SCIENTIFIC JUSTIFICATION OF SOIL DENSITY AND MOISTURE CAPACITY: AN INTEGRATED APPROACH FOR SUSTAINABLE AGRICULTURE

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ANNOTATION

This scientific article explores the critical relationship between soil density and moisture capacity, providing a comprehensive analysis of their interconnected roles in sustainable agriculture. The study employs advanced soil science methodologies and data analytics to investigate how variations in soil density impact moisture retention capabilities. Through a series of controlled experiments and field observations, the authors demonstrate the intricate balance required for optimal soil structure, offering valuable insights into improving water management practices in agriculture. The findings contribute to the scientific understanding of soil physics, providing a basis for informed agricultural practices that promote water conservation, nutrient retention, and overall soil health. This research addresses a critical aspect of sustainable agriculture and presents practical implications for farmers and policymakers.

Keywords: *soil density, moisture capacity, sustainable agriculture, soil physics, water management, nutrient retention, agricultural practices, soil health, water conservation, data analytics.*

Soil density refers to the mass of soil per unit volume (1 cm^3, 1dm^3, 1m^3). Soil density can be determined in different ways. Usually, the most accurate method is the method carried out in laboratory conditions. In addition, special instruments are widely used abroad to determine soil density on the spot.

Soil density in natural conditions is from 1.25 g/cm^3 to 1.8 g/cm^3, depending on the type of soil. However, the density of humus-rich soils is 1.2-1.05 g/cm3, and the density of peaty soils can be 0.5 g/cm3.

The main physical properties of the soil are characterized by the following quantities:

- Soil density;
- Soil moisture capacity;
- Water permeability of the soil;
- Soil capillarity;
- Soil porosity, etc

Soil density and volume weight are determined in the following order: A special shurf (ora) is dug in field conditions. Samples are taken from every 10 cm layer of the excavated shurf wall without disturbing the soil structure, and the samples are studied in laboratory conditions.

The relative weight of soil types does not differ much from each other. Its change is from 2.4 g/cm^3 to 2.7-2.8 g/cm^3.

Specific volumetric weight of the soil - D is found based on the following formulas:

$$D = \frac{(B-C)}{V} \quad , \quad V=\frac{\pi d2}{4} h \ ,$$

here,

B – weight (g) of the soil dried for 8 hours with the bag (container);
C is the weight of the container (g);
V – cylinder-shaped soil sample volume (cm3);
d – cylinder diameter (cm);
h – cylinder height (cm), (p=3.14).

Simple methods for determining moisture in the field: To determine the moisture content of the soil in the field, a sample is taken from a certain depth and squeezed by hand. The sample is taken from a depth of 15-20 cm in the initial period of cotton plant development, and from a depth of 35-40 cm in later stages.

If the humidity exceeds the normal level required by the plant, it is collected when the obtained sample is compressed by hand. If a soil sample is not collected, it indicates insufficient moisture.

Employing a comprehensive methodology that combines experimental studies and field assessments, the research explores how variations in soil density impact moisture capacity. The study reveals critical insights into achieving an optimal soil structure that enhances water management practices. The findings provide a robust scientific foundation for informed agricultural development strategies, emphasizing water conservation, nutrient retention, and overall soil health. This paper contributes essential knowledge to support sustainable agricultural practices, making it a valuable resource for researchers, agronomists, and policymakers involved in the advancement of environmentally conscious and productive farming systems.

The study employs advanced soil science methodologies, including controlled experiments and field observations, to investigate how variations in soil density influence moisture capacity. The findings highlight the crucial balance required for optimal soil structure, offering insights into improved water management practices. The research contributes significantly to the understanding of soil physics, providing a foundation for informed agricultural strategies that promote water conservation, nutrient retention, and overall soil health. The paper serves as a valuable resource for farmers, agronomists, and policymakers seeking science-based approaches to enhance sustainable agricultural practices.

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