The Impact of Soil Sensors and Plant Probes on Modern Agriculture

Soil Sensors and Plant Probes: What Did it Bring to Agriculture?

With many advantages, such as alleviating the stresses caused by climate change, reducing the rate of chemical use, and preventing soil degradation through sustainable methods, Precision Agriculture Technologies contribute to every aspect of agriculture.

Precision Agriculture Technologies, which is vital for tracking in the field, makes important contributions to agriculture in important parameters such as soil structure and humidity, temperature, water quality, pH, detection of plant nutrients, control of pest-disease, electrical conductivity (ec), determination of the plant's water requirement through EC0 calculation, and radiation.

Digital and sustainable technologies, which simultaneously facilitate production, offer environmental, economic and social opportunities. Let's dive into what parameters digital sensors can enhance effectiveness of agricultural practices.

Soil Moisture

Soil moisture, also known as soil water, is an important parameter for soil health evaluation and plays a key role in plant growth. It is the water source for crops to maintain their physiological activities. Soil moisture level significantly influences the physicochemical properties of soil, thus affecting salt dissolution, plants' uptakes of water and ions, and microbial activities.

Therefore, monitoring soil moisture level is of great significance to maintain suitable soil conditions for agriculture production. Soil moisture sensors are used to estimate the water content in soil, based on which farmers are informed the irrigation time and amount at a proper level for plant growth.

Soil Temperature

Soil temperature, ranging from -10°C to 50°C, is an important parameter for agriculture because it influences germination, blooming, compositing, and a variety of plant growth processes, and also significantly influence the physical, chemical, and microbiological processes in soils that play critical roles in plant growth .

Soil temperature sensor consists of the temperature probes to transfer the temperature variation into electrical signals and the bias and readout electronics to interpret the electrical signal into digital data.

Soil pH

Soil pH is a measure of the acidity or basicity/alkalinity of soil, reflecting the combined effects of the soil-forming factors such as parent material, organisms, and climate. Besides its influence on microbial activities, soil pH determines the chemical forms of different nutrients thus affecting plant nutrient availability.

The optimal pH range of soil suitable for growth of most plants is between 5.5 and 7.5. For smart and precision agriculture, pH value of soil can provide valuable information for controlling the health of soil in a suitable range for specific crops in the farm.

Soil Nutrient

Among the soil organic matter (SOMs), nitrogen (N), phosphorus (P), and potassium (K) are the most important nutrients for crop production 94-95. In agriculture engineering, N, P, and K fertilizers are applied to improve the production of crops. However, excessive anthropogenic nutrient inputs have significant side effects economically and environmentally.

Only a small amount of fertilizers (e.g., N and P) is consumed by crops and much of them is lost due to leaching, volatilization, and erosion. To adapt nutrient deprived environments of plants, efficient and accurate detection of nutrient compounds in soil is essential for developing precision agriculture and the sustainability of the environment.

Soil sensors and plant probes have revolutionized agriculture by providing precise data on critical parameters like soil moisture, temperature, and nutrients, leading to more efficient and sustainable farming. These technologies enhance crop yields, reduce environmental impact, and ensure resilience against climate change.