Multi-K™ Potassium Nitrate is superior to Potassium Sulfate (SOP)

Multi-K™ vs. SOP

Summary

	Multi-K potassium nitrate	SOP
Nutritional value	Two Macronutrients (N & K). Typical N contents in plants is 3-5% (DW)	One macro nutrient - K One secondary nutrient - S Typical S contents in plants is 0.15-0.25 % (DW)
Solubility	Very high	Moderate
Compatibility	Compatible with All fertilizers	Incompatible with Ca fertilizers
K-accompanying anion	NO_3^- plays major roles in the plant and soil	SO_4^{2-} has very limited functions
Reaction in water	No reaction in water	Reacts with Ca^{++} and may clog emitters
Nutritional value	Two Macronutrients (N & K). Typical N contents in plants is 3-5% (DW)	One macro nutrient - K One secondary nutrient - S Typical S contents in plants is 0.15-0.25 % (DW)

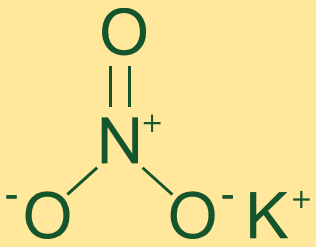
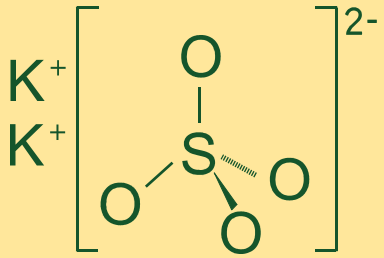
Multi-K™ vs. SOP

Nutritional Composition

	Multi-K potassium nitrate	SOP
Nutrients	Potassium & Nitrogen	Potassium & sulfate
K_2O (%)	46%	50 – 54%
N (%)	13%	None
Sulfate (%)	None	18%
Chloride (%)	0.02 - 1.3%	0.4 – 2%
pH (1g fert./L water)	Most products:8 - 9 Multi-K Absolute: 4 - 5	3 - 4
EC (1g fert. /L water)	1.3 dS/m	1.69 dS/m

Multi-K™ vs. SOP

Chemical properties

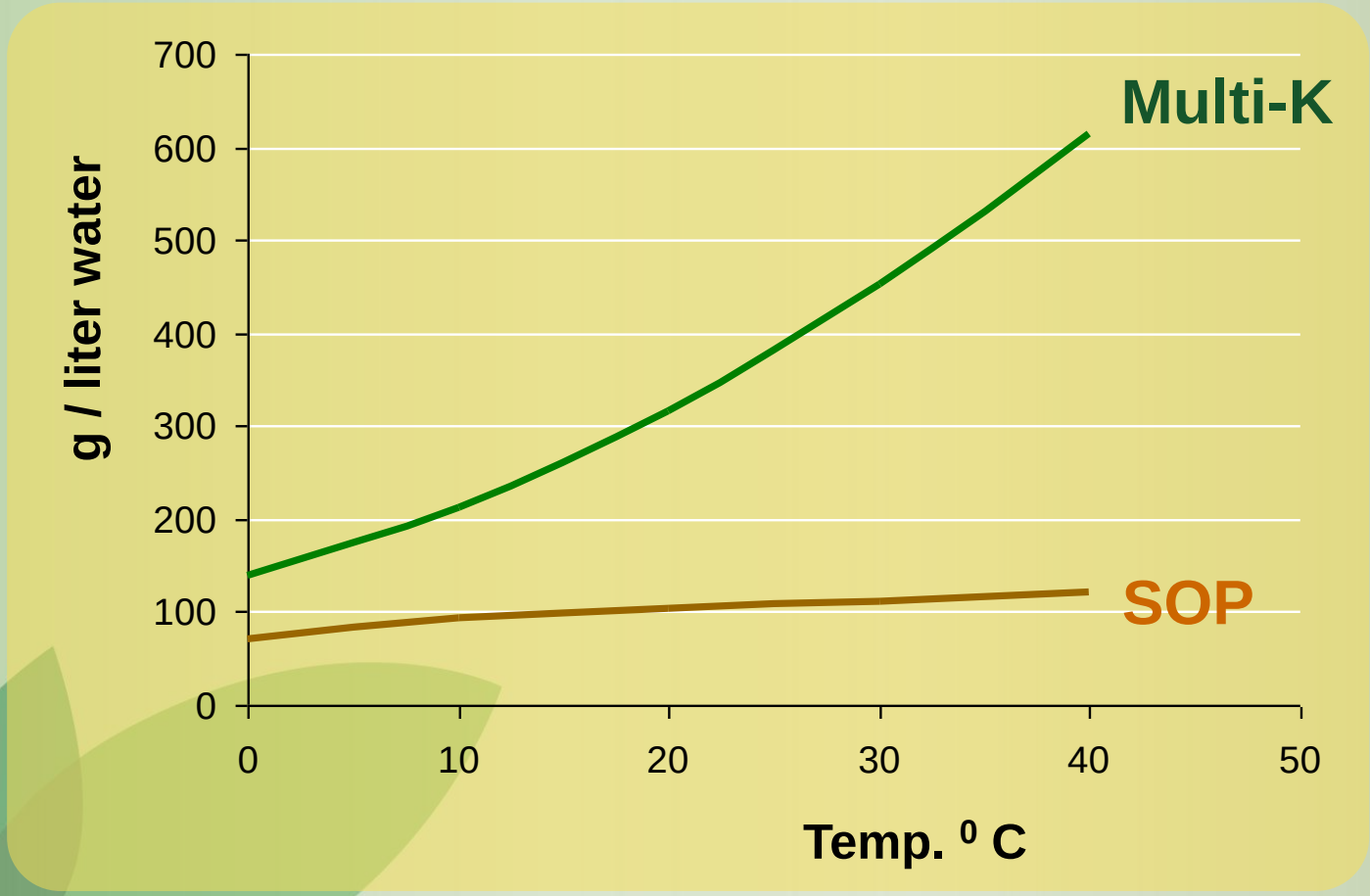
	Multi-K potassium nitrate	SOP
Chemical compound	Potassium nitrate	Potassium sulfate
Other names	Saltpeter, Nitrate of potash	Potassium sulphate
Molecular formula	KNO_3 	K_2SO_4 
Molar mass	101.10 g/mol	174.26 g/mol
Density	1 g/cm3 (16 °C)	1.1 g/cm^3
Melting point	334 °C	1069 °C

Example of different SOP (potassium sulfate) grades

	SOP Fine powder	SOP Granular	SOP Powder	Low-chloride SOP Powder
Mean K_2O	50.9%	50.3%	50.3%	50.5%
Mean SO_4	55.8%	52.6%	52.6%	53.8%
Mean Cl	0.6%	2.1%	2.1%	0.4%
Sieve analysis	85% < 0.30mm	90% between 1.60mm & 4.5mm	97% < 1.65mm (*Tyler 10*)	96% < 1.65mm (*Tyler 10*)

SOP may contain a marked level of detrimental chloride (Cl^-)

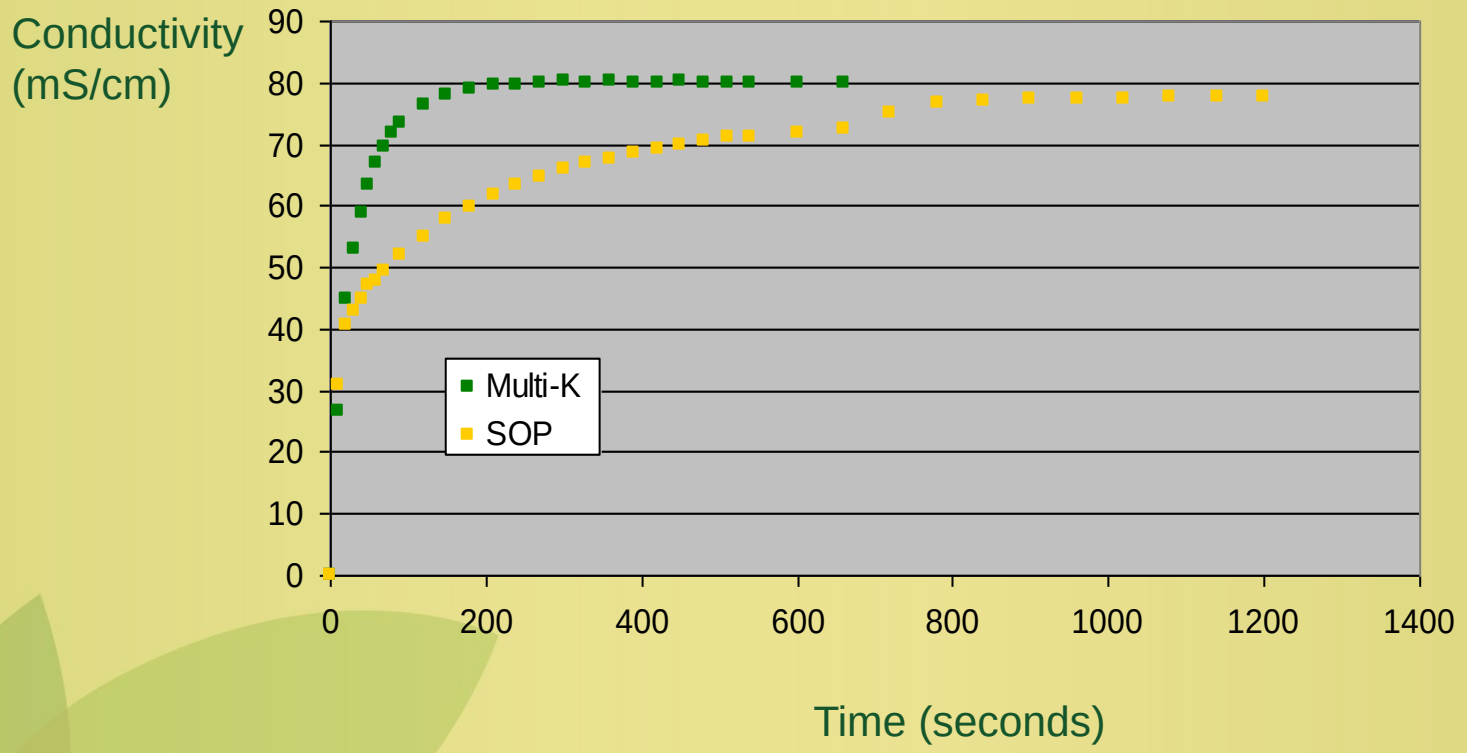
Multi-K™ vs. SOP
Water-solubility



Multi-K™ vs. SOP

Dissolution rate

Dissolution of 10% solution, stirring speed: 65 rpm



Multi-K dissolves faster than SOP

Multi-K™ vs. SOP

Nutrients ratio

- **SOP** - Nutrients ratio is 1:1 SO_4/K_2O whereas plant requirement ratio is 1:20 SO_4/K_2O .

