

# Potassium

Potassium (identified by the letter K, its chemical symbol) is found in every cell. It is the third most abundant mineral in our bodies, surpassed only by calcium (Ca) and phosphorus (P). More than 85 percent of the body's K is found in major tissues and organs, such as muscles, skin, blood, the digestive tract and the liver.

## Is Potassium Nutrition Different in Plants?

Potassium's role in plant growth is quite similar to that for humans. One big difference is that plants cannot tell us when they are hungry or when they are being restricted by a nutrient shortage. Chemical analysis of certain plant parts is one tool available to give an early indication of nutrient stress or "hidden hunger".

Under severe deficiency, plants will often develop visible symptoms. In general, the edges of older leaves will turn brown while yield and quality decline. Sometimes the signals are even more specific. For example, orange trees will drop their fruit; strawberries do not fully develop their sweet taste; corn stalks will break, sending ears to the ground; tomatoes will be small and contain too much white tissue.

Each plant is an individual food production factory. It matters little if it is an African violet growing in an eighty-acre field of corn. All plants require certain basic raw materials if they are to operate at their most efficient level. Potassium is one of the key raw materials. The following illustrates the K uptake of certain crops:

Crop Production Yield per Acre	Total K Uptake Pounds per Acre
200 bushels corn	220
60 bushels soybeans	120
80 bushels wheat	135
8 tons alfalfa	400
30 tons tomatoes	280

## Potassium Is a Naturally Occurring Plant Food Element



**Potassium helps cotton to grow long, strong fibers.**

Fertilizer K is often referred to as "potash". Early American settlers coined that name. They produced potassium carbonate needed for making soap by evaporating water filtered through wood ashes. The ash-like residue remaining in the large iron pots was called "pot ash". This process is registered as the first US patent.

Commercial production of potash in the US began when supplies from Germany were stopped due to military conflicts. Carlsbad, New Mexico, became the hub of US production. Other production from brines was developed in Utah and California. Then, in the early 1960s potash from vast, high quality Canadian reserves became available. As a result, Canada now supplies about three-fourths of the potash used in US crop production.

Most of the known world reserves of K were developed as sea water evaporated and K salts crystallized to become the beds of potash ore being mined today. The deposits are a mixture of crystals of potassium chloride (KCl) and sodium chloride (NaCl), better known as common table salt. Separation of the KCl from the mixture produces a high analysis natural K fertilizer. Other production methods result in the crystallization of potassium sulfate or potassium chloride from brines, such as those in the Great Salt Lake of Utah.

Nearly 95 percent of the commercially produced K is used in agriculture. The remaining 5 percent is used for industrial purposes and for products common in the home.

### **What Are the Functions of Potassium in Plants?**

Nearly every aspect of plant growth is dependent upon an adequate supply of K. Along with nitrogen (N) and phosphorus (P), it is one of the three primary nutrients needed in large amounts. Potassium is a team player and helps to improve a plant's disease resistance, tolerance to water stress, winter hardiness, tolerance to crop pests, efficient

use of N and other nutrients, yield, and quality. Research has documented that K is needed for the following eight major plant functions.

**Enzyme activation** – Potassium in the cell is directly involved in more than 60 different enzyme systems which regulate the rates of major plant growth reactions.

**Efficient use of water** – The process of opening and closing of the leaf pores, called stomates, is regulated by the K concentration in cells surrounding these pores. A shortage causes the pores to partially open and to be slower in closing. This increases weather stress injury and causes poor use of moisture.

**Photosynthesis** – When plant chlorophyll converts sunlight, carbon dioxide and water into sugars, K helps to regulate the production of high energy compounds needed to fuel other processes.

**Transport of sugars** – Adequate K keeps sugars moving out of the leaves, allowing photosynthesis to move ahead at full speed.

**Water and nutrient movement** – Potassium activates enzyme systems which lead to better movement of water and nutrients within the plant.

**Protein synthesis** – Potassium is required for every major step in the formation of plant protein.

**Starch formation** – Potassium activates the enzyme responsible for starch formation and speeds the relocation of starch to its storage site.

