The benefits of Multi-K - Potassium Nitrate
Multi-K potassium nitrate yields

- Efficient plant nutrition
- Stronger & healthier plants
- Higher yields and better quality
- Reduced effect of soil salinity
- Water saving
- Improved soil properties
- Convenience in handling and application
Efficient plant Nutrition

A meal of nitrogen and potassium

Multi-K potassium nitrate is the only fertilizer that supplies both macro-nutrients, highest in the composition of any plant:

- Nitrogen as nitrate anion (NO$_3^-$), the **most available** form of nitrogen for plant uptake
- Potassium as K$^+$, the **major cation** in the plant
The synergistic effect between K\(^+\) and NO\(_3^-\) facilitates uptake of both ions by the plant roots.

The electrical affinity between K\(^+\) and NO\(_3^-\) prevents adsorption of potassium to soil particles, keeping it available to plants.
Efficient plant Nutrition

An excellent source of potassium

The potassium in Multi-K is essential for plant development and normal functioning of tissues.

K⁺ in the plant:

- Electrically balances most of the negatively charged mineral anions and organic carboxylates.
- Participates in many metabolic processes in the cell
- Serves as an osmo-regulator
- Contributes plant’s water management mechanisms
Efficient plant Nutrition

100% plant nutrients

N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O formula: 13-0-46

13% N = 62% NO<sub>3</sub>-

46% K<sub>2</sub>O = 38% K<sup>+</sup>

100% KNO<sub>3</sub>

- Fully consumed by the plant
- Leaves no residues in the soil
Multi-K for Stronger & Healthier plants
Stronger & Healthier plants

No Chloride

Chloride hinders plant development and reduces yields.

The higher the chloride in the plant composition, the lower its dry weight.
Stronger & Healthier plants

No Chloride

- When chloride (Cl-) concentration in the soil solution increases, plants take it up on the account of essential anionic nutrients, especially nitrate.
- High concentrations of chloride may cause toxic effects and even death of plants.
- Multi-K is free of detrimental chloride, so it is a safe for use in all growing methods and for all crops.
Stronger & Healthier plants

No Chloride

The nitrate in Multi-K counteracts the chloride's harmful effect:

![Graph showing the relationship between chloride and nitrate content in tissues](image)

Application of nitrate reverses the process of chloride accumulation in the plant tissues.
Relieving chloride toxicity in avocado leaves by increasing nitrate concentration in irrigation water containing 16 mM Cl
When ammonium enters the root, the $\text{NH}_4^-$ is completely metabolized in the root, consuming the sugar that is transported to the root by the phloem flow.

Sugar concentration is reduced and not available to ammonium metabolism. Free ammonia ($\text{NH}_3$) accumulates in the cell and is toxic and the plant roots die.
Stronger & Healthier plants

No root-toxicity

The mechanism of ammonium accumulation in roots

High temperature in the root zone

More intensive cell respiration

Sugar concentration reduces

No sugar is available for ammonium metabolism

Ammonium accumulates in the roots

Ammonia toxicity + lack of sugars & root death

Ammonium fertilization
Stronger & Healthier plants

No root-toxicity

- At elevated temperatures (e.g. during the summer) ammonium may accumulate in the roots, causing toxicity and root death.
- Multi-K is an ammonium-free source of nitrogen, hence safe for use even at high temperatures.
Stronger & Healthier plants

Enhanced tolerance to extreme conditions

The potassium in Multi-K
- Helps building thicker cell walls
- Increases the concentration of electrolytes inside the cell
Thus protecting the cell from frost damages

The potassium in Multi-K
- Encourages establishment and branching of roots
- Improves water uptake from the soil
Thus enhancing the plant’s ability to withstand drought
Better resistance towards pathogens

Excessive N, K deficiency

Accumulation of short-chained carbohydrates and non-protein nitrogen

Development of bacteria, fungi, nematodes and viruses

Adequate K supply is essential to prevent the development of plant diseases
Higher yields & better quality

