
TESSENDERLO
Kerley
TOMATOES

Originating from the Andean regions of Peru, North Chile and Ecuador, tomatoes are the most widely grown vegetable. The worldwide annual production of tomatoes is more than 180 million tons, cultivated on 4.7 million hectares. Both fresh and processing tomatoes can be cultivated in open field conditions, however in order to better control growing conditions, tomatoes are often grown in poly-houses. Growing the plants under plastic avoids exposing the plants to rain and therefore reduces the risk of fungal diseases. Also the average temperature is higher and this is an advantage when outside temperatures are low.

The most high-tech cultivation is the growth of tomatoes in greenhouses where they are grown in substrate (mainly rock wool or coco-peat) with support of carbon dioxide and artificial light. As a result, a production of 1000 tons of tomatoes per hectare annually can be possible using these high-tech conditions. With such high production levels, the tomato crop not surprisingly requires a high amount of fertilizers.

Tomatoes contain high levels of potassium, phosphate and iron. They are also a source of vitamin A, vitamin C, niacin and lycopenes. Lycopenes are known for their antioxidant properties and can play a role in the prevention of cataracts, cancer, blood high pressure, and neuropathic pain as well as having other health benefits.

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FRESH TOMATOES

Tomatoes can be grown as fresh tomatoes to be used raw in a salad or for cooking. Fresh tomatoes are grown in open fields, in soil in greenhouses or alternatively in substrate in greenhouses. The production of open field tomatoes will depend on the climate, variety and other factors. For a production of 100 ton per hectare per year the crop requires roughly 300 kg N, 80 kg P_2O_5, 450 kg K_2O, 80 kg SO_3, 90 kg CaO and 50 kg MgO per hectare per year. The exact amount will depend on the climate, nutrient level of the soil, soil structure, crop variety, etc.

For protected cultivation the plants depend on water from the irrigation system (driplines). Water is usually combined with fertilizers, the technique of fertigation. The concentration of these dissolved fertilizers can be given as ppm (mg/liter) or as mol/liter (an indication of the number of ions per liter). Recommendations for protected cultivation of tomatoes in the soil are 134-145 ppm N, 16 ppm P, 176-243 ppm K, 49-65 ppm S, 60-90 ppm Ca and 32-36 ppm Mg. Micronutrients like iron (280 ppb or mg/1000 liter), manganese (110 ppb), zinc (65 ppb) and boron (110 ppb) are also important. Small changes should be made according to the crop growth stage.

For cultivation in substrate, the plants depend completely on fertilizers provided through the fertigation system. Drainage in substrate can be as high as 40% if temperature is high and humidity is low. Therefore the concentration rate of the fertilizers will be higher relative to those for cultivation in the soil.

Recommendations for cultivation in substrate are 178-213 ppm N, 31 ppm P, 322-471 ppm K, 165-197 ppm S, 176-236 ppm Ca, and 52-70 ppm Mg. For micronutrients, the following are important: iron (850 ppb), manganese (550 ppb), zinc (330 ppb), boron (325 ppb), Cu (50 ppb) and Mo (50 ppb).

Cherry tomatoes are grown for a more concentrated taste. The fruit is small compared to the regular tomatoes so it is important that the plant produces more flowers than a regular tomato plant. To steer the crop into a more generative state, the grower will use a higher EC in the irrigation water. The ratio between the nutrients may stay the same.

Often ground water is used for irrigation and this can contain minerals. It is therefore important to know the quantity of minerals in the ground water so that it can be deducted from the amount that needs to be applied as fertilizer.

PROCESSING TOMATOES

The majority of tomato production is destined for processing purposes, so as to produce canned peeled tomatoes, tomato paste, sauce or juice. The tomatoes used for processing are varieties selected for uniform ripening. The processing tomatoes are usually harvested mechanically, all at once, when most of the fruit is fully ripe, so that they can be transported directly to the processing plant. Ethylene-releasing chemicals can be used before harvest to hasten ripening and increase the percentage of ripe fruits at the time of harvest. During the last two weeks before harvest, irrigation is stopped to increase dry matter content.

