

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 (**NO₃⁻**), the **most available** form of nitrogen for plant uptake
- Potassium as **K⁺**, the **major cation** in the plant



Efficient plant Nutrition

Efficient absorption

- ♥ 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-P₂O₅-K₂O formula: 13-0-46

$$\begin{array}{rcl} 13\% \text{ N} & = & 62\% \text{ NO}_3^- \\ \hline 46\% \text{ K}_2\text{O} & = & 38\% \text{ K}^+ \\ \hline & & \mathbf{100\% \text{ KNO}_3} \end{array}$$

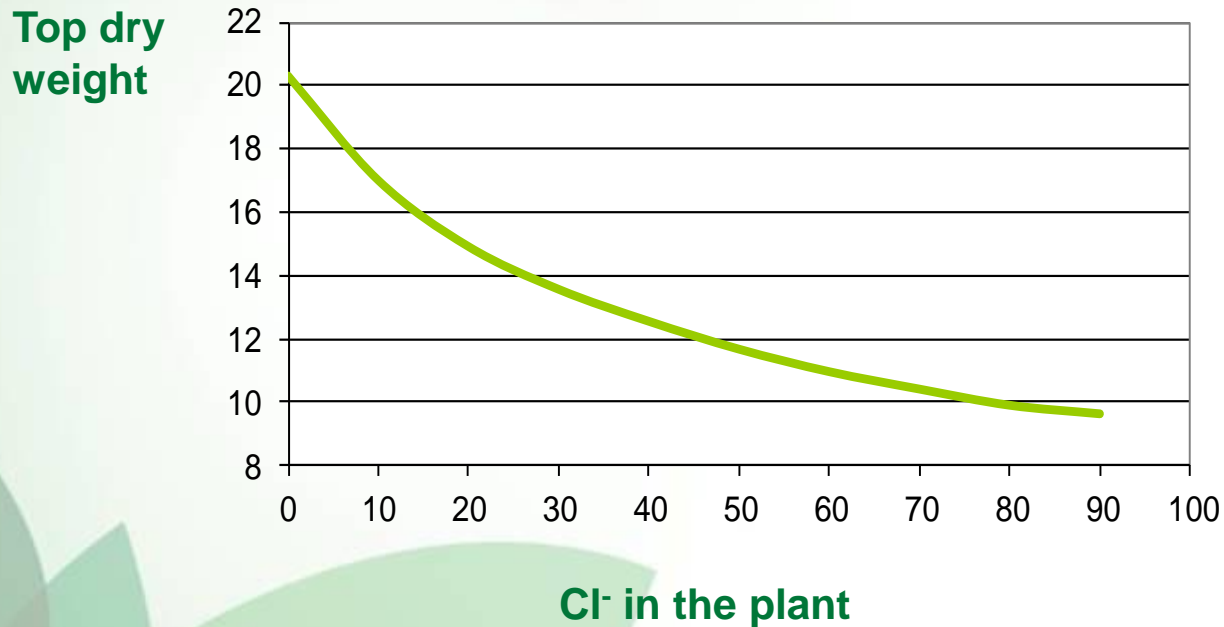
- ♥ Fully consumed by the plant
- ♥ Leaves no residues in the soil

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

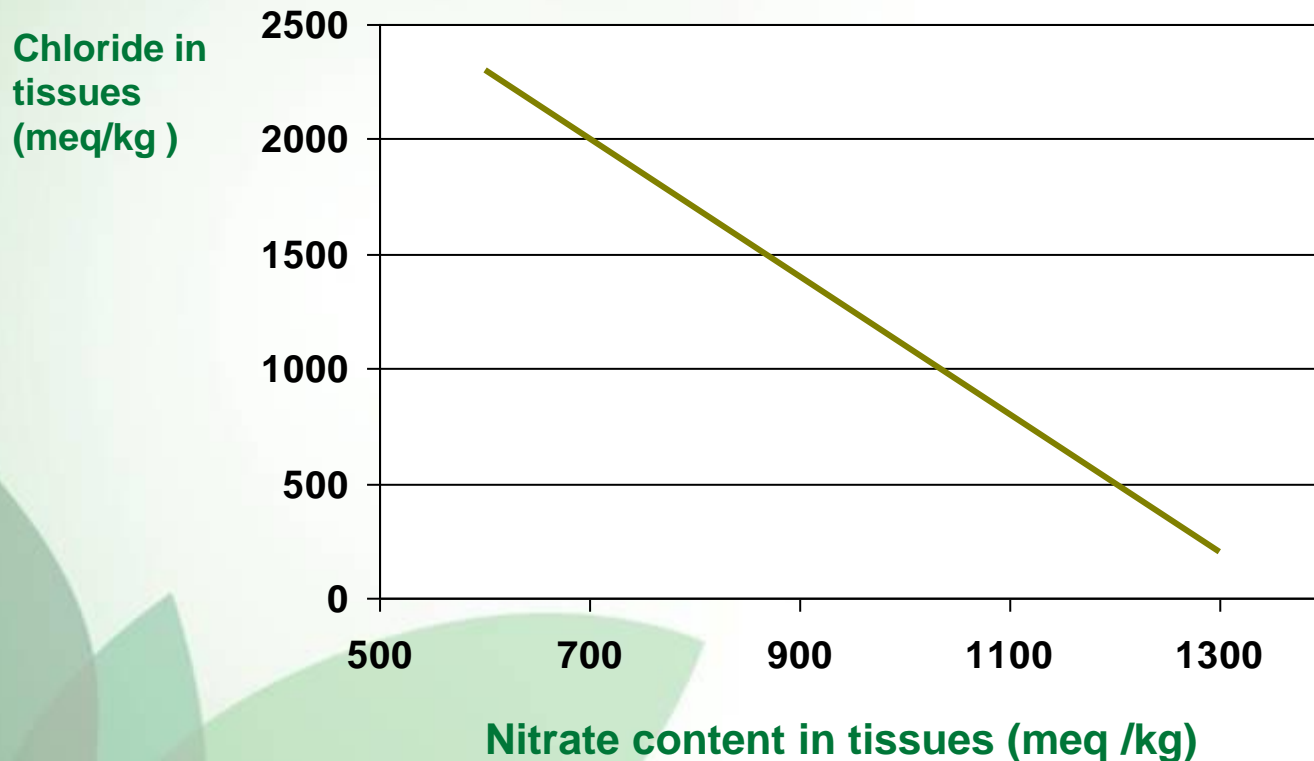
No Chloride

- ❖ 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:



Application of nitrate reverses the process of chloride accumulation in the plant tissues.

