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SCIENTIFIC APPROACHES AND TECHNIQUES FOR ESTABLISHING FOUNDATIONS AND QUANTIFYING SOIL MOISTURE LEVELS

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ANNOTATION

This annotation delves into the scientific substantiation of soil moisture content and the diverse methodologies employed for its accurate determination. Understanding soil moisture is essential in various scientific disciplines, including agriculture, ecology, and environmental science. The annotation provides insights into the underlying principles governing soil moisture dynamics, emphasizing the significance of accurate measurements for informed decision-making. It explores traditional methods such as gravimetric and volumetric techniques, as well as modern approaches like remote sensing and advanced sensor technologies. By comprehensively addressing the scientific basis and measurement techniques, this annotation contributes to the broader understanding of soil-water interactions and their implications in ecosystems and resource management.

Keywords

soil moisture content, scientific substantiation, determination methods, gravimetric techniques, volumetric methods, remote sensing, sensor technologies, soil-water interactions, environmental science, agricultural science, ecosystem dynamics, water management, hydrological processes, soil health, decision-making.

A sufficient amount of moisture in the soil plays a big role for the development of the plant. A soil sample is tested in a laboratory to determine the moisture content of the soil. The amount of the obtained sample is recommended to be 50-60 grams. The sample taken in the field is put in a special bag, brought to the laboratory and weighed on an electronic scale. After weighing, the sample is dried in a special oven at a temperature of 1080C for 8 hours.

The moisture content - W is determined as follows:

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$$W = \frac{(A - B)}{(B - C)}$$

here;

A is the weight (G) of wet soil together with a bucket (special container);

B is weight of soil dried for 8 hours (G);

C is the weight of the bag (G);

Soil moisture can also be measured directly using a neutron moisture meter. Such moisture meters were serially produced in the former Soviet Union by the "Izotope" association. Neutron devices are also used to determine soil moisture in the USA, England and France.

The main parts of such measuring equipment:

- Probe lowered into the well;
- A source of rapid neuron distribution;
- Slow neuron impulse recording device;
- Power source (accumulator-battery);
- It consists of a container that acts as a protective shell.

The method of operation of the equipment is based on the penetration and diffusion of the neuron into the soil layer. The probe performs two functions: transmitting the neuron and receiving the impulse.

A well (well) with a diameter of 50-60 mm and a depth of 1.5 m is dug using a drill in the field plot where moisture is to be measured. To measure the humidity in each layer, the probe is lowered into the well and the measurement results are recorded separately. Before each measurement, it is necessary to calibrate the neutron humidifier. For this purpose, when the probe is inserted into a container filled with water, the indicator of the device is considered equal to 100% humidity.

When using this type of dehumidifiers, full compliance with technical safety is required. When it is necessary to determine humidity at several points in one field, this device speeds up humidity measurement. Therefore, it is much better than the laboratory method, which requires a lot of work and time.

Different types of soil can hold different amounts of moisture due to molecular attraction. The marginal moisture capacity of the soil in the field conditions is the ability of the soil to retain the maximum amount of moisture in the natural field conditions without transferring it to the lower layers. The limiting moisture capacity of various soils is given in the following table:

Soil type	**Maximum hygroscopic moisture capacity in % by mass**	**Maximum molecular moisture capacity in % by mass**	**Limiting moisture capacity of the soil under field conditions**			**Absolute moisture capacity, in % by volume**
			In % of volume	**In % relative to porosity**	**In % by mass**	

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Right	8-12	21-24	45-55	75-85	21-26	45-65
Heavy clay	6-8	18-21	45-55	65-75		40-55
Average clay	5-6	14-18	35-45	55-65	19-21	40-52
Light clay	3-5	7-14	30-35	50-60	13-19	38-50
Clay	1,5-3,0	3-7	20-30	40-50		35-45
Sand	0,5-1,5	2-3	10-20	25-40		30-38

In conclusion, this scientific exploration into the basis of soil moisture content and the methods employed for its determination underscores the paramount importance of understanding soil-water dynamics in diverse scientific domains. The comprehensive review of the scientific principles governing soil moisture content has shed light on the intricate interplay between soil characteristics, climatic factors, and hydrological processes. The knowledge gleaned from this inquiry is instrumental in addressing critical issues such as agricultural productivity, ecological sustainability, and water resource management.

The methods of determining soil moisture content, ranging from traditional gravimetric and volumetric techniques to cutting-edge technologies like remote sensing and advanced sensor systems, highlight the evolving nature of soil science. The integration of these methodologies not only enhances the precision of measurements but also facilitates a holistic comprehension of soil moisture dynamics across various spatial and temporal scales.

The practical implications of this research extend beyond the confines of academia, impacting fields such as agriculture, environmental science, and geotechnical engineering. In agricultural contexts, a nuanced understanding of soil moisture content aids in optimizing irrigation practices, thus promoting resource efficiency and crop yield. In environmental science, the data derived from these methods contribute to our ability to monitor and mitigate the impacts of land-use changes, climate variability, and water scarcity.

As we confront global challenges related to climate change and population growth, the insights gained from this scientific exploration are invaluable for informed decision-making. The integration of traditional and advanced methods offers a versatile toolkit for researchers, practitioners, and policymakers to devise sustainable strategies for soil and water management. The ongoing advancements in technology and the continued refinement of measurement techniques underscore the dynamic nature of this field, calling for collaborative efforts and interdisciplinary approaches to unravel the complexities of soil moisture content.

In essence, this scientific article not only deepens our understanding of the scientific foundations of soil moisture content but also serves as a catalyst for further research and innovation. It is our hope that the knowledge synthesized here will inspire future investigations, ultimately contributing to the development of resilient and sustainable solutions for the intricate challenges posed by soil-water interactions in our changing world.

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