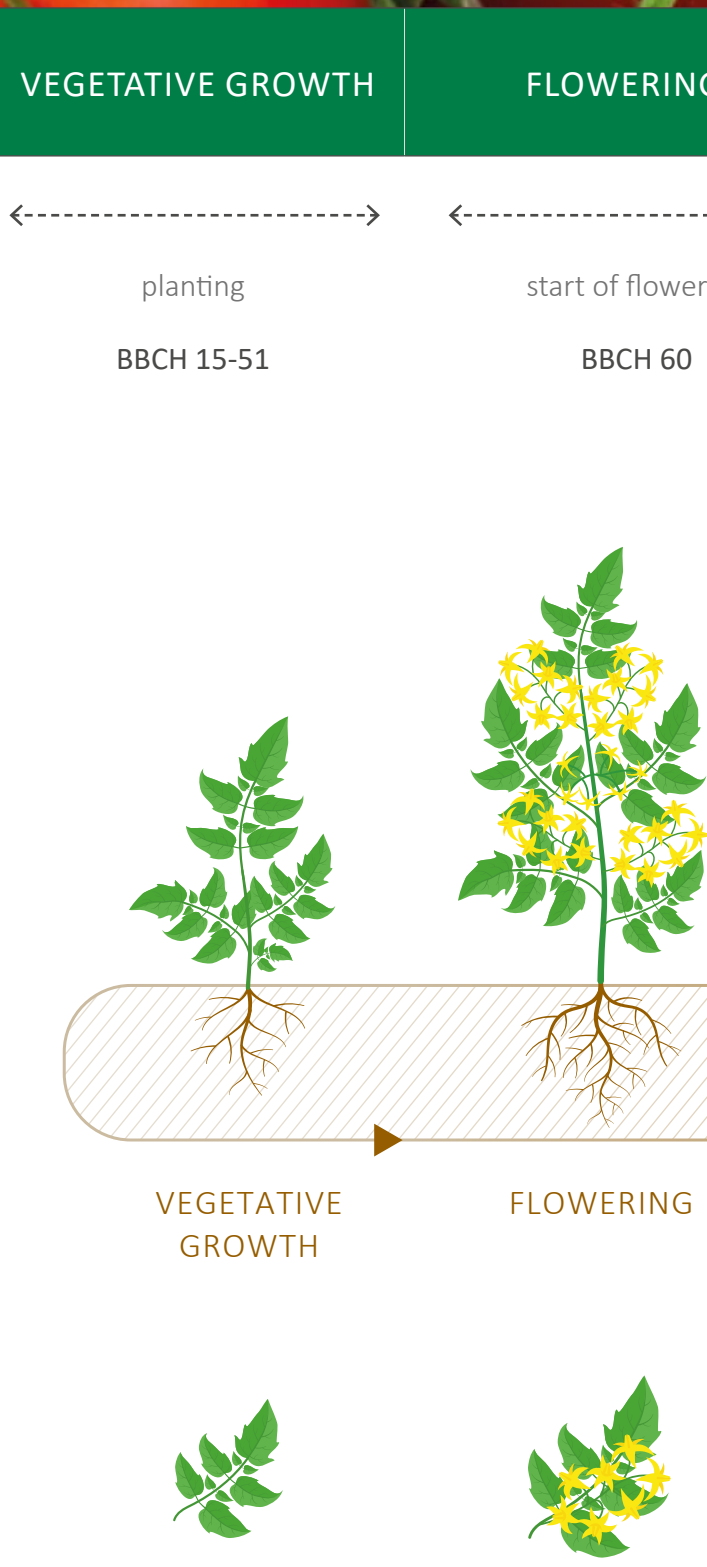
Processing tomatoes (and fresh tomatoes from open field) have a 'determinate' (bush-like) growth habit. This means that plant produces side shoots, which stop growing after flowering. Tomatoes in greenhouses have 'indeterminate' growth: the plant keeps on growing and can reach a length of up to 20 meters. Indeterminates bloom, set new fruit and ripen fruit simultaneously throughout the season.