Stronger & Healthier plants

No Chloride

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



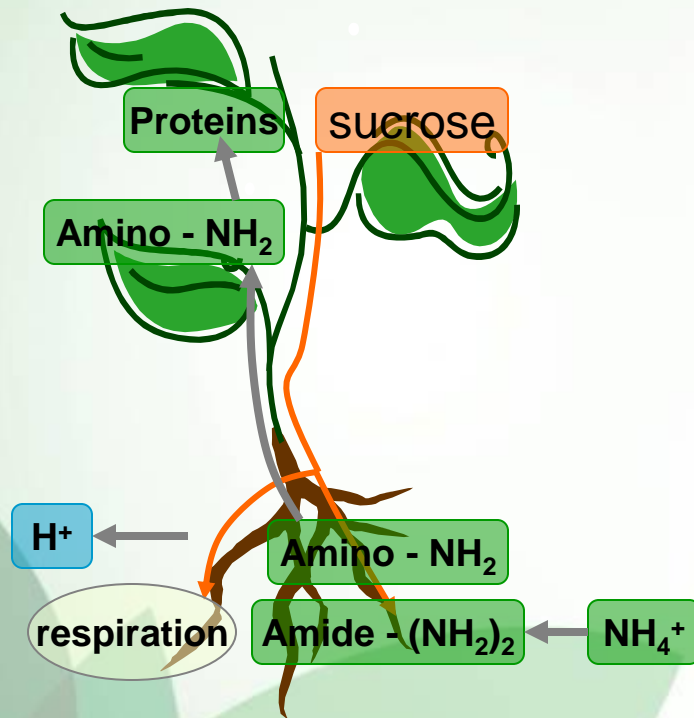
Relieving chloride toxicity in avocado leaves by increasing nitrate concentration in irrigation water containing 16 mM Cl

Stronger & Healthier plants

No root-toxicity

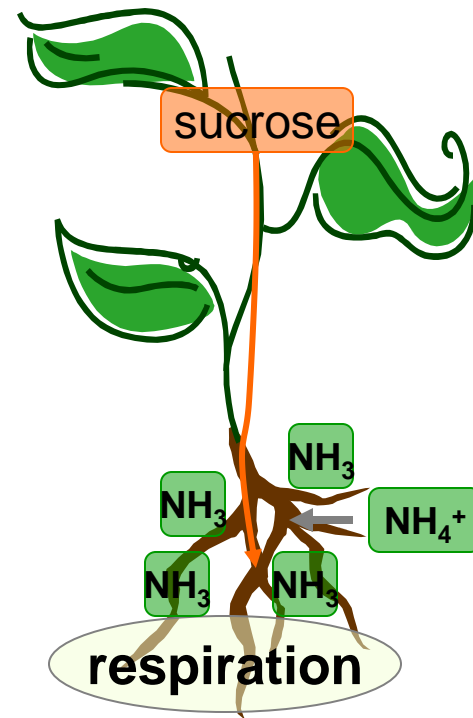
Both cell respiration and ammonium metabolism require sugars

Low \ moderate temperatures



When ammonium enters the root, the $\text{NH}_4\text{-N}$ is completely metabolized in the root, consuming the sugar that is transported to the root by the phloem flow.

Elevated temperatures

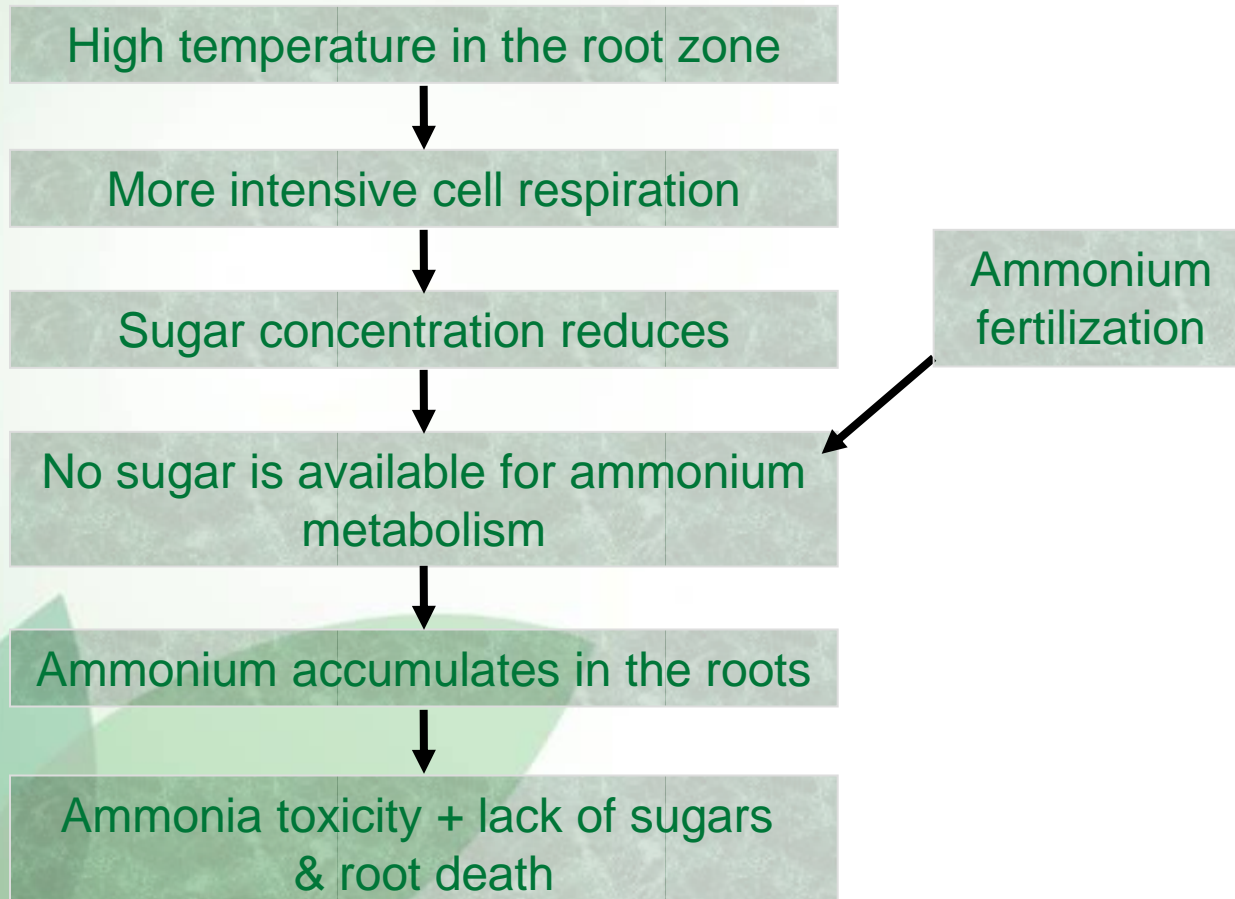


Sugar concentration is reduced and not available to ammonium metabolism. Free ammonia (NH_3) accumulates in the cell and is toxic and the plant roots die.

Stronger & Healthier plants

No root-toxicity

The mechanism of ammonium accumulation in roots



Stronger & Healthier plants

No root-toxicity

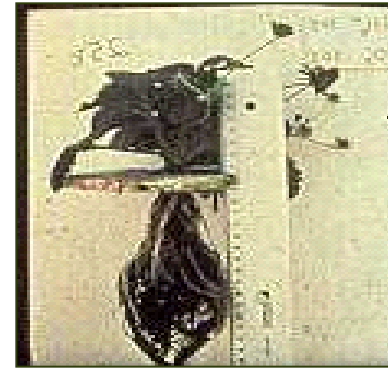
- At elevated temperatures (e.g. during the summer) ammonium may accumulate in the roots, causing toxicity and root death.
- Multi-K is an ammonium-free source of nitrogen, hence safe for use even at high temperatures.