The potassium in Multi-K increases yields

The effect of potassium (K) on pepper yield, under constant N rate of 224 kg/ha
Higher yields & better quality

The potassium in Multi-K increases yields

The effect of K rate on the yield and quality of processing tomatoes
Higher yields & better quality

K for Quality

The potassium in Multi-K helps improving quality parameters of:

- **Fruit size:** larger dimensions, better uniformity
- **Fruit looks:** better color, minimized color blemishes or unusual markings of mechanical injuries or any sign of disease
- **Nutritional values:** higher content of protein, oil, vitamin C, etc.
- **Organoleptic features:** enhanced flavor and aroma
- ** Longer shelf life**
- **Adequate processing quality** for industry
Higher yields & better quality

K for Quality

The Effect of Multi-K on Quality Parameters of Mineola Tangelo

Source: Fuente & Ramirez, 1993
Multi-K combats salinity
Multi-K combats salinity

Multi-K Reverses the Adverse Effects of Salinity on Greenhouse Tomatoes

Source: Satti et al., Muscat, Sultanate of Oman 1994
Multi-K combats salinity

Multi-K increases fresh yield in greenhouse Chinese cabbage under salinity

Source: Feigin et Al. 1990, Israel
Multi-K combats salinity

The Effect of Salinity and Multi-K on Shoot Mass of Sweet Corn

Dry matter (g/plant)

E. C. of Nutrient Solution (dS/m)

Source: Imas & Feigin, 1995. Israel
Multi-K saves water
Nitrate improves water management

- Nitrate-fed plants utilize water about 100% more efficiently than ammonium-fed plants.

- The difference becomes even more significant when potassium concentration in the soil solution is low.
Multi-K saves water

K+ enhances water uptake

K in plant roots produces a gradient of osmotic pressure

Adequate K level: Osmotic pressure draws water into the root

K deficiency: Reduced ability to absorb water
Multi-K saves water

$K^+$ prevents water losses

The potassium in Multi-K regulates water status in the plant

Dehydration at low K:
Stomata remains open and more water is lost

Minimal transpiration at adequate K:
Close stomata prevents further loss of water
Multi-K saves water

Multi-K prevents salinity build-up

Multi-K is consumed by the plant completely. Preventing accumulation of salts in the soil and salinity build-up.
Multi-K improves soil properties
Multi-K improves soil properties

Multi-K increases soil pH

Multi-K has an alkaline effect in the root zone.
Multi-K improves soil properties

Multi-K enhances P availability

The nitrate in multi-K increases, indirectly, phosphorous availability to plants.

Increase in nitrate level in the soil enhances exudation of the carboxylates. Carboxylate anions released into the rhizosphere facilitate the release of phosphate from the soil particles to the soil solution.
Multi-K is user-friendly
Multi-K is highly soluble

Multi-K dissolves in water quickly and completely, which makes it ideal for application by Nutrigation™ (fertigation) and for foliar application.

Solubility comparison between Multi-K and SOP

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>Solubility g / Liter Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>multi-K (Potassium Nitrate)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10°C</td>
</tr>
<tr>
<td>multi-K (Potassium Nitrate)</td>
<td>210</td>
</tr>
<tr>
<td>Potassium sulfate (SOP)</td>
<td>80</td>
</tr>
</tbody>
</table>
Multi-K is non hygroscopic

Hygroscopicity is the capacity of a product to absorb moisture from the air. The more hygroscopic a fertilizer is, the more problems one can expect during storage and handling.