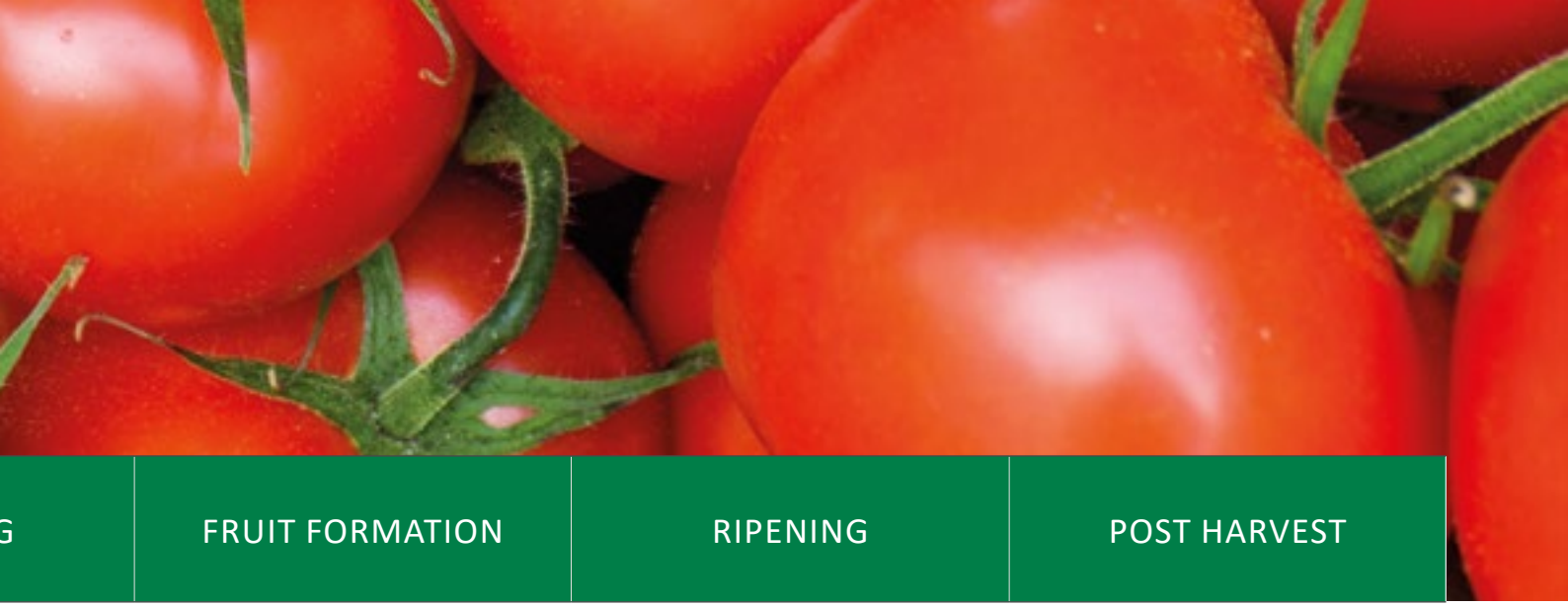
The quality of processing tomatoes is determined predominately by colour and taste. Shape or damage to skin of the fruit is much less important since the fruits are processed within a few hours after harvest.

THE TOMATO GROWTH CYCLE

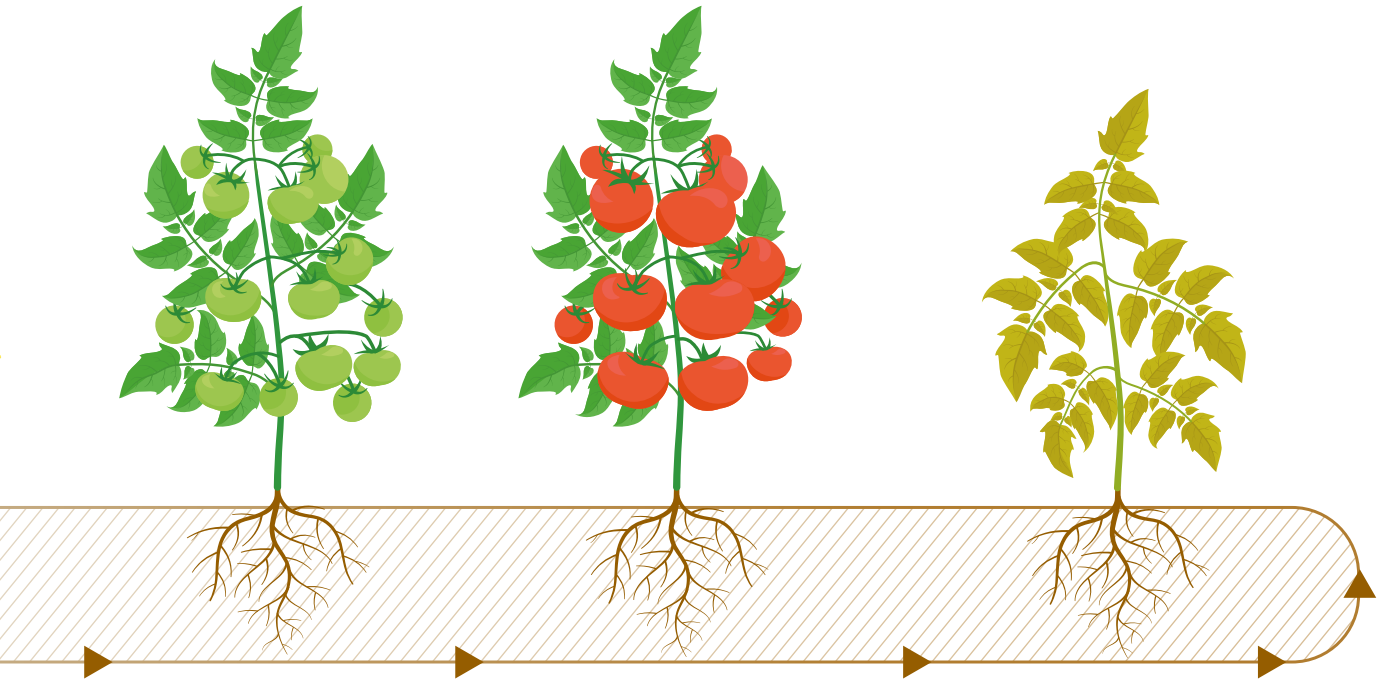
Tomato cultivation using seedlings is the most common practice and direct sowing is used only in some situations for processing tomatoes.