100% NH_4^+



50% NH_4^+ / 50% NO_3^-



100% NO_3^-

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**

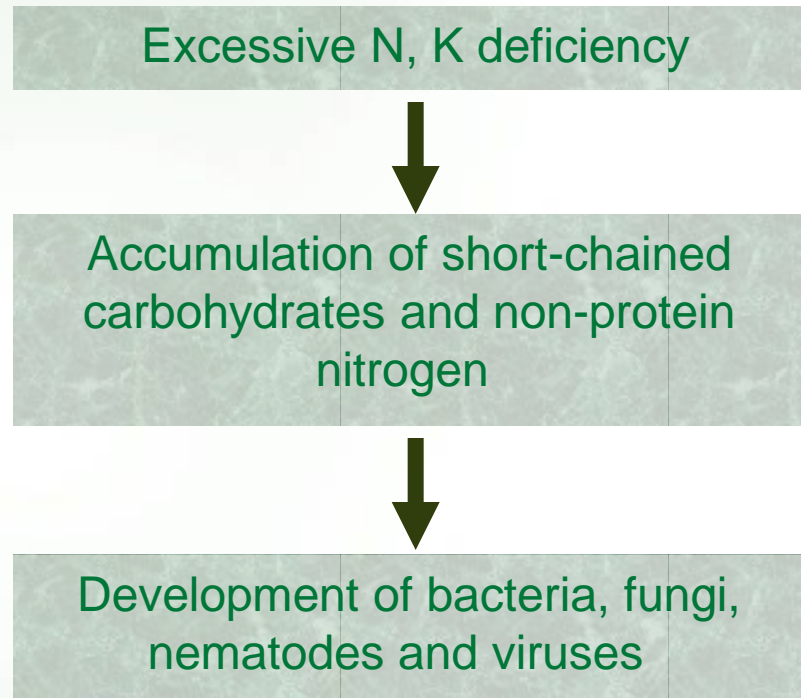
The potassium in Multi-K

- Encourages establishment and branching of roots
- Improves water uptake from the soil

Thus **enhancing the plant's ability to withstand drought**

Stronger & Healthier plants

Better resistance towards pathogens

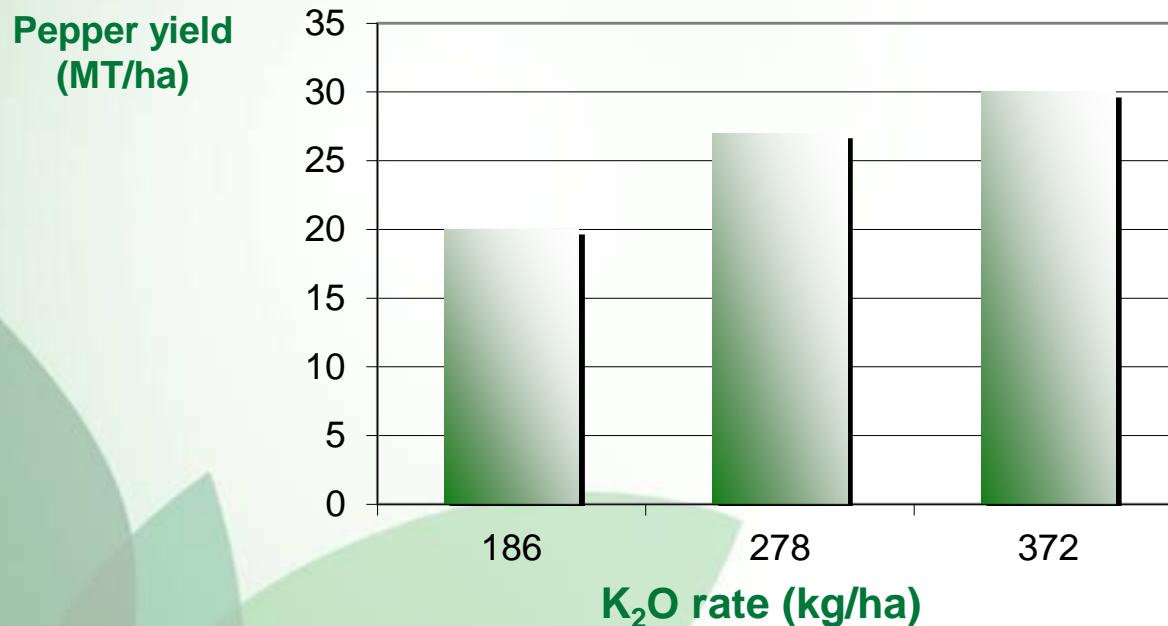


Adequate K supply is essential to prevent the development of plant diseases

Higher yields & better quality

The potassium in Multi-K increases yields

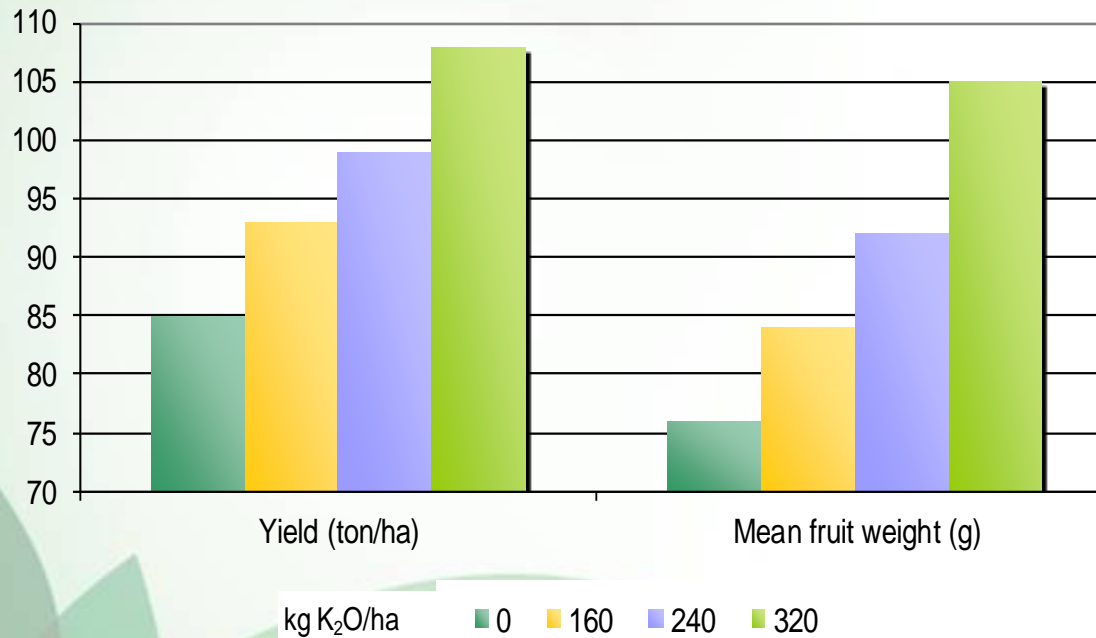
The effect of potassium (K) on pepper yield, under constant N rate of 224 kg/ha