**Crop quality** – Potassium improves crop physical condition, resistance to diseases, harvestability, feeding value of grain, and market appeal and value.

#### **How potassium works to increase yields.**

- Helps retard crop diseases
- Maintains turgor; reduces water loss and wilting
- Increases protein content of plants
- Produces grain rich in starch
- Helps translocation of sugars and starch
- Aids in photosynthesis and food formation
- Reduces respiration, preventing energy losses
- Assists many enzyme actions
- Builds cellulose and reduces "lodging" caused by weak stalks
- Increases root growth and improves drought resistance

#### **Potassium Helps to Protect the Environment**

Nitrogen use efficiency by a plant is highest when K is readily available. Why? Because K regulates N uptake and helps to build plant proteins. A K shortage in the plant reduces protein content, lowering its value as a food source for humans and livestock.

Potassium helps plants reach optimum productivity. High yielding grain crops leave more residues on the land. These residues cover the soil and protect it from the forces of erosion. These same residues give rainfall more time to soak into the soil where it can serve the next crop or help to recharge groundwater supplies.

Wildlife, such as deer, pheasants and rabbits, find better protection along with food in the crop residues left from well-managed fields. Farmers recognize better than most the long-term value from good resource management. They care about the welfare of wildlife and the improvement of the land's productivity. Such values are characteristics of good stewards of the land.

### **Potassium Helps Improve Use Efficiency of Other Nutrients**

Potassium is known to interact with almost all of the other essential plant food nutrients. It helps P produce higher grain yields and improves seed quality. In some cases the improved market value of the grain alone pays the K fertilizer bill. The yield improvement due to K is an added bonus.

Potassium helps most crops to better use available water. There are several reasons why this happens:

Rapid seedling development. Good early growth provides quick cover of the soil with plant leaves and less water evaporation.

Deep root growth. Roots penetrate deeper into the soil and make use of subsoil moisture.

A larger root system. Healthy plants generate more roots for maintaining soil organic matter (humus). This helps to improve soil structure and infiltration of water into the soil.

### **Potassium Is Needed to Produce Quality in Crops**

For some crops, higher quality means better appearance, more pleasing flavor, enhanced feed value, improved harvestability, or longer shelf life. In tomatoes, for example, K contributes in several ways. It helps to improve total yield, increases the percentage of that higher yield that is suitable for market, and also improves the efficiency of fertilizer N. What does this mean? It means greater profit potential to the farmer, best possible use of inputs for groundwater protection, and a continued lowest possible cost of tomatoes in the marketplace.

Specialty crops such as turf for home lawns and golf courses also benefit from the wise use of K. It helps build in winter hardiness and tolerance to moisture stress, and increases plant regrowth vigor. Potassium improves disease resistance and durability under use. And it helps N produce the deep green color associated with healthy turf.

Hybrid tea roses and other flowering plants also respond well to K. Studies show they produce more flowers, grow longer stems and have improved regrowth.

Cotton clothing and K have a lot in common. Cotton plants need K for long and strong fibers. Quality cotton fiber is the first step to the natural comfort desired from cotton clothing.

### **Summary**

Potassium is often described as the "regulator" in crop production. It has earned this distinction due to its influence upon protein and starch formation, its regulation of over 60 enzyme systems controlling the development of crop quality, and its positive interaction with N, P and other essential crop production inputs.

Potassium and other essential plant food nutrients contribute much to North American agriculture, which is envied by nations throughout the world. Yet, many people do not realize that without fertilizer, production of food, feed and fiber would drop by one-third or more and that proper use of fertilizer protects the environment and groundwater quality and that the incredible productivity of US and Canadian farmers keeps supermarkets fully stocked with low-cost, high-quality food. Our standard of living is possible because of farmers' innovative character, our long established system of research, the effective dissemination of research through the extension service and an agribusiness system capable of supplying input needs. They form the team who are so few, but produce so much for so many.