Communicate with experts to discuss the team's results.
- 5- Writing the research and presenting it in the final form.

Table (2) division of roles among team members

Supervisors & Maryam & Fatima	GLOBE team meeting and research title discussion
Supervisors & Maryam & Fatima	Choosing a study site
Maryam & Fatima	Practice doing the protocols
Maryam & Fatima	Performing protocols and collecting samples
Maryam & Fatima	Analyze the results and communicate with the experts
Maryam & Fatima	Submit the research in its final form

Photo (1): An aerial photo of the site via satellite.

Photo (2): the study site on the map.



- ✓ We used soil protocol, soil PH.
- ✓ After preparing the planting pots, only red soil was added to the first pot, and red soil + powder from Nargile waste was added to the second pot.
- ✓ The soil pH, soil salinity, and soil conductivity were measured by making a soil extract from the two samples, adding water (1:1 ratio), then measuring them with a pH device and a conductivity device.
- ✓ Natural seeds for planting (cowpea seeds) were prepared by soaking them in water for 24 hours before planting them in the soil.
- ✓ After planting, the soil was irrigated, and seed growth was monitored.



Results

- 1- When implementing the activity, the first time, we added a large amount of Nargile waste to the soil, which subsequently led to its rotting and the emergence of an unpleasant odor, which forced us to repeat the experiment using an appropriate amount of plant waste.
- 2- When we monitored the growth of the plants, we noticed that their growth was faster and stronger in the soil to which we added the Nargile, and the number of seeds that grew was greater.
- 3- The surface of the pot that contains only soil dries faster than the soil that contains the Nargile, and this may indicate - superficially - that the second pot retains more moisture.

