Soil moisture

GLOBE		*Related SDGs:*	*Type of activity*
Sphere	**Protocols**		
Pedosphere	Soil Moisture: Soil Water holding capacity	4 (Quality Education) 6 (Clean Water and Sanitation) 12 (Responsible Consumption and Production) 13 (Climate Action)	Research

Overview

Soil hydration is a very important phenomenon to consider because it influences the moistening of the atmosphere interface and its temperature and allows it to support the development of plants that are grown in them. The presence of water in soils is directly related to its apparent density, the existence of interstices in its body, where physical and chemical changes occur. In addition to the calculation of soil densities to estimate its capacity to retain water, in this activity we will see the possibility of considering the addition of a chemical product generically called Hydrogel, which is usually a hydrophilic polymeric compound, capable of retaining water in its structure and release it with some ease, reversibly modifying the condition of soil porosity.

Time
4 classes***.***

Prerequisites

Notions of GLOBE Soil protocols.

School level
Upper Middle School and Secondary Education.

Purpose

To know hydration management options in a given soil.

Student Outcomes

- To determine the indexes and modality of control of soil moisture factors, for agricultural use and entomological habitat purposes.
- To know the polymeric structures and their application and interaction characteristics of organic functional groups.
- To raise awareness of the importance and scarcity of water resources on the planet.

Introduction

The low availability of water due to global water scarcity and the high energy cost of accessing it in the depths of the groundwater table, as well as its growing demand for agriculture irrigable soils, make it necessary to implement a more efficient technological water use and management in order to reduce the volumes that must be applied to crop production to the minimum, without affecting their quality and yield.

In this context, the hydrogel is a polymer that has a high water-holding capacity. Hydrogels are made of soft and elastic materials that absorb aqueous solutions, depending on the nature of the polymer, and that are characterized by their hydrophilic and water insoluble capacity, which, according to their characteristics, can be classified as neutral or ionic and, according to the change of structures, as physical or chemical. These gels contain functional groups such as carboxylic acids or functional groups; they are usually cross-linked polymeric materials in the shape of a three-dimensional network that can be of animal or synthetic origin; They increase their ability to absorb the amounts of water available and their ability to be incorporated into the soil, forming soft and elastic materials which are harmless to crops, and improve the soil structure as a substrate and its eventual aeration; This way, hydrogels are a possible solution to maintain the moisture of these soils.

Scientific Concepts

- Hydration
- Water scarcity
- Structural polymers
- Organic functional groups

Guiding Research Questions

- How do hydrogels work to improve soil hydration?
- What are the advantages and disadvantages of using these types of products for soil biodiversity and agricultural uses?

Materials and Tools

- Hydrogel (in a commercial variety available at an agriculture or farm shop)
- Soil samples of at least three varieties
- Water
- Drainage devices
- Volume-measuring instruments and record sheets
- Ad hoc tools (a small spade, a spatula, a paintbrush, etc.)
- A scale

What to Do and How to Do it

Beginning

- Have drainage devices available (they can be made from disposable beverage containers), and place equal portions of soil in each, identifying the type and origin of at least two of each type so as to place hydrogel in each of them in their conditions of origin.

Development

- Saturate them with an aqueous preparation, (hydrogel is used at a rate of 10 g. per liter), then place a collection container in each. Monitor the process by taking anecdotal records of the changes and the water release values. Using these data and samples taken from the GLOBE sample containers, run tests to calculate their moisture percentages, also considering the amount of water released from each portion of soil.

Closing

- Evaluate the holding capacity in the different samples, and try both to determine the temporality of this in some way and to model its behavior mathematically.

Frequently Asked Questions

-How could you contextualize this knowledge in an everyday reality?

It could be by performing an advanced activity like the following: In the same sampling conditions as above, take a crop of your choice and measure the quantities of water required for the vital process of the vegetables. In addition, investigate the hydrogel behavior in some macro crop, make comparisons and arrange an informed discussion of the topic, with audiovisual material that allows you to expose your research in your community, highlighting the use of these products in mitigating the effects of global water scarcity.

Bibliography

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