



**Potassium (K)** is one of the three most important macronutrients for plants (alongside nitrogen and phosphorus). In agriculture, it plays a key role in many vital plant processes.

### **Main functions of potassium in plants:**

#### **1. Regulation of water management**

Potassium is responsible for opening and closing stomata, allowing the plant to manage water more efficiently and increasing its resistance to drought.

#### **2. Enzyme activation**

It is essential for the functioning of many enzymes that control metabolic processes, such as protein and sugar synthesis.

#### **3. Transport of nutrients**

It facilitates the movement of sugars (products of photosynthesis) from leaves to other parts of the plant, such as roots or fruits.

#### **4. Improvement of crop quality**

- increases yield size and uniformity
- improves taste, color, and storage durability (e.g., in potatoes and fruits)
- affects sugar and starch content

#### **5. Resistance to stress and diseases**

Plants well supplied with potassium are more resistant to:

- drought
- frost
- fungal and bacterial diseases

#### **Symptoms of potassium deficiency**

- yellowing and drying of leaf edges (“marginal necrosis”)
- weaker plant growth
- lower yield and poorer quality
- increased susceptibility to diseases and stress

#### **Importance in agricultural practice**

Potassium is particularly important in crops such as:

- potatoes
- sugar beets
- cereals
- maize
- vegetables and fruits

It is most commonly applied in potassium fertilizers, such as:

- potassium chloride (KCl)
- potassium sulfate ( $K_2SO_4$ )



## Summary

Potassium is mainly responsible for water regulation, plant resistance, and crop quality. Its proper level in the soil is crucial for achieving high yields of good quality.

In agriculture, “available forms of potassium” are those that plants can directly absorb from the soil. The key point is that plants take up potassium almost exclusively in one form:

### Main available form of potassium

#### → Potassium ion: $K^+$

This is the only form directly absorbed by plant roots.

- present in the soil solution
- readily available, but also prone to leaching (especially in light soils)

### Forms of potassium in soil (in terms of availability)

#### 1. Potassium in soil solution ( $K^+$ )

- ✓  immediately available to plants
- ✓  constitutes a small portion of total soil potassium

#### 2. Exchangeable potassium (adsorbed)

- ✓  bound to the soil sorption complex (e.g., clay and humus particles)
- ✓  easily released into the soil solution → indirectly available

#### 3. Fixed potassium (less available)

- △  “trapped” between layers of clay minerals
- △  released slowly over time

#### 4. Structural (mineral) potassium

- ✗ bound within minerals (e.g., feldspars, micas)
- ✗ practically unavailable to plants in the short term

### Forms of potassium in fertilizers

In fertilizers, potassium occurs in forms that quickly convert to  $K^+$ :

- potassium chloride ( $KCl$ ) – most commonly used
- potassium sulfate ( $K_2SO_4$ ) – better for chloride-sensitive crops (e.g., potatoes, vegetables)
- potassium nitrate ( $KNO_3$ ) – also supplies nitrogen

After application, potassium dissolves in soil water and converts into  $K^+$ , the plant-available form.

## Summary

- Plants absorb potassium exclusively as the  $K^+$  ion
- The two most important pools are:
  - ☞ potassium in the soil solution (directly available)
  - ☞ exchangeable potassium (readily available reserve)