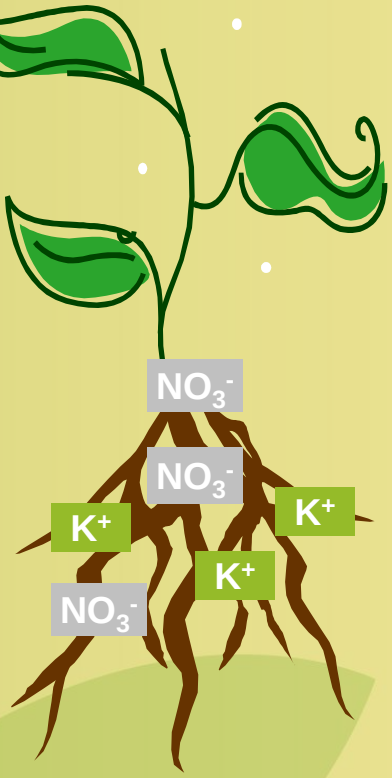
  The excessive SO_4 may lead to accumulation of soil sulfate, soil acidification & osmotic pressure buildup.

- **Multi K™**- Nutrients ratio is 1:3.5 NO_3/K_2O Contains only major nutrients N & K which plant needs the most.

- Multi K S (12-0-46 +5.4SO_4): Nutrients ratio is 1:8.5 SO_4/K_2O improved nutrients ratio which better comply with plants needs.

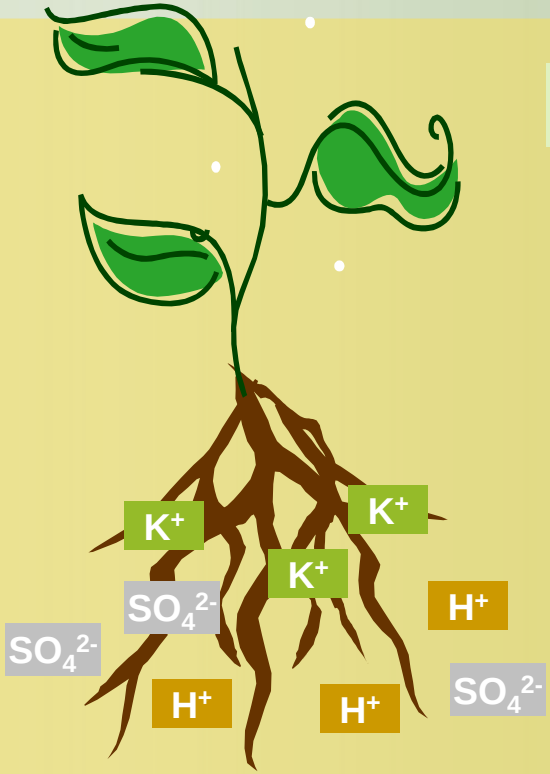
Multi-K™ vs. SOP
Effect on soil properties

Multi-K



- K^+ and NO_3^- are absorbed at similar rates
- Multi-K has a minor effect on soil pH

SOP



- K^+ is absorbed faster than SO_4^{2-}
- H^+ is excreted to balance electrical charges.
- In light soils and soilless culture SOP may markedly acidify the growing medium to harmful levels of pH

Multi-K™ vs. SOP

Chemistry

- **SOP hinders uptake of essential cations**

- SOP + ammonium fertilizers leads to:
  - Drop of soil pH
  - Reduced uptake of K^{+}, Ca^{+2}, Mg^{+2}, and other cations

Multi-K™ vs. SOP

Chemistry

Multi-K = positive interactions with other ions:

- Reduced uptake of detrimental chloride
  - Nitrate-nitrogen minimizes uptake of chloride when this anion is present in the soil or in the irrigation water.
- Better uptake of essential cations
  - Nitrate-nitrogen promotes the uptake of essential cations such as: K^+ , Ca^{2+}, NH_4^+, Mg^{2+}.

Multi-K™ vs. SOP

Chemistry

The nitrate in Multi-K™ counteracts the harmful effect of the chloride

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

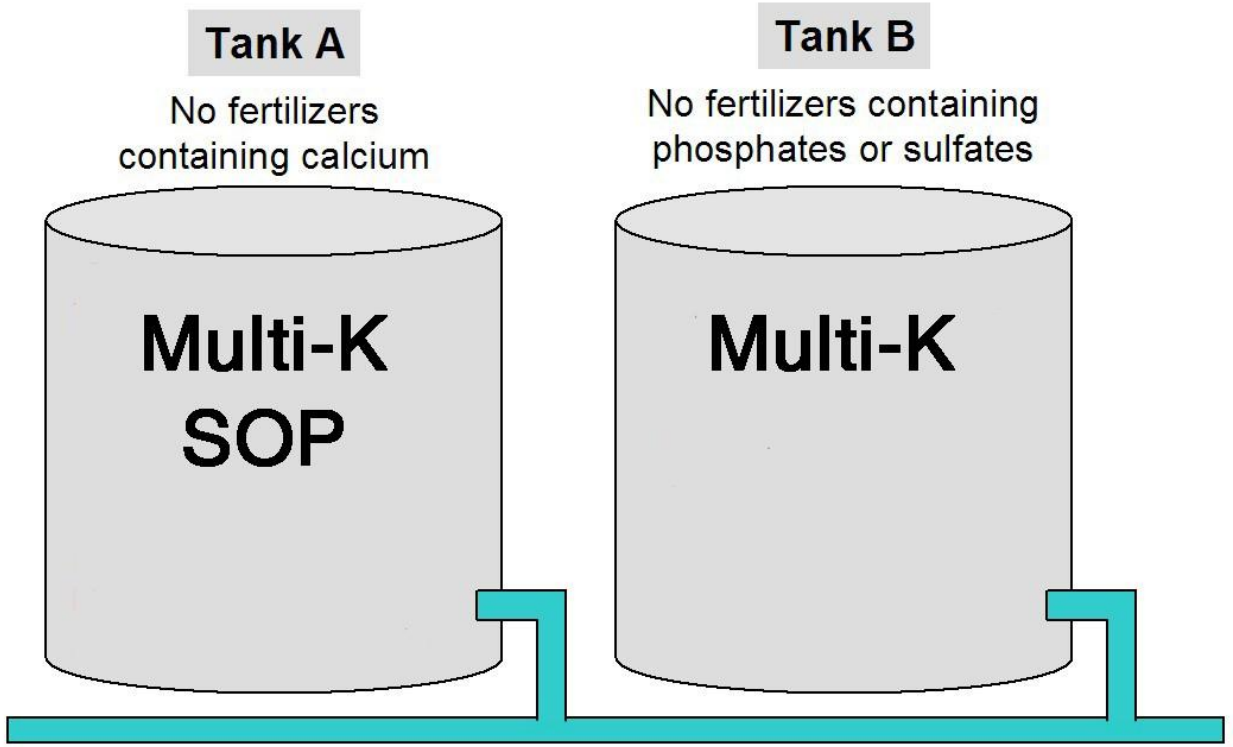
Multi-K™ vs. SOP

Salinity

- Heavy fertilization with **SOP** leads to:
  Soil acidification & salinity buildup →
  - Degradation of soil structure
  - Root scorching
  - Accumulation of soil sulfate

- Fertilization with **Multi-K™** potassium nitrate
  - Efficient uptake prevents salinity buildup
  - Nitrate counteracts the effects of chloride
  - Potassium counteracts the effects of sodium

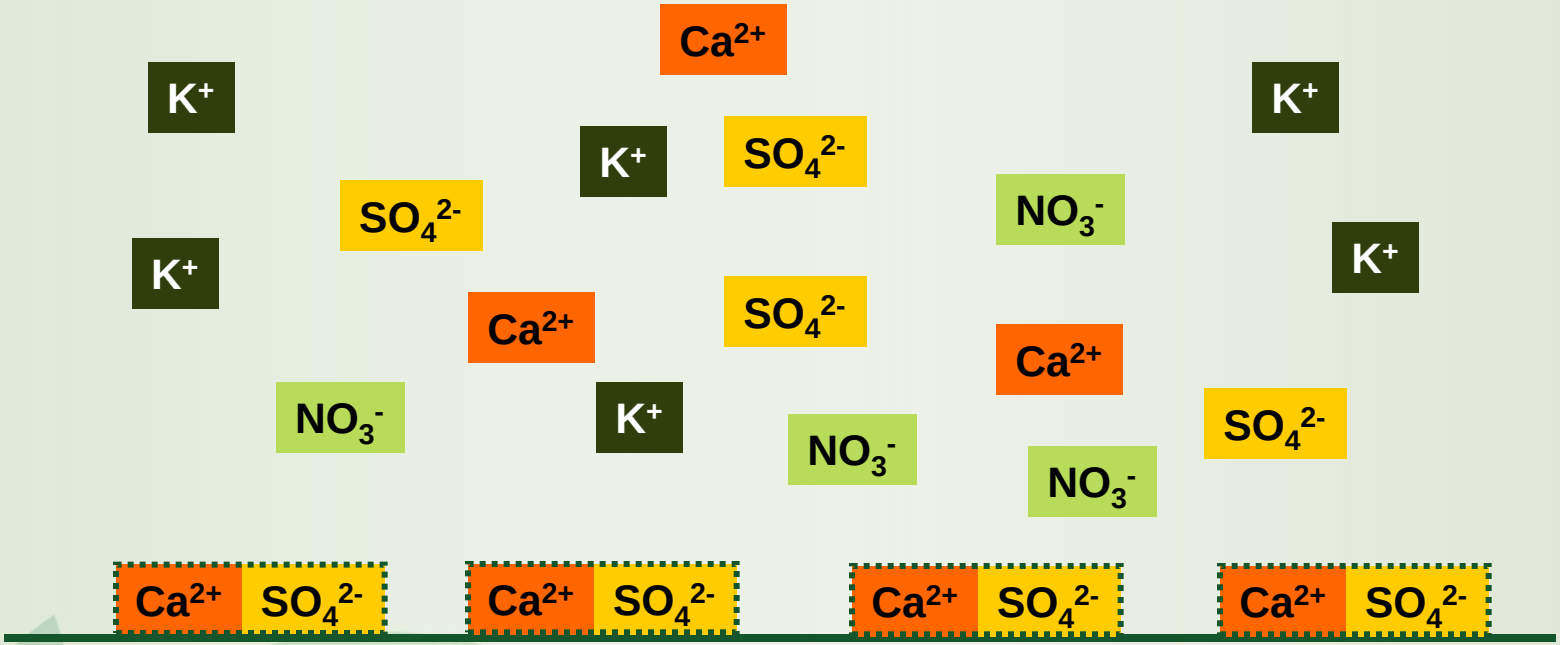
Multi-K™ vs. SOP
Compatibility



Mixing SOP with calcium fertilizers can result in the precipitation of calcium sulfate in the fertilization tank.

Multi-K™ vs. SOP

Chemical interactions



Calcium in water + SOP = Precipitation of calcium sulfate and clogging of drippers.