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

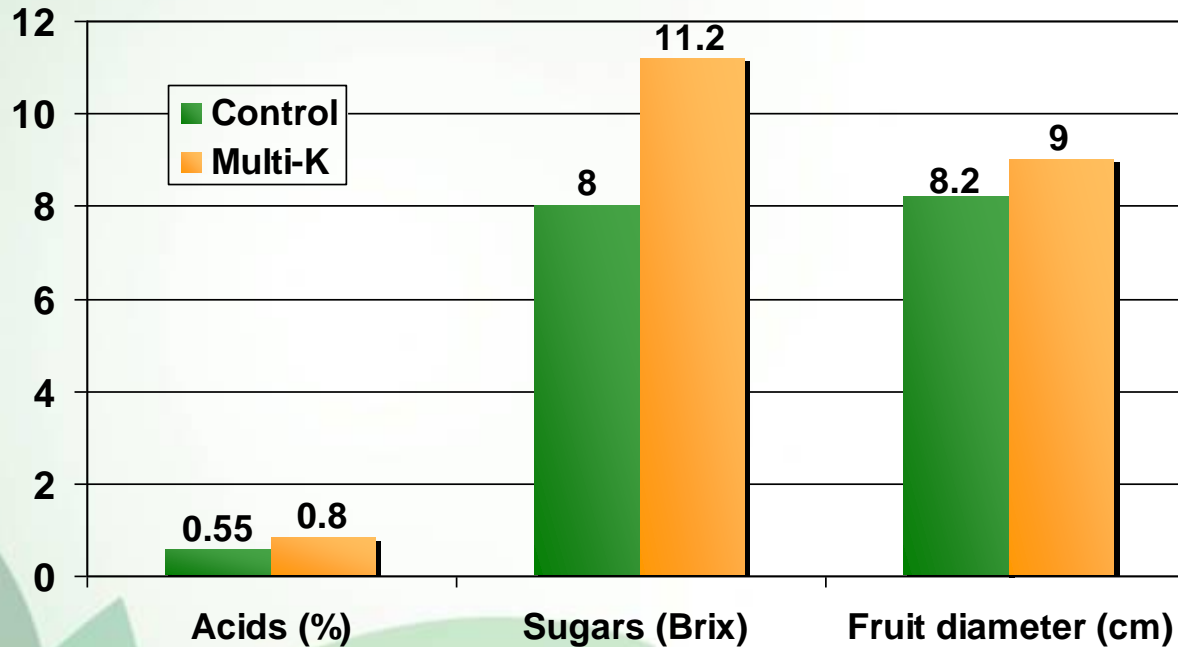
The potassium in Multi-K helps improving quality parameters of:

- **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

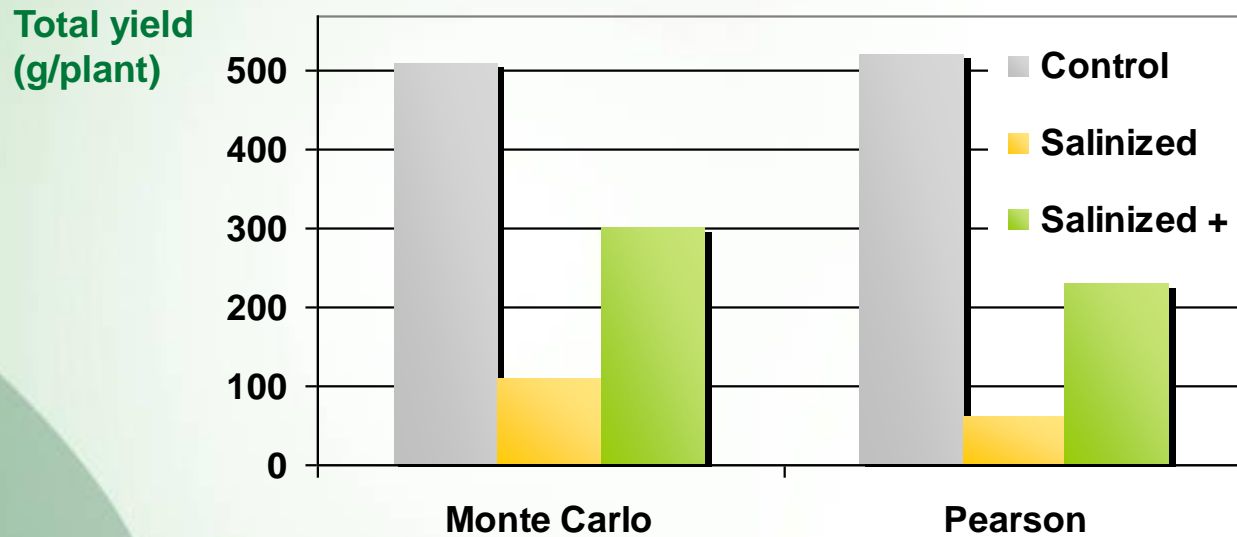


Source: Fuente & Ramirez, 1993

Multi-K combats salinity

Multi-K combats salinity

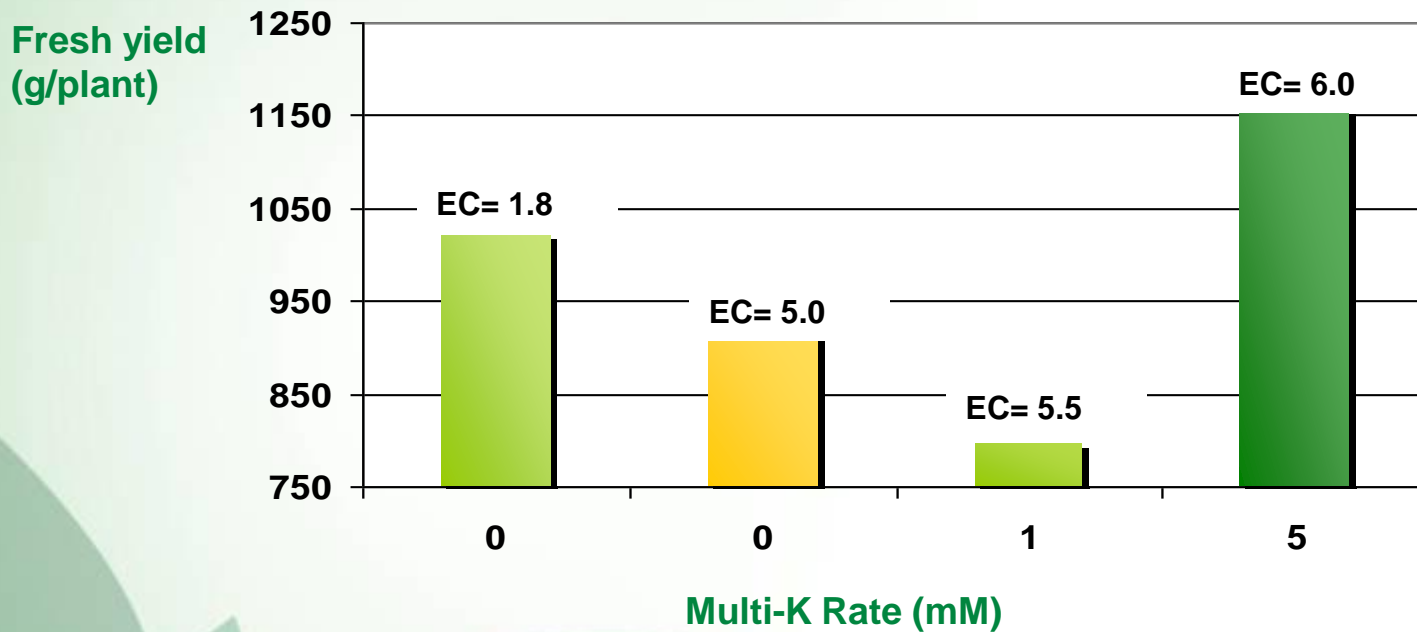
Multi-K Reverses the Adverse Effects of Salinity on Greenhouse Tomatoes