Relative Humidity of Air in Equilibrium with Saturated Solutions of Nitrogen Materials at 30°C

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>Relative humidity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono ammonium phosphate (MAP)</td>
<td>91.6</td>
</tr>
<tr>
<td>multi-K (potassium nitrate)</td>
<td>90.5</td>
</tr>
<tr>
<td>Ammonium Sulfate</td>
<td>79.2</td>
</tr>
<tr>
<td>Ammonium chloride</td>
<td>77.2</td>
</tr>
<tr>
<td>Urea</td>
<td>72.5</td>
</tr>
<tr>
<td>Sodium nitrate</td>
<td>72.4</td>
</tr>
<tr>
<td>Ammonium nitrate</td>
<td>59.4</td>
</tr>
<tr>
<td>Calcium nitrate</td>
<td>46.7</td>
</tr>
</tbody>
</table>

Multi-K can be stored either in bags or in bulk without absorbing moisture that may cause caking and handling difficulties.
Multi-K is compatible with other fertilizers

Chemical interactions in the soil solution

- High pH in water can cause precipitates of calcium carbonate.
- Hazard of clogging emitters
Multi-K is compatible with other fertilizers

**Tank A**

- No fertilizers containing calcium

- Multi-K
- Multi-npK
- Multi-MAP
- Multi-MKP
- Urea
- Ammonium nitrate
- Potassium sulfate
- Phosphoric acid
- Magnesium sulfate
- Chelated micronutrients

**Tank B**

- No fertilizers containing phosphates or sulfates

- Multi-K
- Multi-K Mg
- Magnisal
- Multi-Cal
- Urea
- Ammonium nitrate
- Nitric acid

While mixing other fertilizers an inter-reaction may form insoluble salts and precipitate in the fertilizer tank or even in the water lines and clog the drip system.
Multi-K is non-volatile

Unlike ammonium, the nitrate in Multi-K is non-volatile, so there is no need to work it into the soil when applied by top- or side-dressing.
Multi-K Products

**Crystalline** – for Nutrigation and for foliar application

**Prills** – for side-dressing

**Coated** – controlled-release fertilizers
# Multi-K Products

Crystalline products for Nutrigation and foliar sprays

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multi-K® Classic</strong></td>
<td>Pure potassium nitrate</td>
</tr>
<tr>
<td><strong>Multi-K® GG</strong></td>
<td>Greenhouse-grade potassium nitrate</td>
</tr>
<tr>
<td><strong>Multi-K® pHast</strong></td>
<td>Low-pH potassium nitrate</td>
</tr>
<tr>
<td><strong>Multi-K® Top</strong></td>
<td>Hydroponics-grade potassium nitrate</td>
</tr>
<tr>
<td><strong>Haifa-Bonus npK</strong></td>
<td>Foliar formula with special adjuvants for prolonged action</td>
</tr>
</tbody>
</table>
### Multi-K Products

Crystalline products for Nutrigation and foliar sprays

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-npK®</td>
<td>Potassium nitrate enriched with phosphorus</td>
</tr>
<tr>
<td>Multi-K® Mg</td>
<td>Potassium nitrate enriched with magnesium</td>
</tr>
<tr>
<td>Multi-K® Zn</td>
<td>Potassium nitrate enriched with zinc</td>
</tr>
<tr>
<td>Multi-K® S</td>
<td>Potassium nitrate enriched with sulfate</td>
</tr>
<tr>
<td>Multi-K® B</td>
<td>Potassium nitrate enriched with boron</td>
</tr>
<tr>
<td>Multi-K® ME</td>
<td>Potassium nitrate enriched with magnesium and micronutrients</td>
</tr>
</tbody>
</table>
## Multi-K Products

Multi-K prills for direct soil application

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-K® prills</td>
<td>Potassium nitrate prills</td>
</tr>
<tr>
<td>Multi-npK® prills</td>
<td>Potassium nitrate enriched phosphorus</td>
</tr>
<tr>
<td>Multi-K® Mg prills</td>
<td>Potassium nitrate enriched with magnesium</td>
</tr>
</tbody>
</table>
## Multi-K Products

Controlled-release potassium nitrate

| Multicote 12-0-44 | Polymer-coated potassium nitrate  
|--------------------|--------------------------------|
|                    | For ornamentals, turf and agriculture  
|                    | Release longevity: 2, 4, 6, 8 and 12 months  
|                    | Suitable for blending with other granular fertilizers to reach any composition |