Trials prove that Multi-K™ is a superior K source

Multi-K™ vs. SOP:

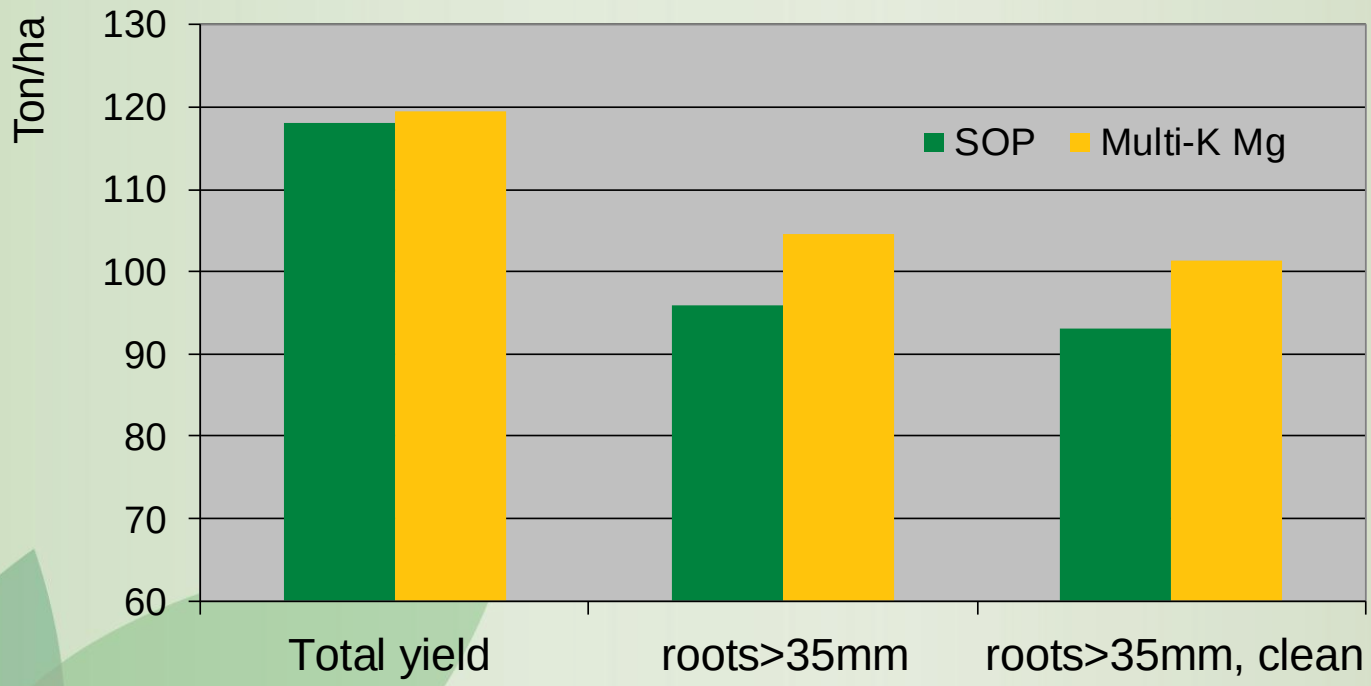
Carrot

Comparison of different K carriers applied by side-dressing at constant N+K rates

- Location: Nord Picardie, France
- Sowing date: 14/4/2000
- Irrigation: water cannons
- Treatments:

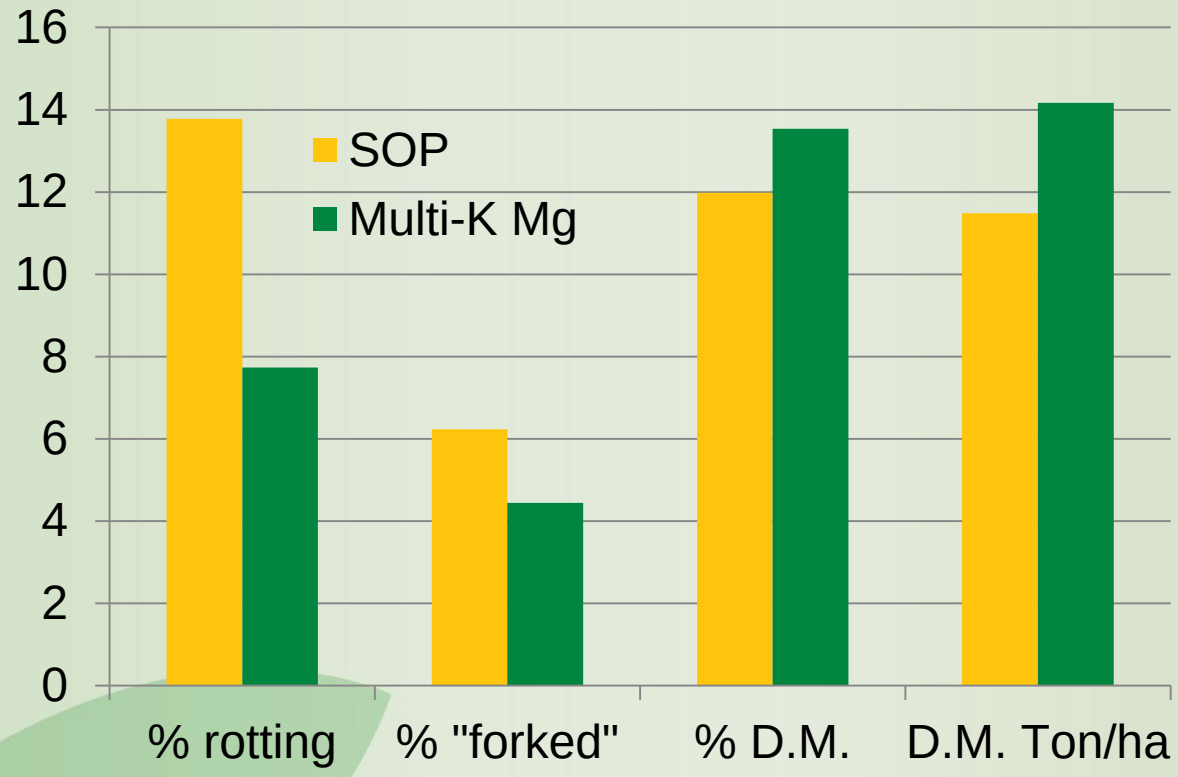
	kg/ha			Application
	N	P_2O_5	K_2O	
SOP + AN	52	0	104	Side-dressing
Multi-K Mg	52	0	104	At 108 days after seeding

Multi-K™ vs. SOP:
Carrot – yield results



Multi-K™ vs. SOP:

Carrot – yield quality



The differences between the treatments are highly significant: P<0.01%

Multi-K™ vs. SOP:

Processing tomatoes

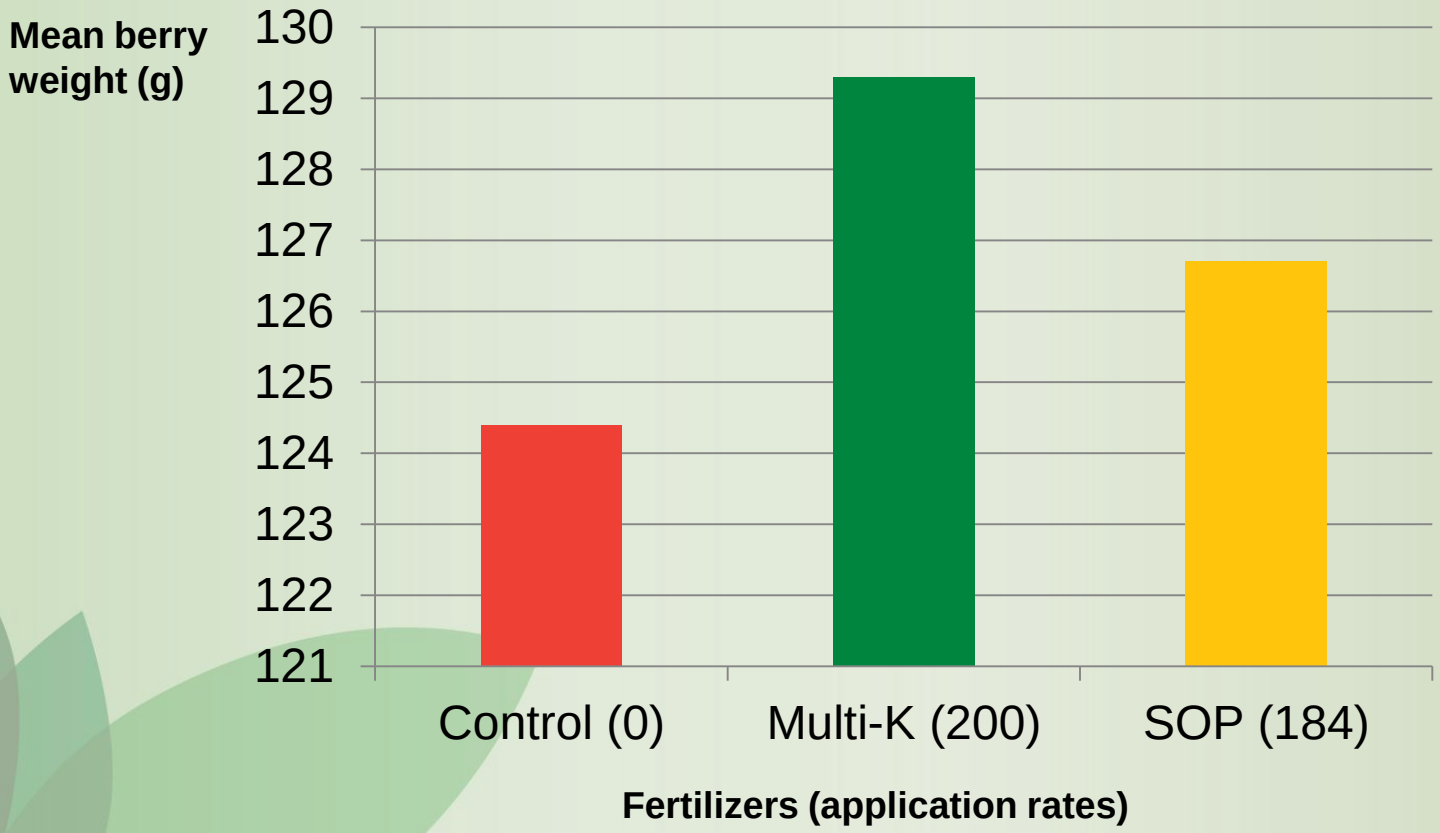
Comparison of base-dressed K- carriers

- Location: Debrecen, Hungary
- Cultivar: *Kecskemeti Jubileum*
- Treatments:

Fertilizer	(Kg / ha)	K_2O kg/ha	Application
Control	0	0	K: base-dressing in Fall, prior to planting N: side-dressing
SOP + N	184	92	
Multi-K	200	92	
Multi-K	300	138	