Source: Satti et Al., Muscat, Sultanate of Oman 1994

Multi-K combats salinity

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

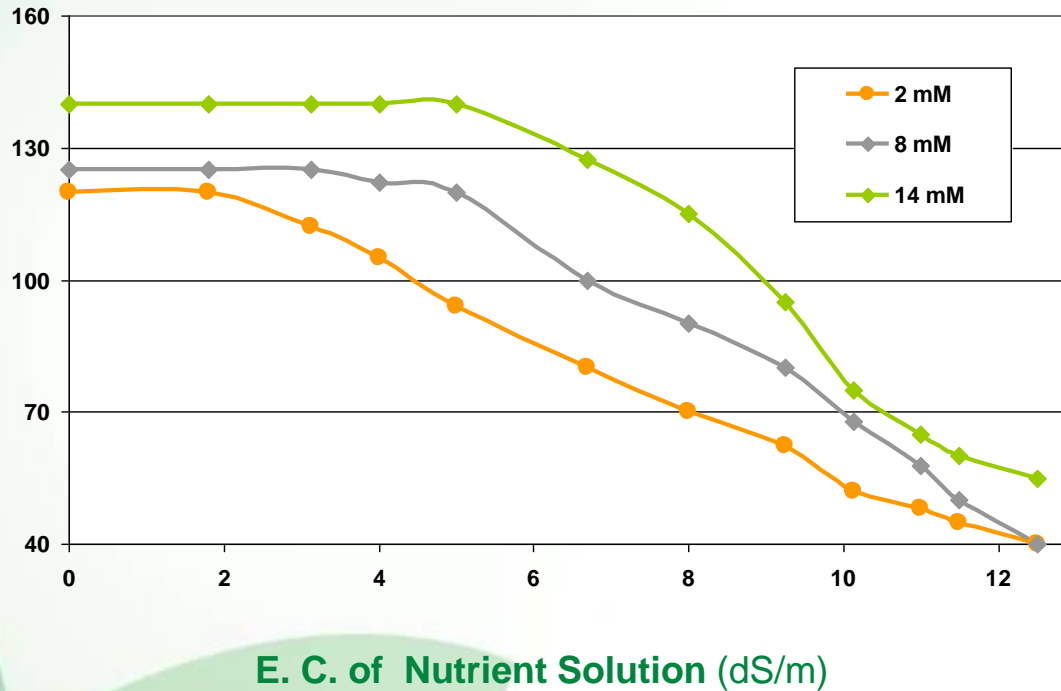


Source: Feigin et Al. 1990, Israel

Multi-K combats salinity

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

Dry matter
(g/plant)



Source: Imas & Feigin, 1995. Israel

Multi-K saves water

Multi-K saves water

Nitrate improves water management

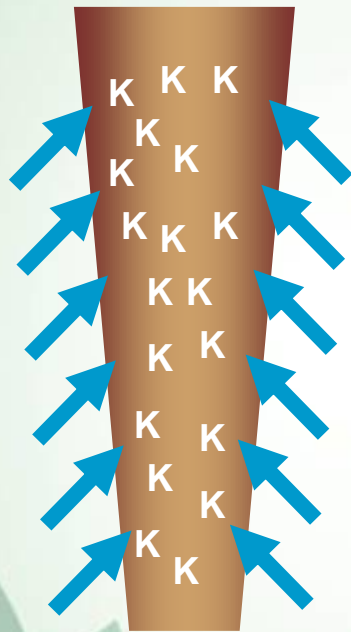
- Nitrate-fed plants utilize water about 100% more efficiently than ammonium-fed plants.
- The difference becomes even more significant when potassium concentration in the soil solution is low.