For tomato it is important to distinguish between cultivation in the soil and cultivation in a substrate. For soil cultivation, analysis of the soil is important to determine the correct amount of fertilizer to apply. The amount of fertilizer to be used should take into account the nutrients that are already in the soil, and also several factors such as crop demand, crop management, environmental conditions as well as production objectives. Regarding the substrate, it should be a stable and inert product, not degrading, releasing or absorbing nutrients. Consequently, all the nutrients must be applied in the drip irrigation water. The root zone for plants grown in substrate is limited and for this reason it is essential that the plants are irrigated every day and receive nutrients along with the water.

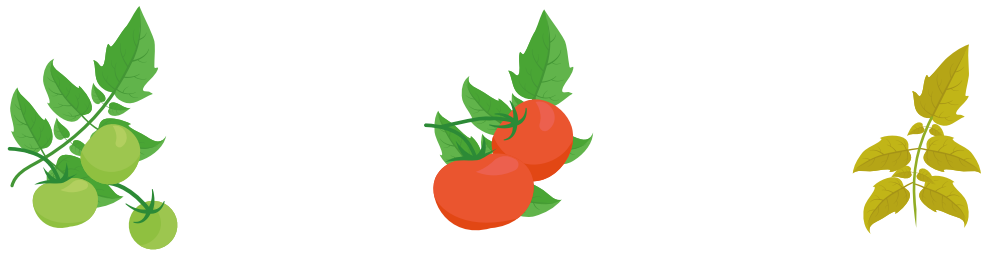




G	FRUIT FORMATION	RIPENING	POST HARVEST
ing	fruit set	start of maturation	harvest
	BBCH 70	BBCH 80	BBCH 90



FRUIT FORMATION RIPENING POST HARVEST



FERTILIZATION OBJECTIVES

To achieve a high yield of tomatoes, it is necessary to use the right source of fertilizer, at the right rate, at the right time and in the right place. A well-balanced fertilizer program is needed to achieve this.

Fresh tomatoes have special quality requirements: visual appearance, flavor, good coloration and firmness. They should not have any flaws such as cracking, blossom end rot, bruising or any kind of spots.

When plants are grown in substrate, the pH of the irrigation water is also important. High pH levels (> 5.8) can potentially lead to precipitation that can cause serious problems when filters and drippers get blocked. A low pH (< 5.2) can result in a too low pH in the root zone which can damage the roots. Acids or alkalis can be used to adjust the pH of the water.

A high pH in the A and B tank within the stock solution can also lead to problems with precipitation. Since the A and B tank are usually 100 times concentrated, the risk for precipitation can already occur with a pH above 5. Often only a small amount of acid is required to lower the pH.

When growers are using chelates, a very low pH (< 1.5 for DTPA or EDTA chelates) in the tank should also be avoided. A low pH will break down the chelates, which as a result will no longer be effective.