:Multi-K™ vs. SOP

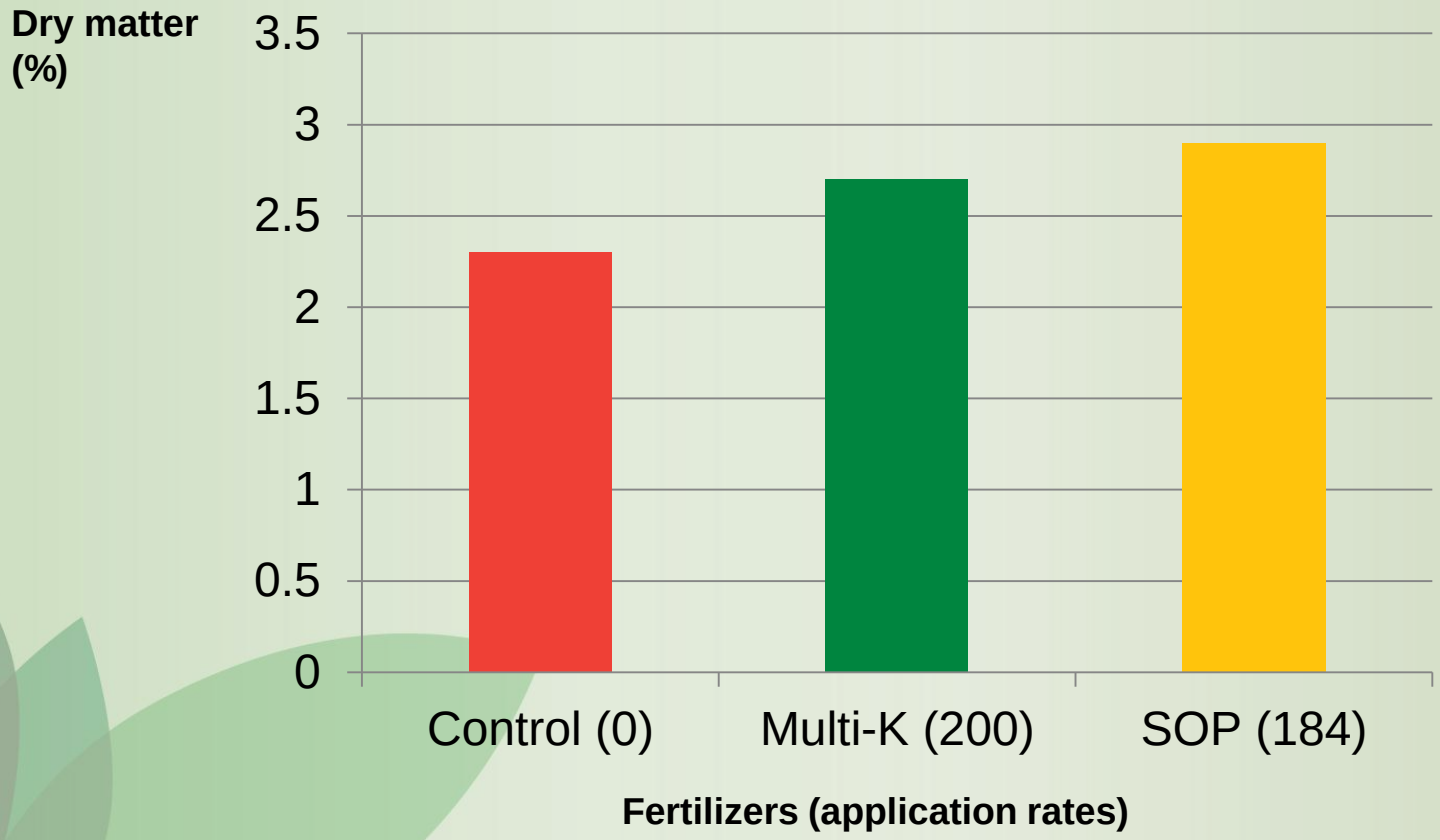
Processing tomatoes



Trial carried out by Biomark, Hungary, 1994

:Multi-K™ vs. SOP

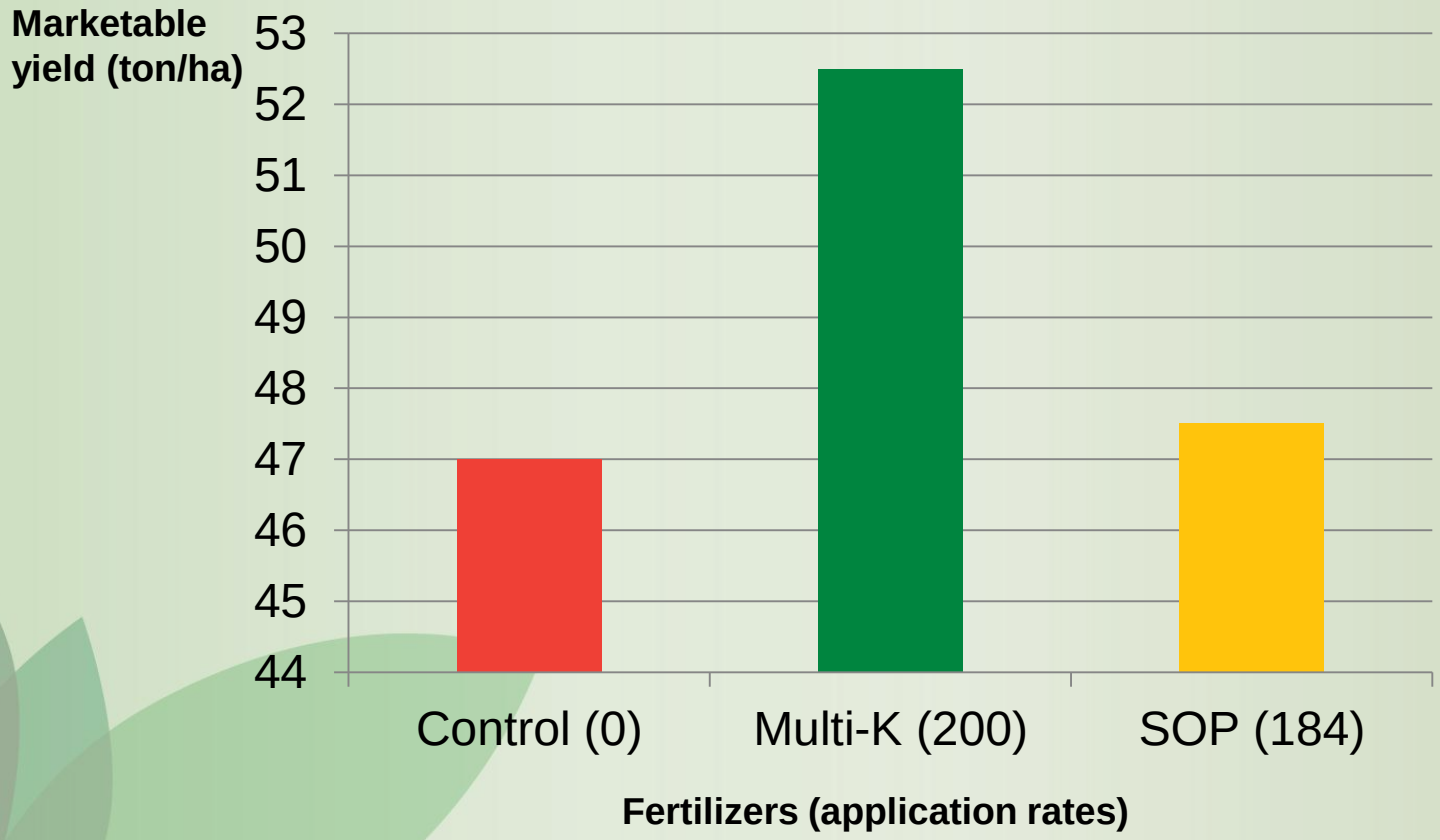
Processing tomatoes



Trial carried out by Biomark, Hungary, 1994

:Multi-K™ vs. SOP

Processing tomatoes



Trial carried out by Biomark, Hungary, 1994

Multi-K™ vs. SOP:

Processing tomatoes

Parameter checked	Increase by Multi-K over	
	Control	SOP
Total marketable yield	12.8%	11.8%
Berry weight	3.9%	2.1%
Dry matter	26.1%	7.4%

Trial carried out by Biomark, Hungary, 1994

Multi-K™ vs. SOP:

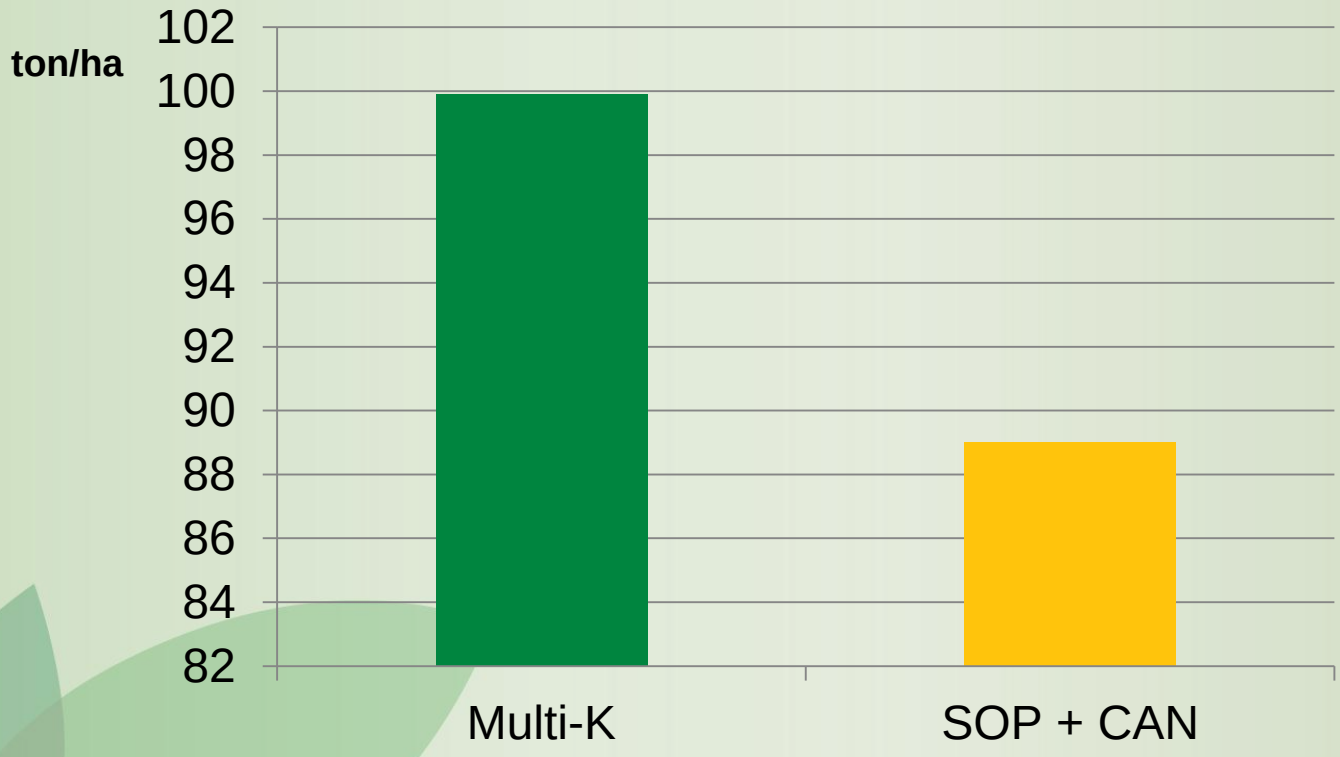
Processing tomatoes

- Location: Emilia Romagna, Italy
- Cultivar: *Perfect Peel hy.*
- Treatments:

Treatment	Fertilizers	Application method
Multi-K	Multi-K Poni-Ter 12-20-27 (granular fertilizer based on Multi-K)	Base dressing: 250 kg/ha Poni-Ter Side-dressing: 250 kg/ha Multi-K
Control	SOP+CAN	Base dressing

:Multi-K™ vs. SOP

Processing tomatoes



Multi-K™ vs. SOP:

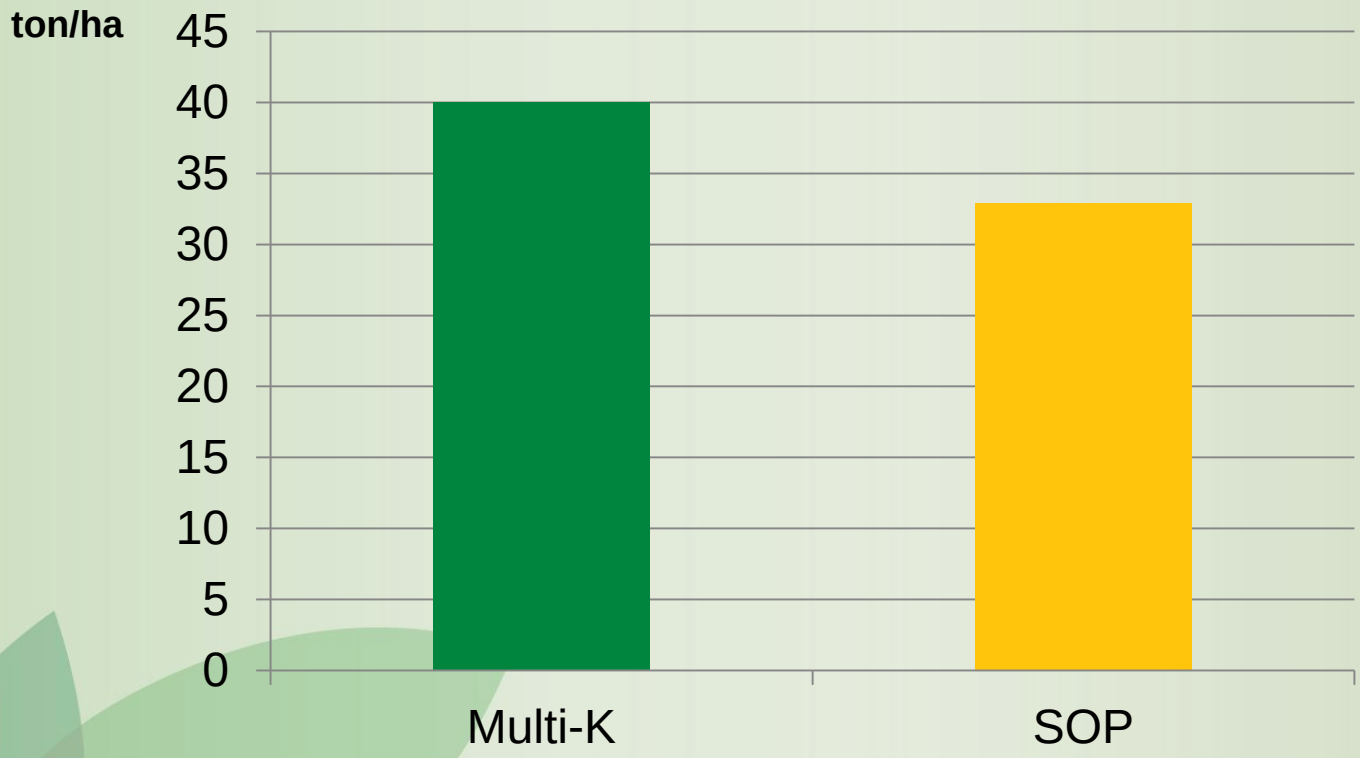
Cucumber

- Location: China / Shouguang /Shandong province
- Xintaimici
- Treatments:

Treatment	Fertilizers	K rate	Application method
Multi-K	Multi-K	345 kg/ha	Base dressing and Fertigation
Control	SOP		

:Multi-K™ vs. SOP

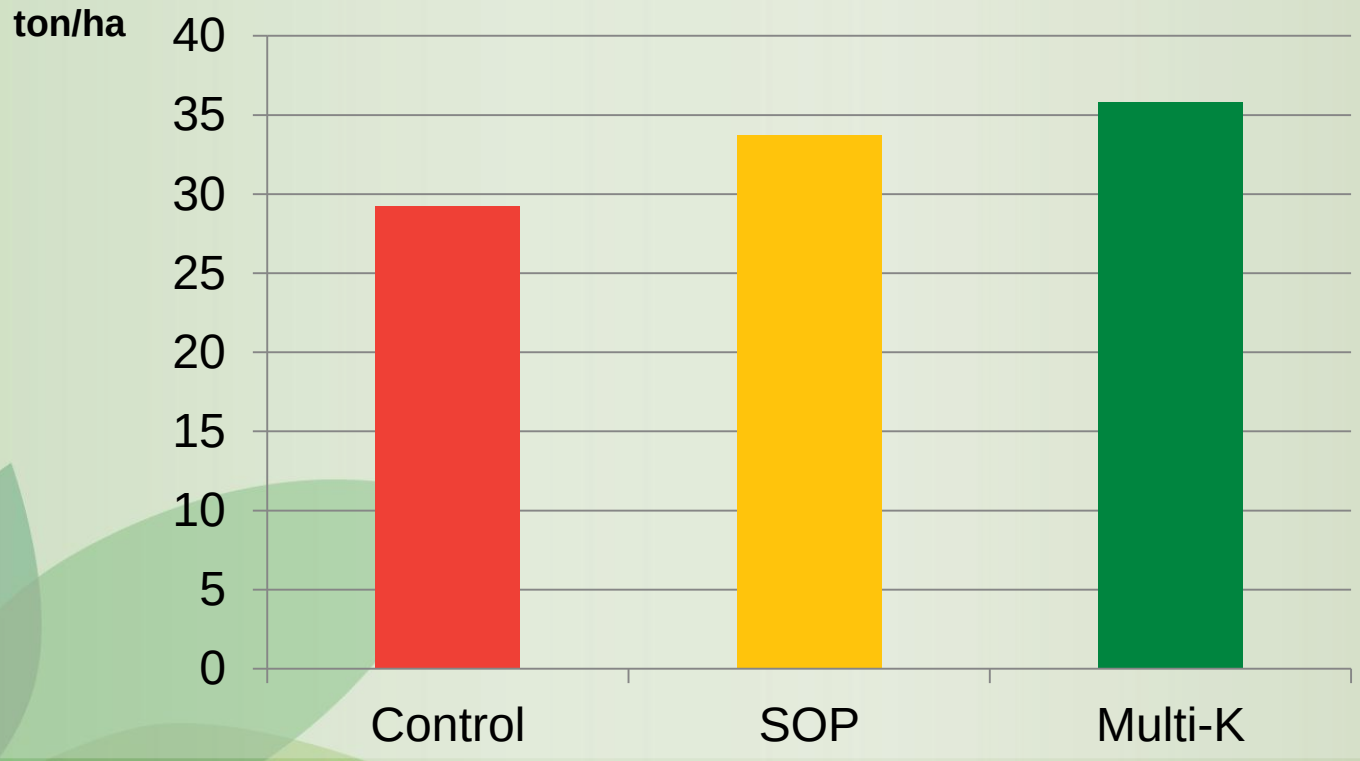
Cucumber



:Multi-K™ vs. SOP

Squash

The effect of K source on yields of Squash (*Zaoqing hybrid)*
K rate: 345 kg/ha
(trial in Shouguang, Shandong province, China)



Multi-K™ vs. SOP:

Squash

- Multi-K yielded 2.1 ton/ha more than SOP
- Frost hardiness was much improved, and so was marketability

Multi-K™ vs. SOP:
Lettuce

Crop*/cultivar*	**Lettuce** ***/*** *roundhead*
Country / location	UK / Essex , Mapleton Growers
Objectives	Comparison between Multi-K and SOP
Application method	B.D. immediately prior to planting
Multi-K benefits	Plants are greener, healthier and 28g/head heavier.
Characteristics of best treatment	Yield increase : ~11% Grower's revenue from yield: 670 US$/MT Cost of treatment (application + material) 150 US$/Ha
Net benefit of Multi-K treatment	Up to 1,400 US$/Ha
Benefit/Cost ratio	10.3

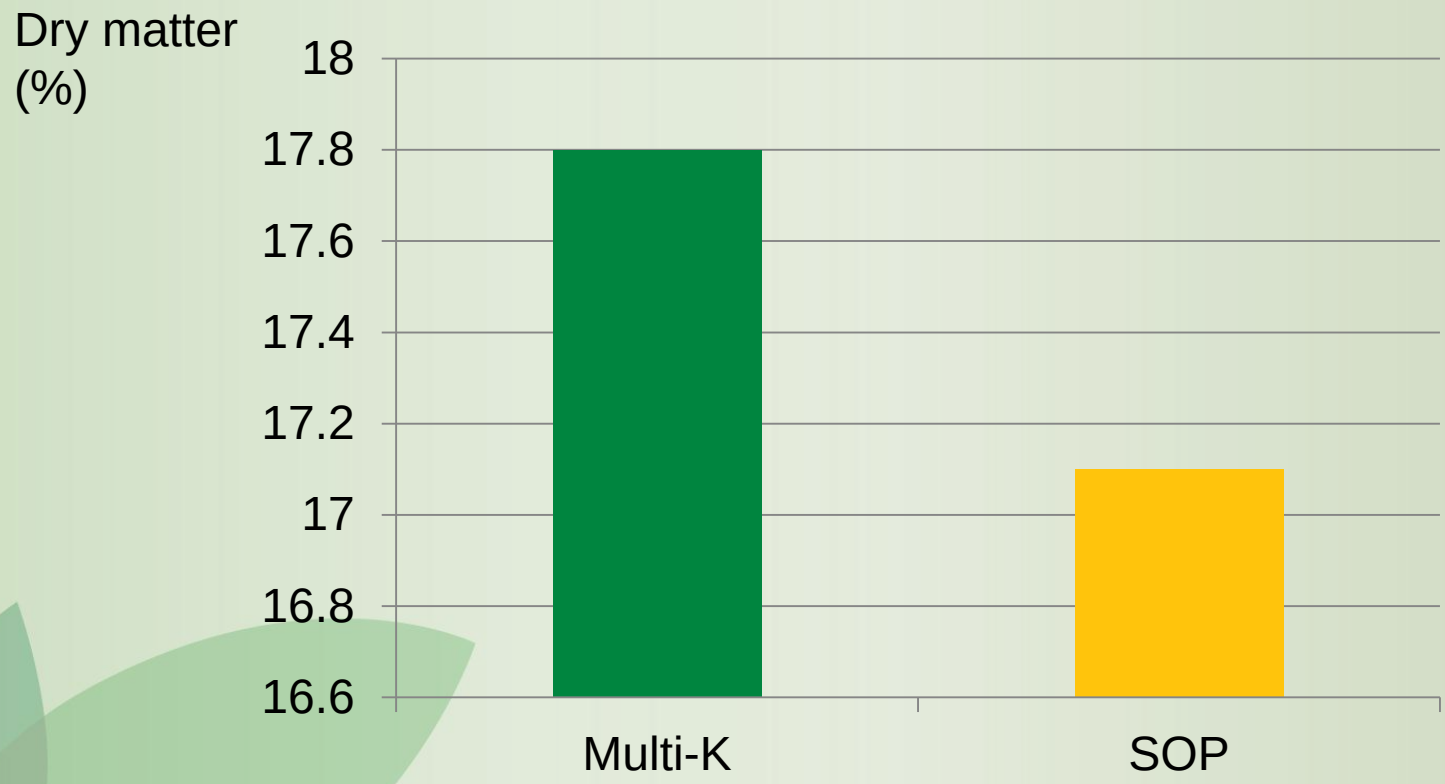
Multi-K™ vs. SOP:

Potato

Crop*/cultivar*	**Processing Potatoes** / *Hertha; PPN; UTD; SV; BP1*
Country / location	South Africa
Objectives	Comparison between Multi-K and SOP
Application method	Fertigation, 300 ppm K. Treatments

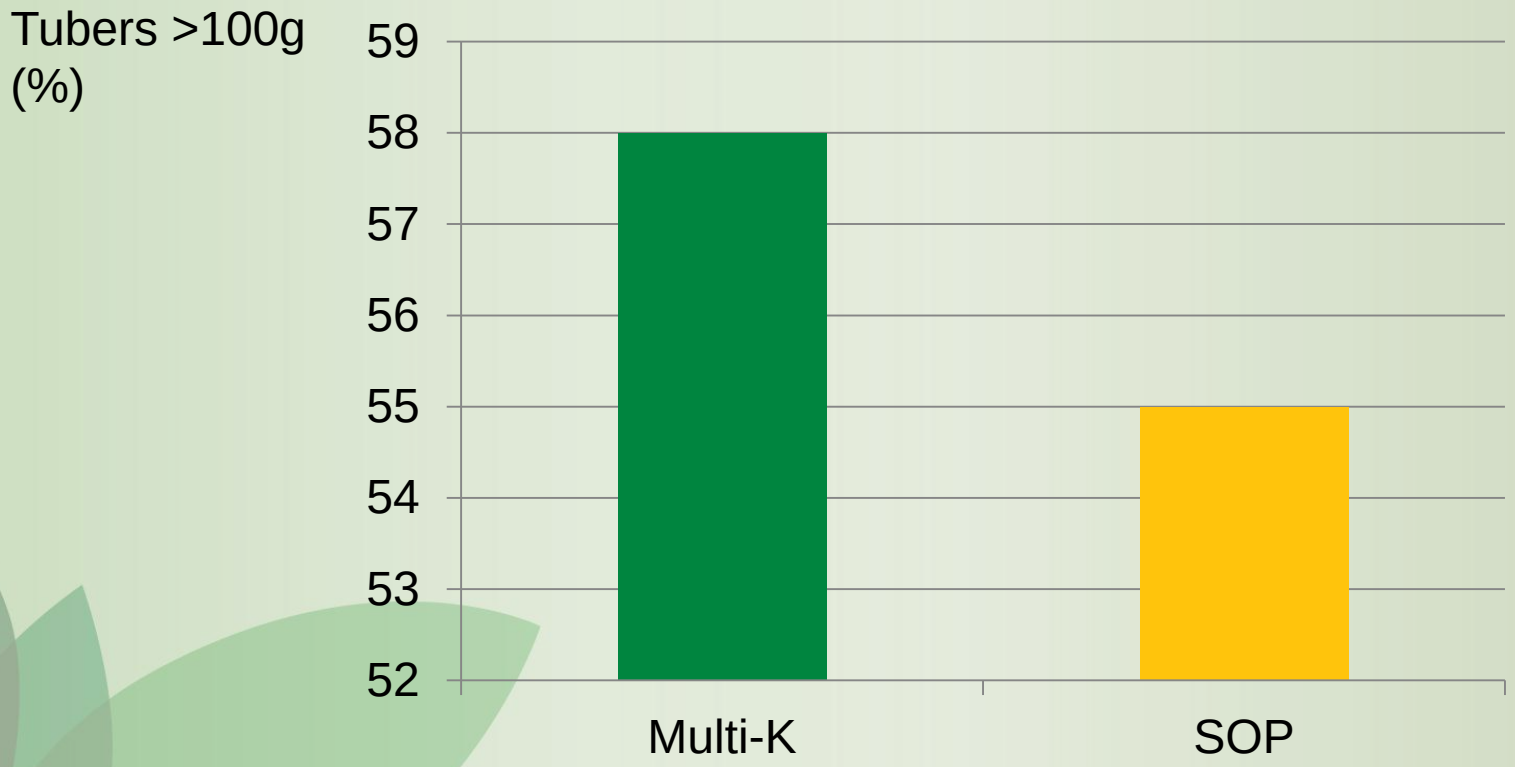
:Multi-K™ vs. SOP