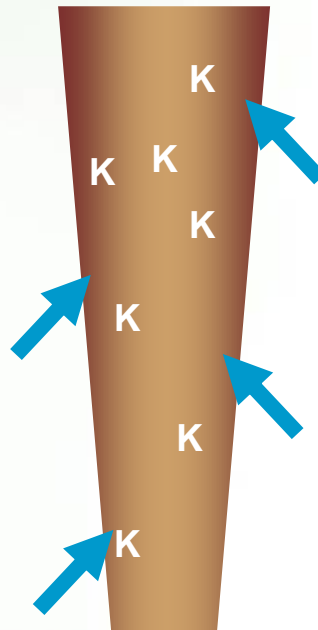
Multi-K saves water

K⁺ enhances water uptake

K in plant roots produces a gradient of osmotic pressure



Adequate K level:
Osmotic pressure draws
water into the root

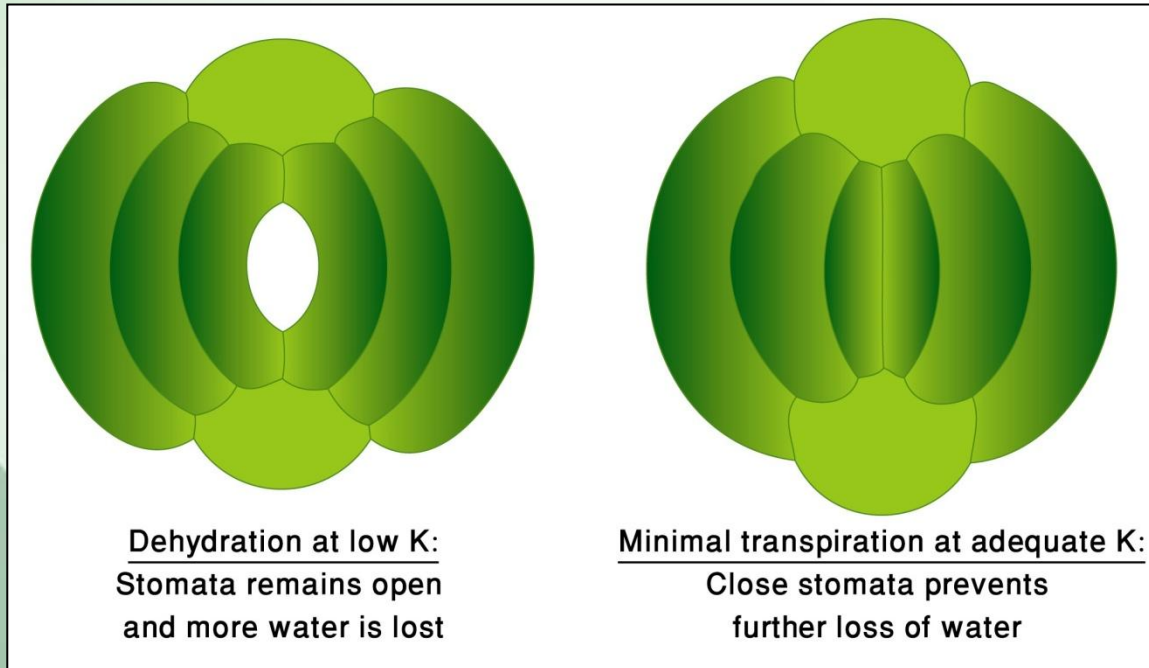


K deficiency:
Reduced ability to
absorb water

Multi-K saves water

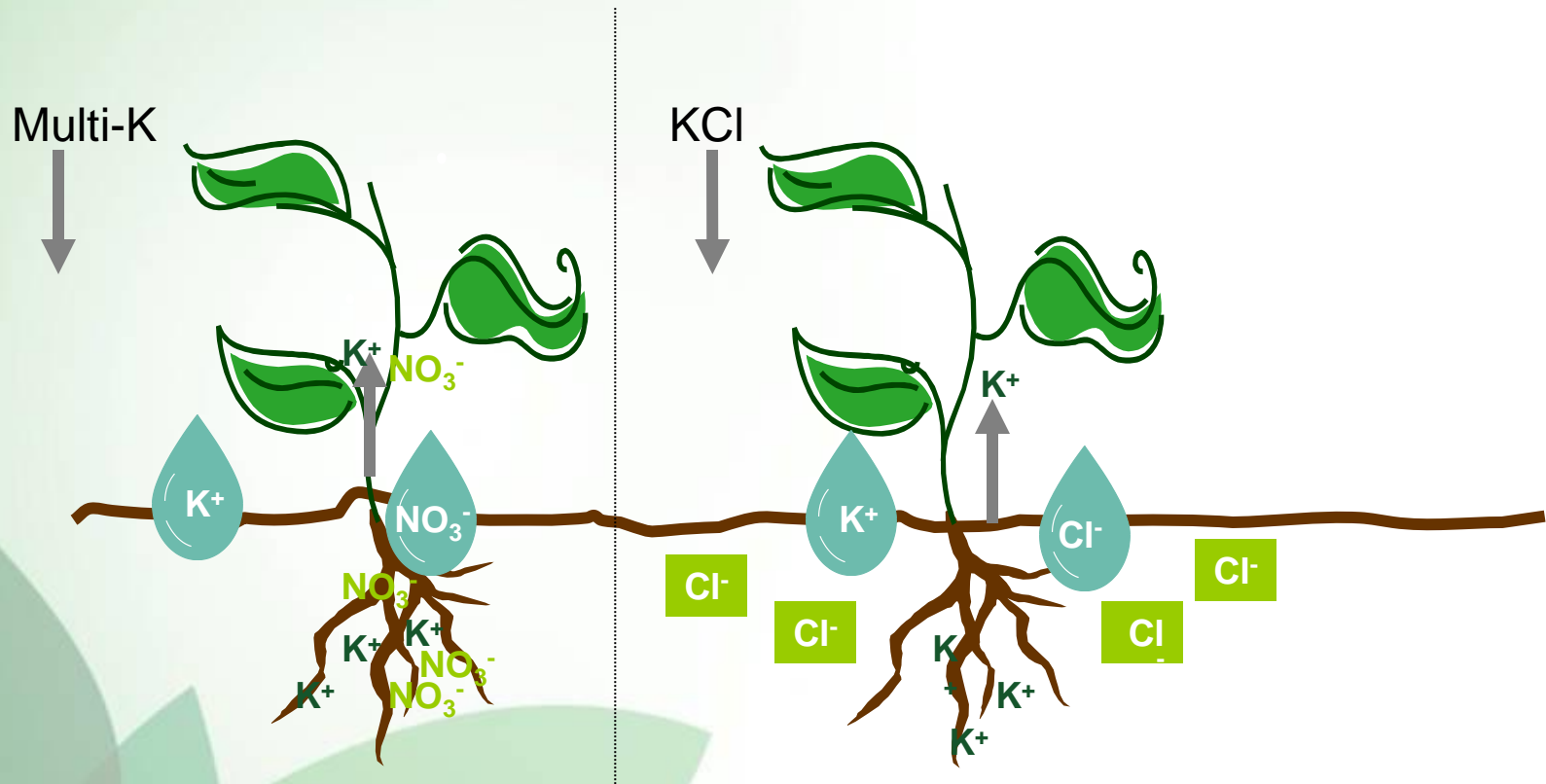
K⁺ prevents water losses

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



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.

