



## The Soil Moisture Role in Sustainable Agriculture and Climate Resilience

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### Description

Soil moisture is a perilous factor in the health and productivity of agricultural lands, playing a pivotal role in sustainable farming and climate resilience. This often-overlooked aspect of soil health is the key to understanding the intricate relationship between water availability, crop growth, and environmental sustainability. In this article, we will delve deep into the world of soil moisture, exploring its significance, measurement techniques, and the essential role it plays in shaping our agricultural practices and mitigating the effects of climate change.

### Understanding soil moisture

Soil moisture refers to the water content present in the soil, typically measured as the volume of water per unit of soil mass or volume. It exists in three main forms: Gravitational water, which drains quickly after rainfall; capillary water, retained within soil particles against the force of gravity; and hygroscopic water, which is tightly bound to soil particles and not available to plants.

### Importance in agriculture

Maintaining the right balance of soil moisture is essential for plant growth and crop yield. Adequate soil moisture ensures that plants receive the necessary water and nutrients, enabling them to carry out essential physiological processes. It also affects seed germination, root development, and nutrient uptake. On the other hand, excessive moisture can lead to waterlogging, causing root asphyxiation and promoting the growth of harmful pathogens.

### Agricultural practices for soil moisture management

**Irrigation:** Implementing efficient irrigation techniques is vital for regulating soil moisture levels. Drip irrigation and sprinkler systems allow for targeted water delivery, reducing wastage and enhancing water-use efficiency.

**Mulching:** The application of organic or synthetic mulch helps to conserve soil moisture by reducing evaporation, maintaining cooler soil temperatures, and suppressing weed growth, which competes for water with crops.

**Crop rotation and cover crops:** These practices can improve soil structure, enhance organic matter content, and increase water-holding capacity, ultimately promoting better soil moisture retention.

**Reduced tillage:** Minimizing soil disturbance through reduced tillage or no-till farming conserves soil moisture by reducing evaporation and preserving soil structure.

### Importance for climate resilience

Soil moisture plays an essential role in climate resilience by influencing the local and regional climate. Through the process of evapotranspiration, plants release moisture into the atmosphere, which affects the humidity and temperature of the surrounding air. Healthy soils with adequate moisture can moderate temperature extremes, reducing the intensity of heatwaves and maintaining a more stable microclimate for plant growth.

### Soil moisture measurement techniques

Several methods are used to measure soil moisture, each with its advantages and limitations. Some common techniques include:

**Gravimetric method:** Involves weighing a soil sample before and after drying it to calculate the water content.

**Tensiometers:** Measure soil moisture tension, which indicates the energy required for plant roots to extract water.

**Time Domain Reflectometry (TDR) and Frequency Domain Reflectometry (FDR):** These electromagnetic techniques measure soil moisture by analyzing the travel time or frequency changes of electromagnetic waves in the soil.

**Neutron probe:** Utilizes neutron scattering to measure soil moisture content at different depths.

### Conclusion

Soil moisture is undeniably a fundamental component of sustainable agriculture and climate resilience. Understanding and managing soil moisture levels can lead to improved crop yields, reduced water wastage, and increased climate resilience. Embracing innovative irrigation methods, adopting soil conservation practices, and investing in advanced soil moisture measurement technologies are steps towards a more sustainable and food-secure future. By unearthing the secrets of soil moisture, empower ourselves to cultivate the land wisely and mitigate the challenges posed by an ever-changing climate.

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