***Average = sum of measurements divided by their number

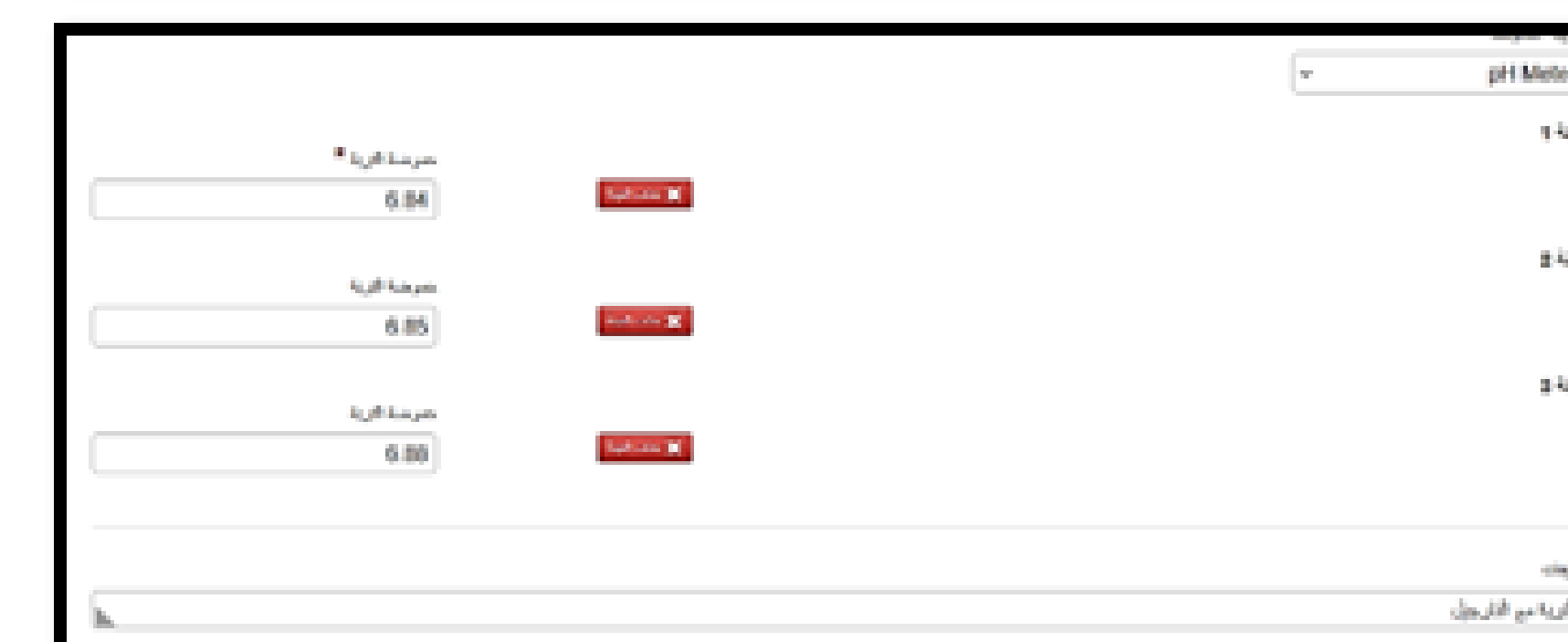
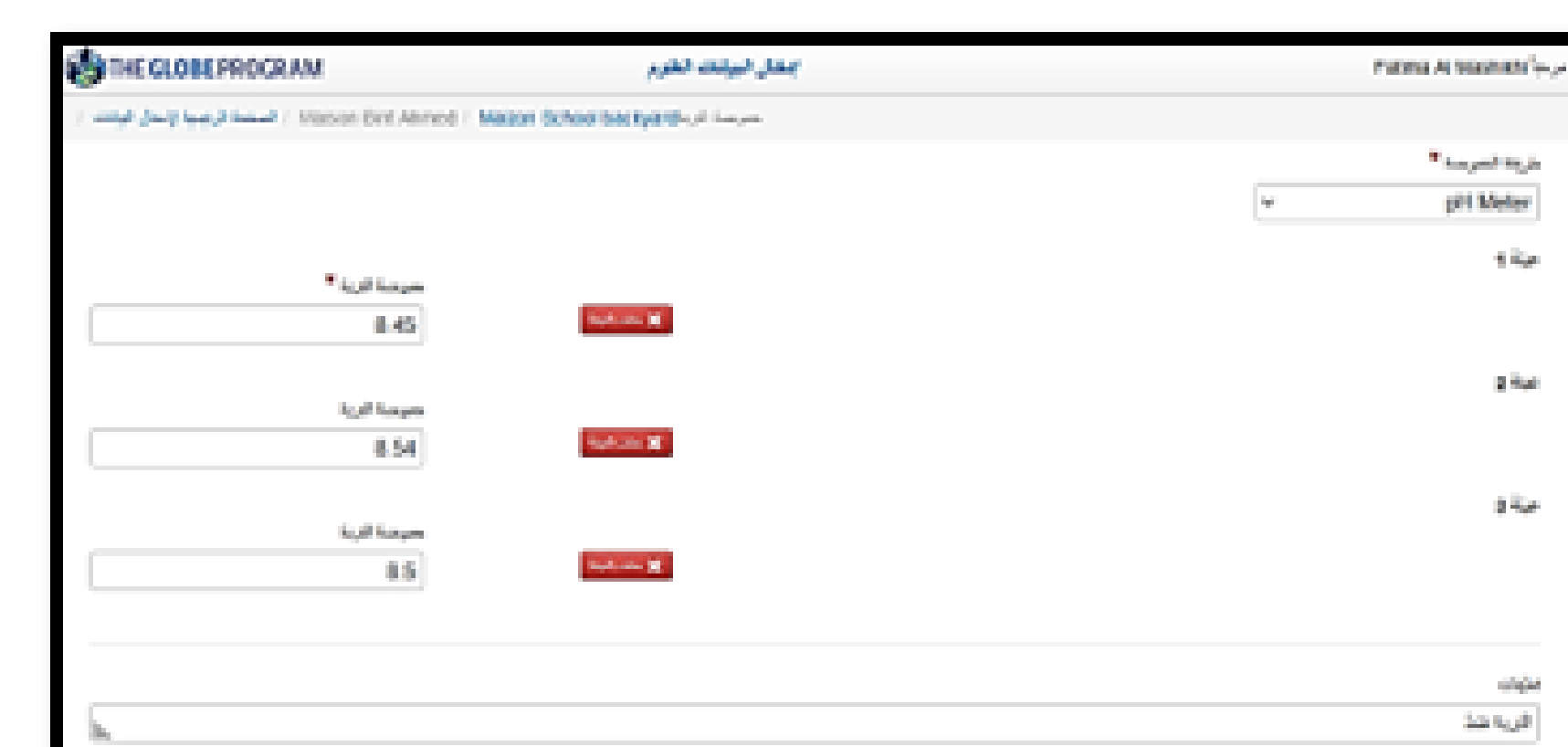
First pot (soil only):

The protocol	Measure 1	Measure 2	Measure 3	Average
pH	8.45	8.54	8.50	8.5
conductivity μ s	707	713	711	710.3
salinity ppm	349	344	343	345.3