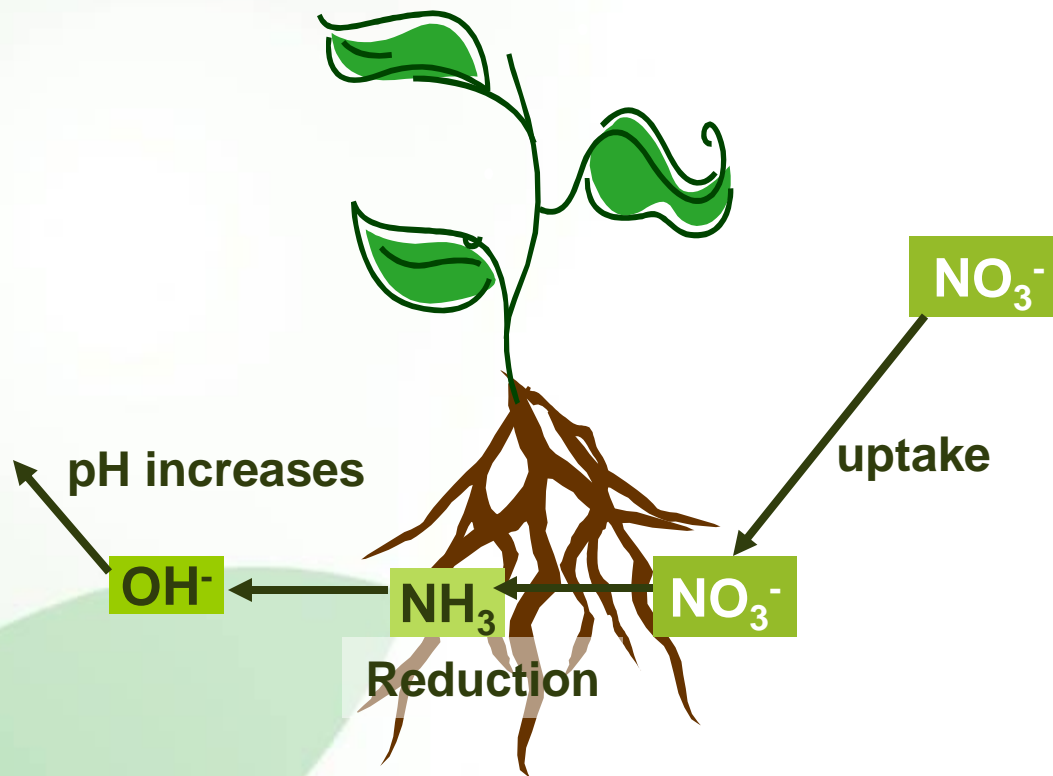
Multi-K improves soil properties



Multi-K improves soil properties

Multi-K increases soil pH

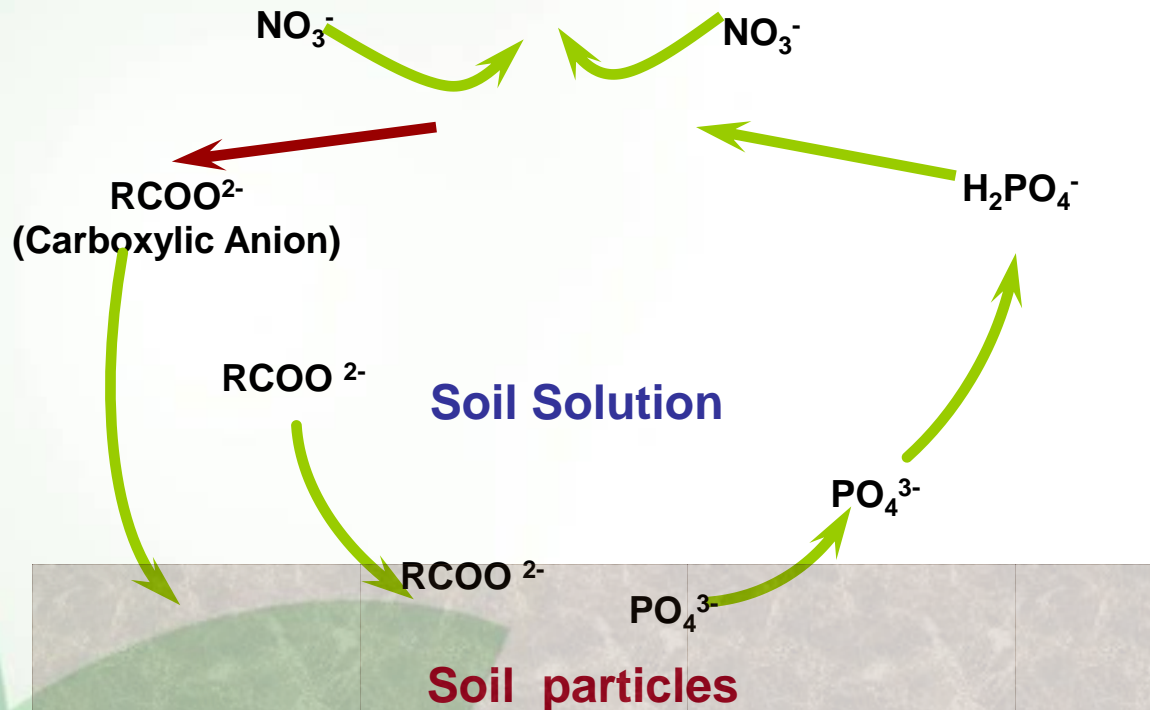
Multi-K has an alkaline effect in the root zone.



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

Fertilizer	Solubility g / Liter Water		
	10°C	20°C	30°C
multi-K (Potassium Nitrate)	210	310	450
Potassium sulfate (SOP)	80	100	110

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.

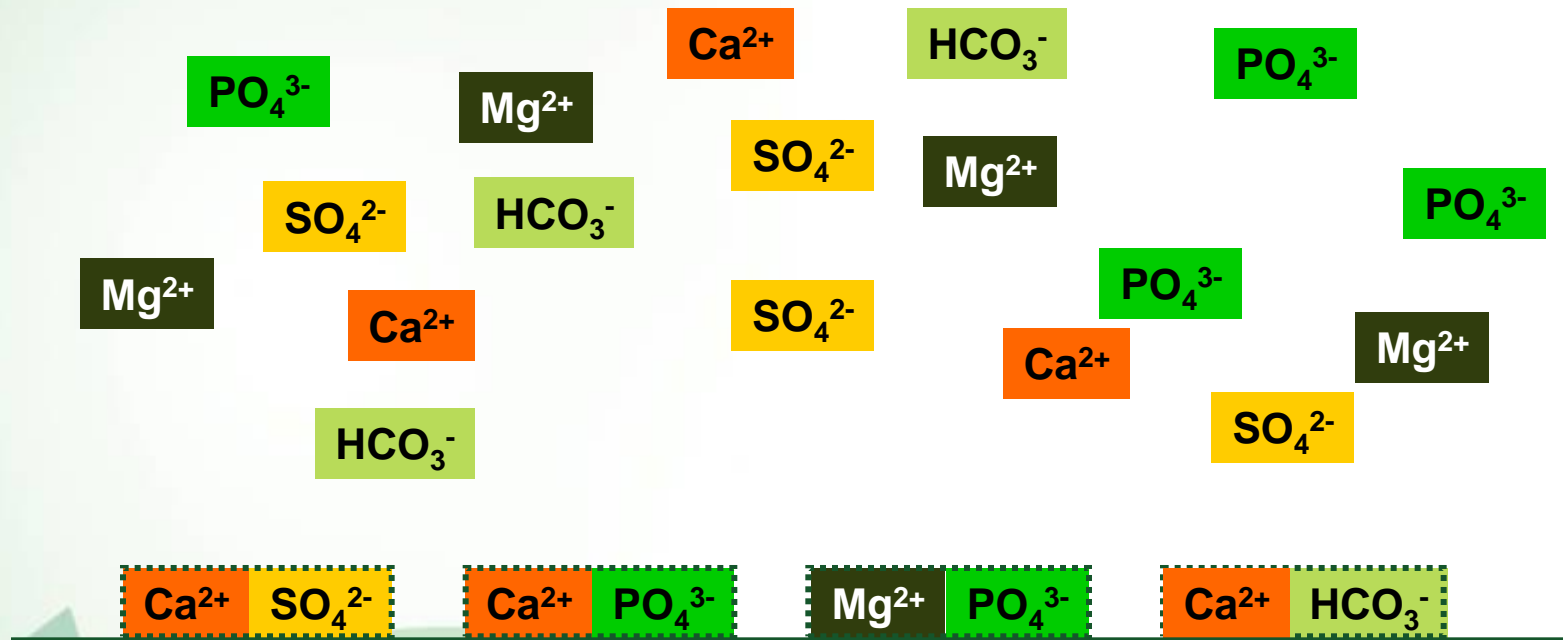
Relative Humidity of Air in Equilibrium with Saturated Solutions of Nitrogen Materials at 30°C

Fertilizer	Relative humidity (%)
Mono ammonium phosphate (MAP)	91.6
multi-K (potassium nitrate)	90.5
Ammonium Sulfate	79.2
Ammonium chloride	77.2
Urea	72.5
Sodium nitrate	72.4
Ammonium nitrate	59.4
Calcium nitrate	46.7