Potato



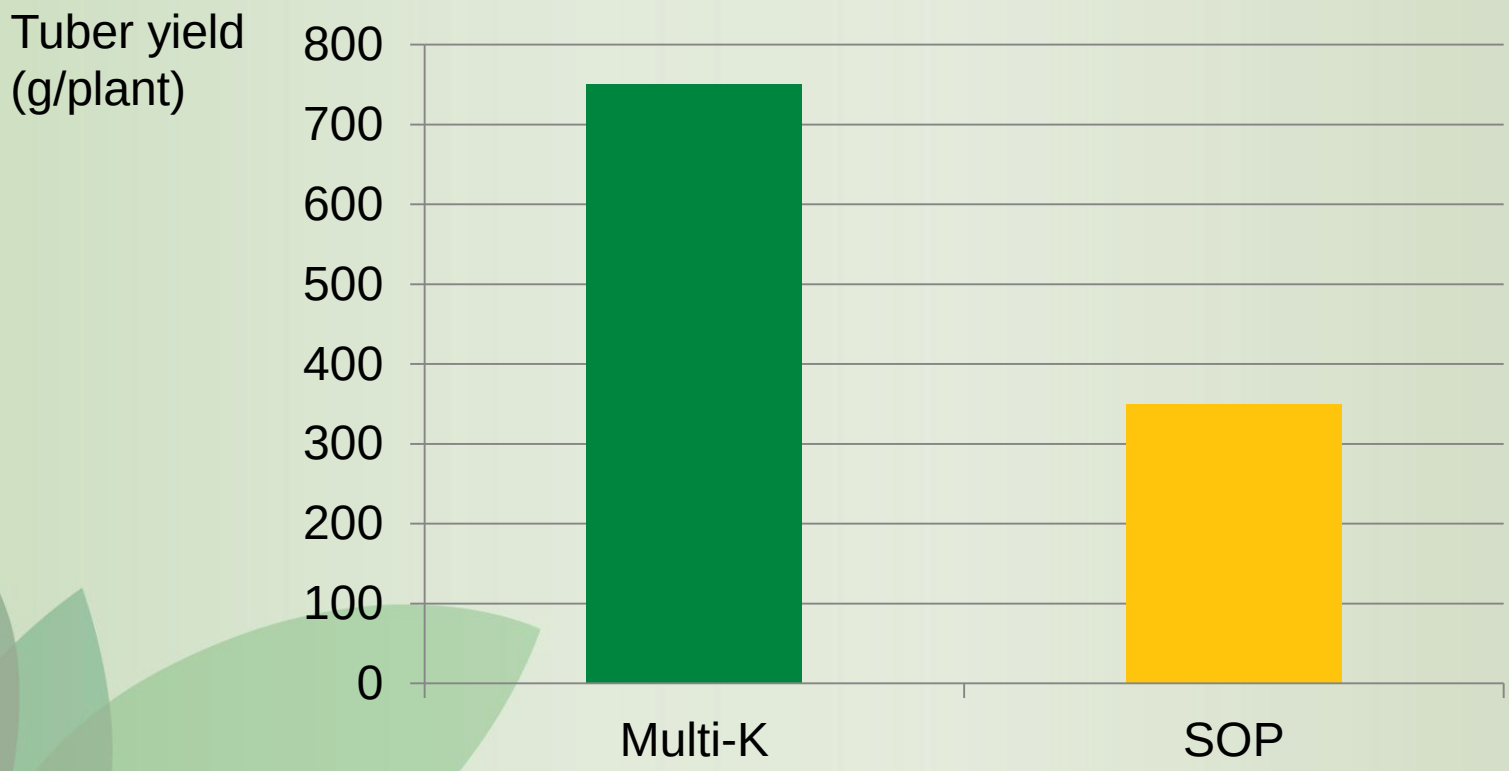
:Multi-K™ vs. SOP

Potato



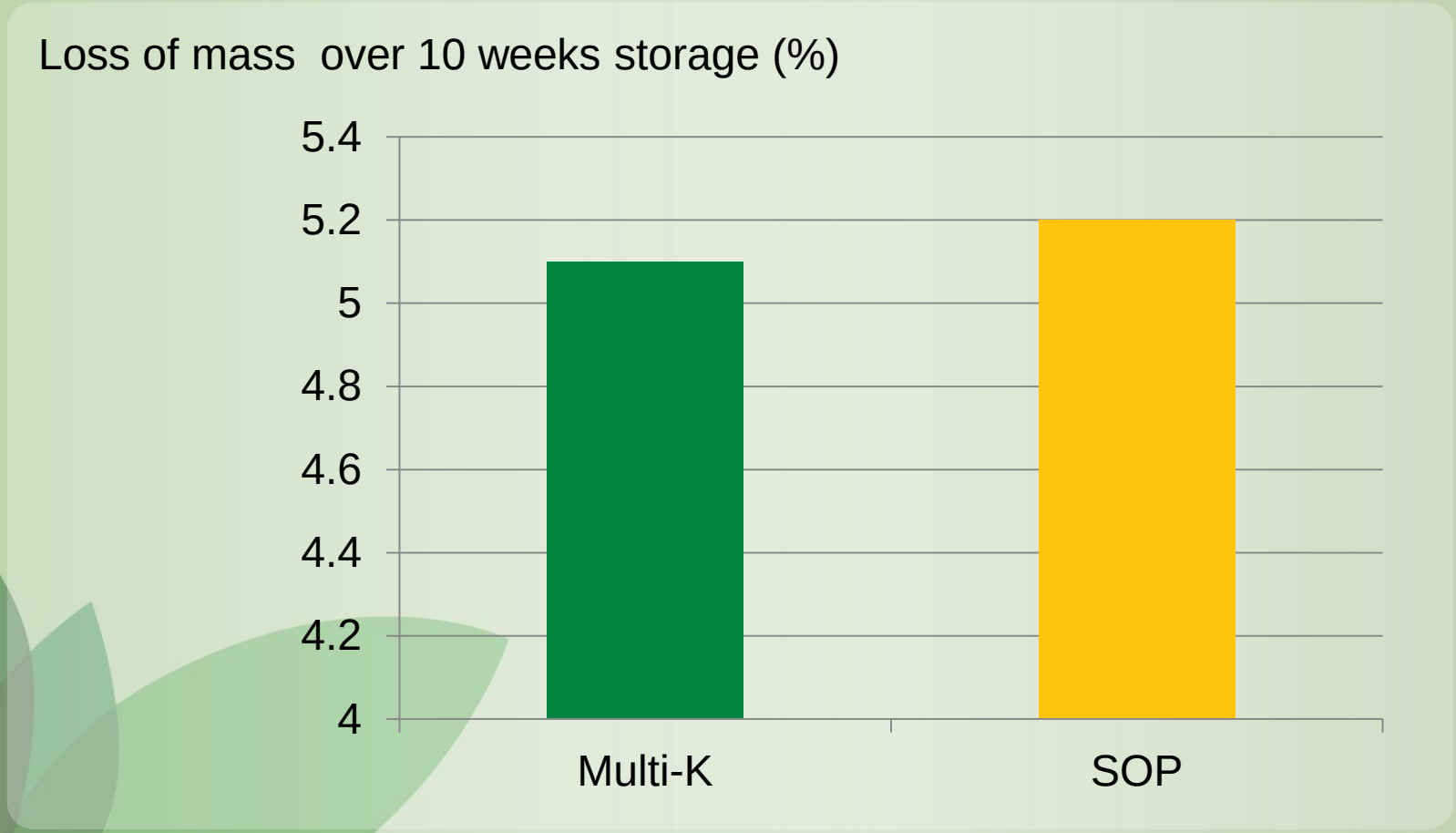
:Multi-K™ vs. SOP

Potato



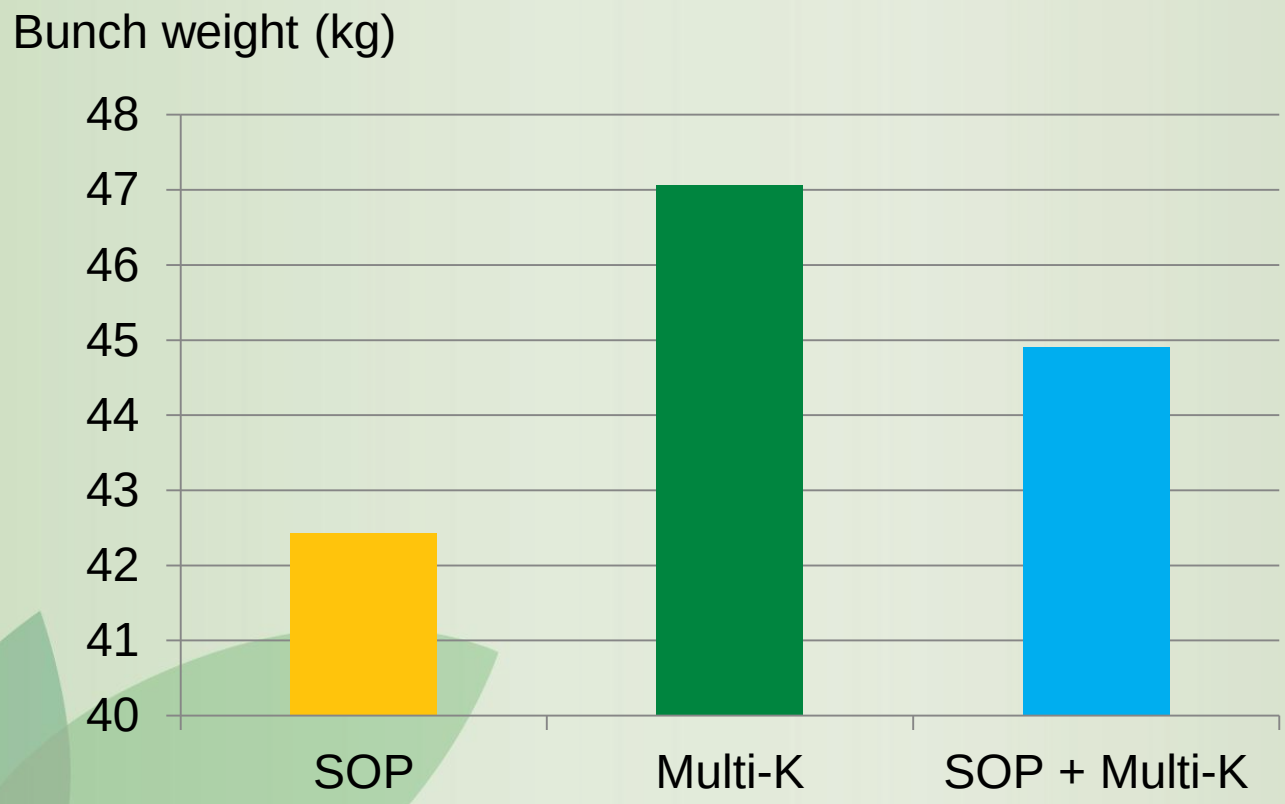
:Multi-K™ vs. SOP

Potato



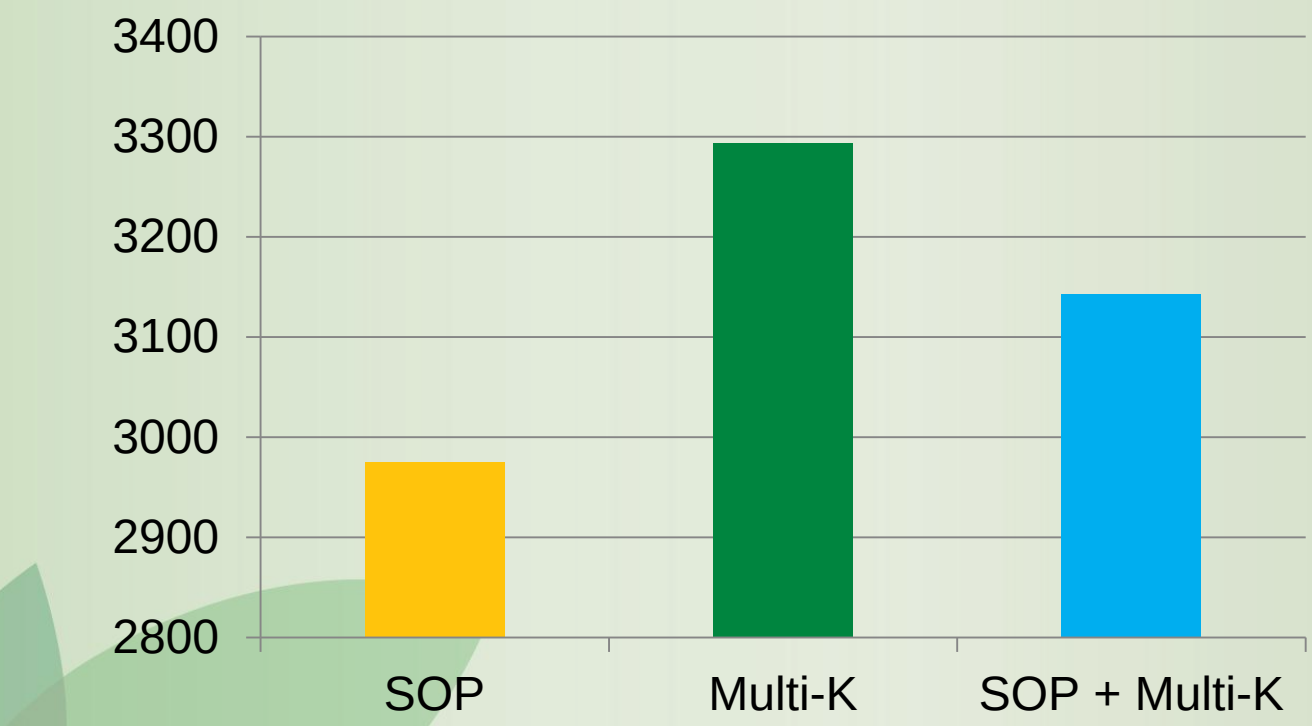
Multi-K™ vs. SOP:

