

LAQUA

HORIBA



IMPORTANCE OF NUTRIENT MEASUREMENT IN POTATO PLANT

Nutrient measurement is essential for the growth, yield, and quality of potato crops. Potatoes require a balanced supply of nitrate (NO_3^-), potassium (K), calcium (Ca), and appropriate soil pH to ensure optimal development. Monitoring these nutrients in soil and plant tissues helps optimize fertilization, prevent deficiencies, and enhance crop productivity.

Importance of Nutrient Measurement in Potato Plants

- 1. Optimized Nitrogen Utilization (Nitrate Measurement):**
 - Ensures sufficient nitrogen for vegetative growth and tuber development.
 - Avoids excessive nitrogen application, which can lead to delayed tuber formation.
- 2. Potassium's Role in Tuber Formation:**
 - Supports starch synthesis, improving tuber size and quality.
 - Enhances disease resistance and stress tolerance.
- 3. Calcium for Cell Wall Strength:**
 - Prevents tuber disorders such as internal browning and hollow heart.
 - Strengthens plant structure and improves shelf life.
- 4. pH Regulation for Nutrient Availability:**
 - Ensures efficient nutrient uptake by maintaining an optimal pH (5.5-6.5).
 - Prevents nutrient lock-up caused by highly acidic or alkaline soils.
- 5. Sustainable Fertilizer Use:**
 - Reduces over-application of nutrients, minimizing environmental impact.
 - Improves nutrient-use efficiency, leading to cost-effective crop management.

Deficiencies and their Effects in Potato Plants

- 1. Nitrate (Nitrogen) Deficiency:**
 - Symptoms: Yellowing of lower leaves, stunted growth, reduced tuber yield.
 - Causes: Poor soil nitrogen levels, excessive leaching, improper fertilization.
- 2. Potassium Deficiency:**
 - Symptoms: Leaf margins turn brown or scorched, weak stems, reduced starch content in tubers.
 - Causes: Sandy soils with low K retention, heavy rainfall, and unbalanced fertilization.
- 3. Calcium Deficiency:**
 - Symptoms: Internal browning, poor tuber skin quality, susceptibility to disease.
 - Causes: Low soil calcium levels, poor translocation in plants, high soil magnesium interfering with calcium uptake.
- 4. pH Imbalance:**
 - Acidic Soil (pH <5.5): Limits nutrient availability, particularly calcium and potassium.
 - Alkaline Soil (pH >7.0): Reduces nitrogen efficiency and micronutrient uptake.

Methods of Nutrient Measurement

Differences in crop yield between fields can be attributed to various factors, with nutrient management being a key determinant. The following section highlights essential nutrients and their target values for maximizing potato yield.

Soil pH and calcium measurement are critical, as they influence the availability of essential nutrients. Additionally, measuring nitrate and potassium levels in fresh plant sap provides real-time insight into the nutrients absorbed by the plant, reflecting its immediate nutritional status. The analyzed sap data obtained from the HORIBA LAQUAtwin is directly correlated with the nutrient concentrations in soil and nutrient solutions. Field testing enables growers to detect nutrient imbalances before visible deficiency symptoms appear. Frequent field analysis allows for a proactive approach in adjusting fertilization strategies, optimizing plant health, and improving overall yield.

Benefits of Measuring Nutrients in Soil and Plant Sap

- **Immediate response:** Field testing provides instant results compared to laboratory analysis, which can take weeks.
- **Simple and quick measurement:** Tests can be performed directly in the field without specialized equipment.
- **Improved fertilization planning:** Soil and sap measurements indicate how crops are responding to current fertilization strategies, enabling timely adjustments.

Method

1. Soil :

- Add 20 mL of deionized water to 20 gram of soil in a glass container. (Dilution 1:1)
- Stir for 5 minutes (ideally let the mixture rest for an hour).
- After calibrating the LAQUAtwin meters, take the water phase of soil sample with a pipette and then place a few drops on the sensor.

2. SAP :

- Select the youngest leave totally developed, we recommend to sample 10-20 leaves per hectare.
- Collect the leaves ideally in the morning and always at the same time of the day.
- Ideal sampling environmental conditions temperature 18 to 25°C and 60 to 85% of relative humidity.
- With a scissor separate the leave from the petiole and cut the petiole in small pieces.
- With a garlic press squeeze the petiole to extract the fresh sap.
- After calibrating the LAQUAtwin meters, place the sap simple and the sensor and take the reading.

Nutrients sufficient levels for potato

Measurement of plant sap	Nitrate * NO3-N (ppm)	Potassium * K+ (ppm)
Plants 8-inch tall	1200-1400	4500-5000
First open flowers	1000-1400	4500-5000
50% of flowers open	1000-1200	4000-4500
100% of flowers open	900-1200	3500-4000
Tops falling over	600-900	2500-3000

Measurement of soil	pH **	Calcium *** Ca2+ (ppm)
	pH 4.8-5.5	300 ppm



pH Nitrate Calcium Potassium

Best Practices for Nutrient Management in Potatoes

- Apply nitrogen in split doses to support initial growth without delaying tuberization.
- Ensure adequate potassium levels throughout the growing season to enhance yield & quality.
- Incorporate calcium-rich fertilizers to prevent internal tuber disorders.
- Monitor and adjust soil pH using lime (for acidic soils) or sulfur (for alkaline soils).
- Conduct regular soil and tissue tests to make informed fertilization decisions.

Monitoring nitrate, potassium, calcium, and soil pH in potato plants is essential for optimizing growth, improving tuber quality, and preventing nutrient-related disorders. Regular nutrient assessments enable precise fertilization, leading to sustainable potato production and enhanced farm profitability. Implementing best nutrient management practices ensures healthier crops and higher yields.