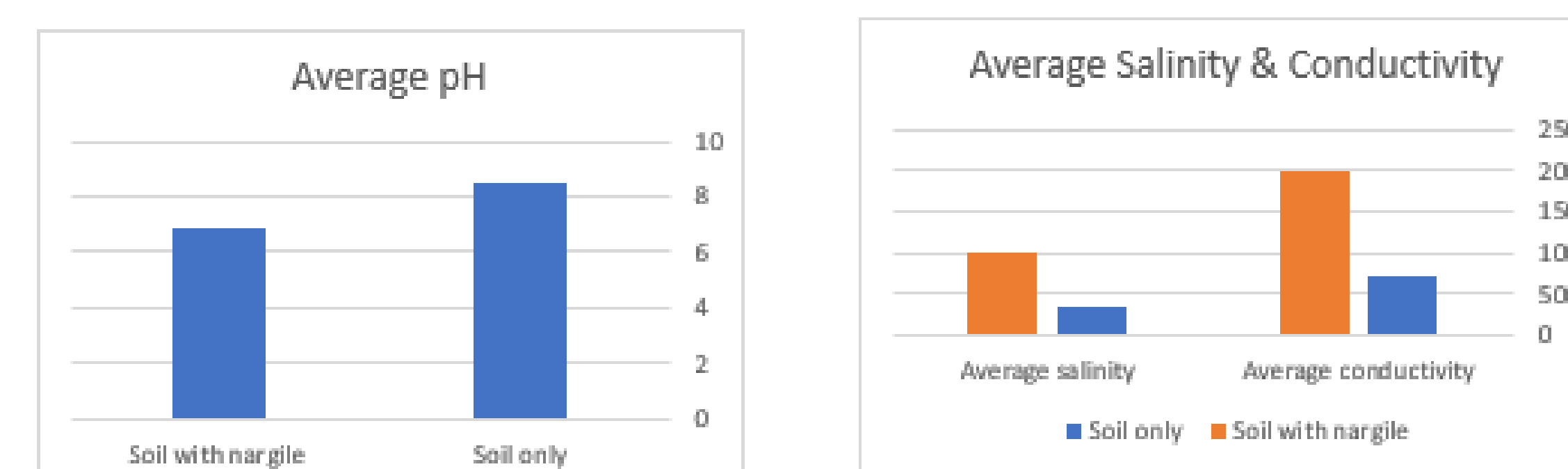
The second pot (soil + Nargile plant waste):

The protocol	Measure 1	Measure 2	Measure 3	Average
pH	6.84	6.85	6.88	6.86
conductivity μ s	1982	1984	1989	1985
salinity ppm	986	989	995	990

** Data entry to the GLOBE website:



*Organize the results graphically:



Discussion

After presenting the results and discussing within the team under the supervision of our teacher, we answered the first question: What is the effect of adding Nargile plant waste on soil properties?

From our measurements of soil pH, salinity, and conductivity, it is clear that the pH was lower in the soil to which we added Nargile plant waste (pH was higher), and also that salinity and conductivity were higher.

In order to explain the faster and better growth of seeds in the container containing Nargile, we searched on websites for the ideal pH for the growth of some vegetables, and it was approximately between 6 and 7 PH.

As for the second question, how can we benefit from Nargile plant waste in recycling and achieving sustainable development?

We have proven through experience that Nargile plant waste improves the quality of soil for agriculture, and therefore it can be used as a natural fertilizer for the soil. In addition, we have made small molds for agriculture made entirely of Nargile plant waste, and they can be used instead of plastic or nylon molds for planting seeds, and then the entire mold is transferred to plant it in the soil, there is no need to take the seeds out of it. It is completely organic, will decompose, and will be beneficial for the soil and for better plant growth.

During the work, we used plastic planting containers. Plastic is not an environmentally friendly material because it pollutes it, and its waste remains for hundreds of years without decomposing. We also noticed that the nurseries place the crops in black nylon bags, which are also not safe for the environment.

Therefore, we designed our own containers from the remains of the Nargile fruits, in which the seeds are planted, and after they grow a little, we transfer them entirely to the soil in the garden or farm. Because they are made of the Nargile plant, which is an organic material, they will dissolve in the soil without contaminating it.

Our organic pots are still under trial, and can be turned into a profitable project, whether in a school or any other institution that adopts this idea within the Sultanate

Conclusions

This study focuses on exploring the recycling of plant waste, using the Nargile palm as a model.

The study aims to improve soil quality to support the growth of plants and vegetables. Using GLOBE protocols, selected soil properties were studied, such as its pH, salinity, and conductivity.

The results showed that adding powdered Nargile waste increased the acidity of the soil and raised its levels of conductivity and salinity.

When monitoring plant growth, soil amended with Nargile residue showed stronger and faster seed and plant growth compared to soil without the additives.

This indicates the possibility of using Nargile waste to improve soil quality and increase crop production. Waste can also be used to produce environmentally friendly products, such as agricultural containers & pots.

Noting that the accumulation of plant and agricultural remains is a global problem, we chose only the distinctive plant that grows abundantly in our region to be the focus of study.

Bibliography

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