Banana

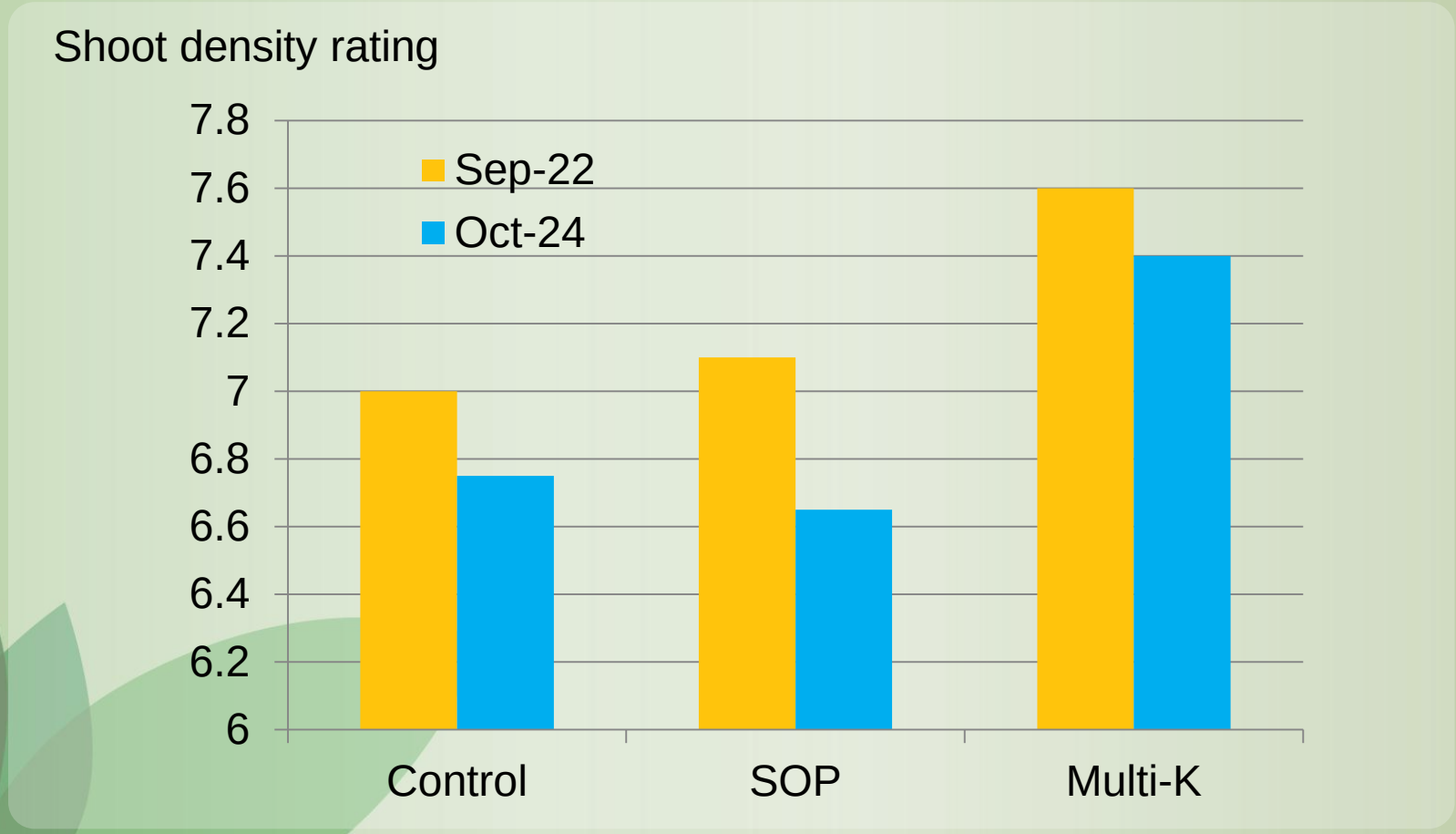


:Multi-K™ vs. SOP

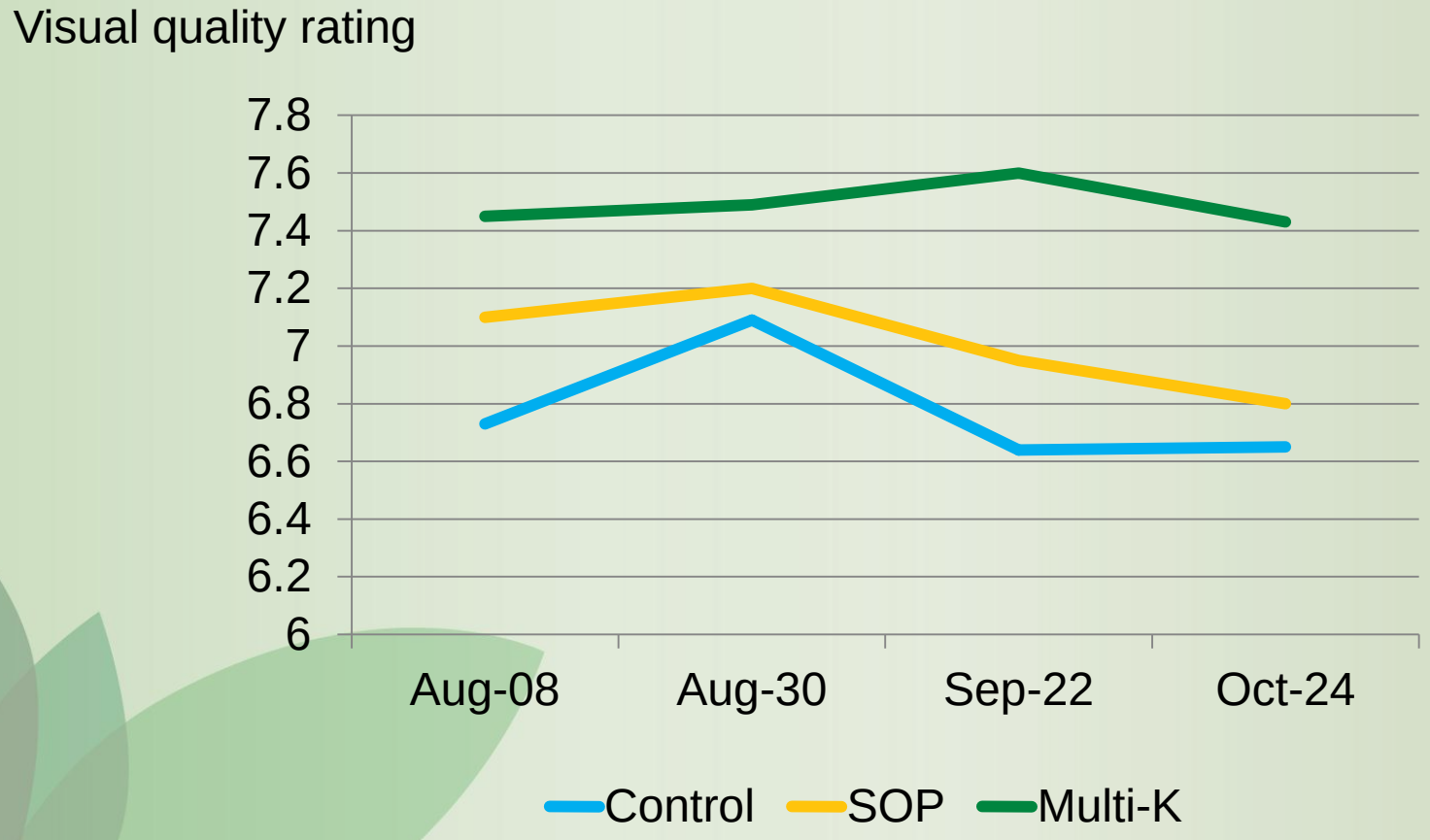
Banana



Multi-K™ vs. SOP:
Turf (bentgrass)



Multi-K™ vs. SOP:
Turf (bentgrass)



Multi-K™ vs. SOP:

Olives

- Location: Olive research institute, Kemalpasa , Izmir, Turkey Cultivar: Memecik (widely used for fresh consumption and oil extraction)
- Fertilizers tested: Multi-K, SOP
- Application method & timing:
  - 4 x foliar spray @ 4%, 1000 l/ha
  - Twice (20 days apart) after fruit-set (May)
  - Twice (20 days apart) after pit hardening (August)

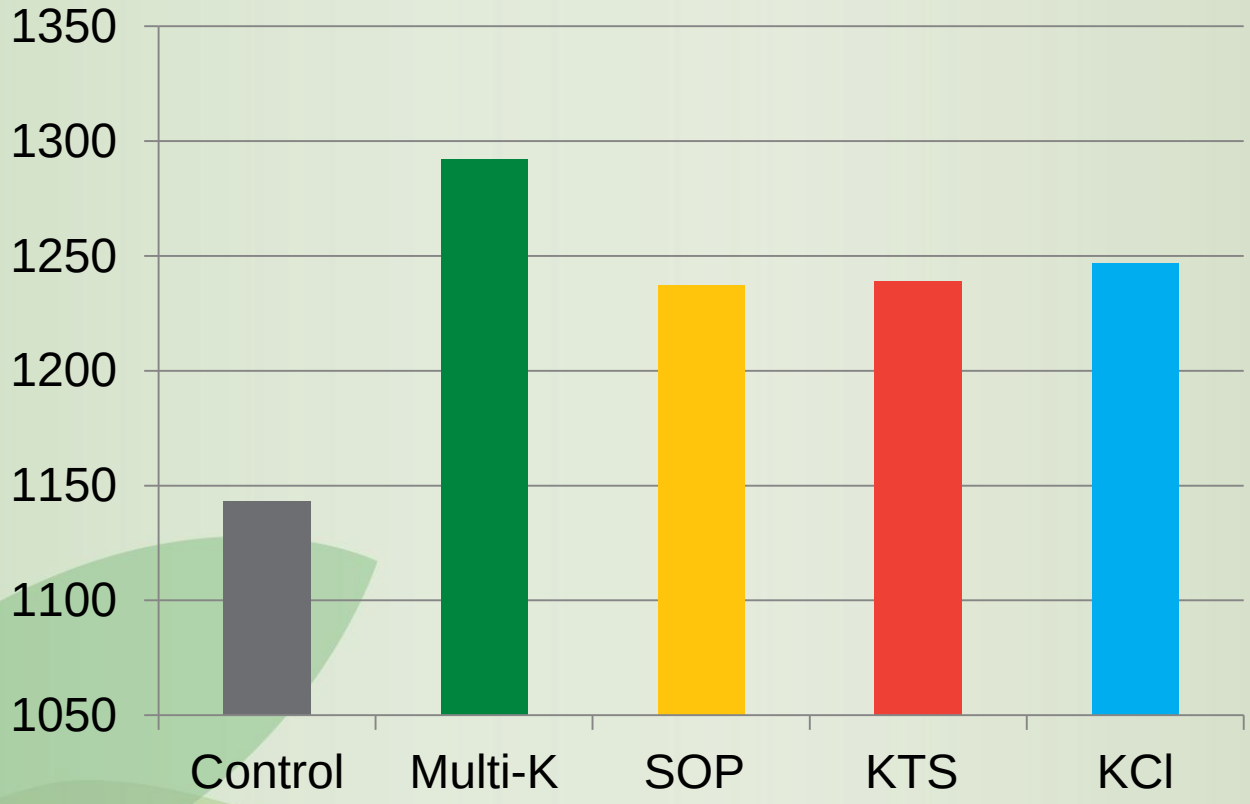
Multi-K™ vs. SOP:
Olives

	SOP	Mult-K™
Weight of 100 fruit units	217.5 g.	278.7 g.
Pulp/pit weight ratio	2.90	3.54
Oil content:	47.8% in D.M	52.9% in D.M.
Total yield:	2.47 m^3	2.14 m^3
K content in December (fruit maturity):	Leaves: 0.61 fruit pulp: 1.56	Leaves: 0.81 fruit pulp: 1.65

:Multi-K™ vs. SOP

Cotton

The effect of foliar sprays with different K fertilizers on Lint yield (kg/ha)



Multi-K™ Products

- **Crystalline** – for Nutrigation and for foliar application
- **Prills** – for side-dressing
- **Coated** – controlled-release fertilizers

Multi-K™ Crystalline products for Nutrigation 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™ Absolute	Pure potassium nitrate for hydroponics and soilless media
Haifa Bonus	Foliar formula with special adjuvants for prolonged action

Multi-K 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 micronutrients

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

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

Multi-K vs. SOP:

Conclusions

Multi-K potassium nitrate offers the benefits of:

- Favorable nutritional composition
- Better performance as K source
- Higher solubility and faster dissolution rate
- Full-range compatibility with other fertilizers and agrochemicals
- No interference with plant uptake of other ions
- Lower content of residual chloride
- Minimal effect on soil pH
- Minimal contribution to soil salinity
- Multi K S for balanced S nutrition

Multi-K™

Because your plants deserve the Best