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

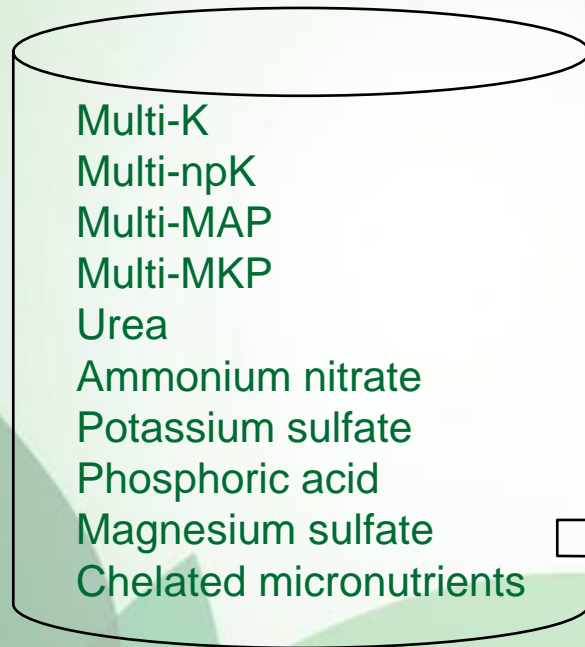


- High pH in water can cause precipitates of calcium carbonate.
- Hazard of clogging emitters

Multi-K is compatible with other fertilizers

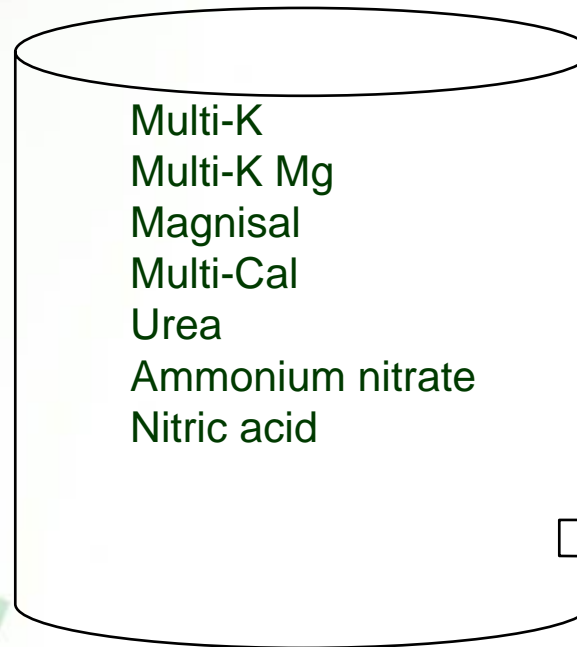
Tank A

No fertilizers containing calcium



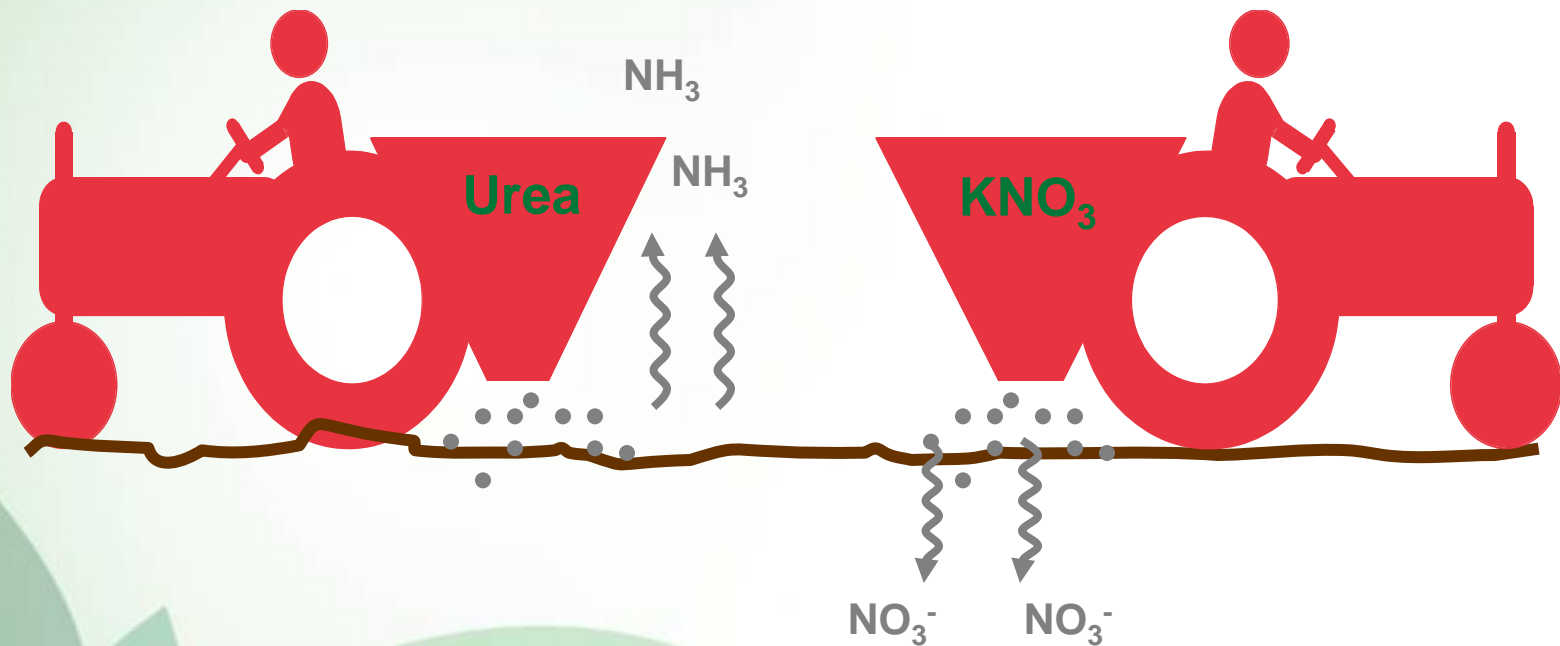
Tank B

No fertilizers containing phosphates or sulfates



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 Nutrification and foliar sprays

Multi-K[®] Classic	Pure potassium nitrate
Multi-K[®] GG	Greenhouse-grade potassium nitrate
Multi-K[®] pHast	Low-pH potassium nitrate
Multi-K[®] Top	Hydroponics-grade potassium nitrate
Haifa-Bonus npK	Foliar formula with special adjuvants for prolonged action



Multi-K Products

Crystalline products for Nutrigation and foliar sprays

Multi-npK[®]		Potassium nitrate enriched with phosphorus
Multi-K[®] Mg		Potassium nitrate enriched with magnesium
Multi-K[®] Zn		Potassium nitrate enriched with zinc
Multi-K[®] S		Potassium nitrate enriched with sulfate
Multi-K[®] B		Potassium nitrate enriched with boron
Multi-K[®] ME		Potassium nitrate enriched with magnesium and micronutrients



Multi-K Products


Multi-K prills for direct soil application

Multi-K[®] prills		Potassium nitrate prills
Multi-npK[®] prills		Potassium nitrate enriched phosphorus
Multi-K[®] Mg prills		Potassium nitrate enriched with magnesium



Multi-K Products

Controlled-release potassium nitrate

 <p>Multicote 12-0-44</p>	<p>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</p>
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