NUTRITIONAL REQUIREMENTS OF TOMATOES

1. Nitrogen (N)

Nitrogen stimulates the vegetative growth of the plants. This is good when climatic conditions encourage generative growth (for instance low humidity and high temperature). In autumn when light levels and temperature drop and humidity increases, it is better to decrease the nitrate level to make the plant more generative. Growing the plants in a vegetative manner would decrease production, since sugars would be used for leaf and stem growth instead of fruit formation.

Lack of nitrogen will turn the color of old leaves pale green, the flowers will turn pale yellow and plants may mature earlier leading to lower yield and quality. Excess of nitrogen will cause thick stems, big leaves and big flower trusses followed by poor fruit set.

Open field growers will use less nitrogen at the start of the cultivation to steer the crop from vegetative growth to more generative growth.

Processing tomatoes in certain cases may require more nitrogen compared to fresh tomatoes.

2. Phosphorus (P)

Phosphorus is important for early plant growth, particularly development of the roots. A low soil temperature can decrease the uptake of phosphorus at the beginning of the growth season. Phosphorous is also needed for the vegetative growth and fruit set periods. Besides a low temperature, a high pH can also reduce the availability of the phosphorous in the soil.

In case of deficiency, the plant appears to be stunted and leaves may be a darker green. Later the underside of the leaves will have a red/purple color, especially the old leaves. Leaves are small and turned slightly downwards.

Excessive levels of phosphorous are very uncommon but can lead to zinc deficiency. High levels of phosphorous in drip irrigation water can easily lead to precipitation.

3. Potassium (K)

Potassium plays an important role in the fruit quality. Two thirds of all the potassium that is taken up by the plants is needed for the formation of the fruits. A lack of potassium will lead to problems of irregular coloring, puffiness, boxy fruit and cracking. Cracking of the fruit can also be caused by uneven watering. Potassium is also important at the stage of transplanting and to reduce drought and salt stress.

Deficiency will lead to reduced growth and chlorosis followed by necrosis on the old leaves. Chlorosis will first appear at the margins of old leaves. Post-harvest quality will be poor.

Uptake of potassium can be limited in anaerobic rooting conditions, with low root-zone temperatures or when there are high levels of magnesium and calcium.

Potassium deficiency in tomatoes

4. Sulfur (S)

Sulfur is required for the formation of certain amino acids, as well as S-bonds in some hormones, vitamins, glucosides, sulfolipids and coenzyms. Sulfate is often used to reduce the amount of nitrate given to tomatoes, and therefore to make the crop more generative.

In the past sulfur deficiency was very rare due to atmospheric deposition. A reduction of sulfur emissions from industry and traffic, along with the development of higher yielding varieties, makes it more likely today that deficiency could occur.

Deficiency will cause the upper leaves to turn light green. To correct this sulfur can be applied as sulfate or as thiosulfate.

5. Calcium (Ca)

Calcium plays and important role in the cell wall. It is therefore important for rigidity and strength of the tissues, which influences the shelf life of the fruit. Deficiency will lead to burning of tips and edges of young leaves. Blossom end rot is the most well-known physiological disorder caused by calcium deficiency. Calcium deficiency can be caused by lack of calcium or high salinity in the root zone, but watering strategy and large variations in relative humidity can also influence the risk of blossom end rot. The nitrogen source plays an important role in the uptake of calcium for cultivation in substrate. Nitrogen applied as ammonium will decrease the uptake of calcium.

6. Magnesium (Mg)

Magnesium deficiency is rather common especially during fruit setting. At that moment the uptake of potassium increases, leading to a decrease in the uptake of magnesium. This will lead to chlorotic spots in the old leaves but rarely leads to a reduction of the yield.

NUTRITIONAL REQUIREMENTS OF OPEN FIELD FRESH TOMATOES (100 T/HA)					
	TOTAL	PRE PLANTING	VEGETATIVE GROWTH	FLOWERING	FRUIT SET UNTIL HARVEST
	kg/ha	%			
N	305	25	25	15	35
P_2O_5	82.5	100	0	0	0
K_2O	445	50	15	10	25
SO_3	80	40	25	10	25
CaO	90	0	50	0	50
MgO	50	100	0	0	0

NUTRITIONAL REQUIREMENTS OF GREENHOUSE TOMATOES IN SOIL					
	VEGETATIVE GROWTH	FLOWERING	FRUIT SET	GENERATIVE ACTION	END OF CULTIVATION
	ppm				
N	131	138	145	131	131
P	16	16	16	16	16
K	176	196	223	223	243
S	64	56	49	65	65
Ca	90	80	70	70	60
Mg	36	36	32	32	32

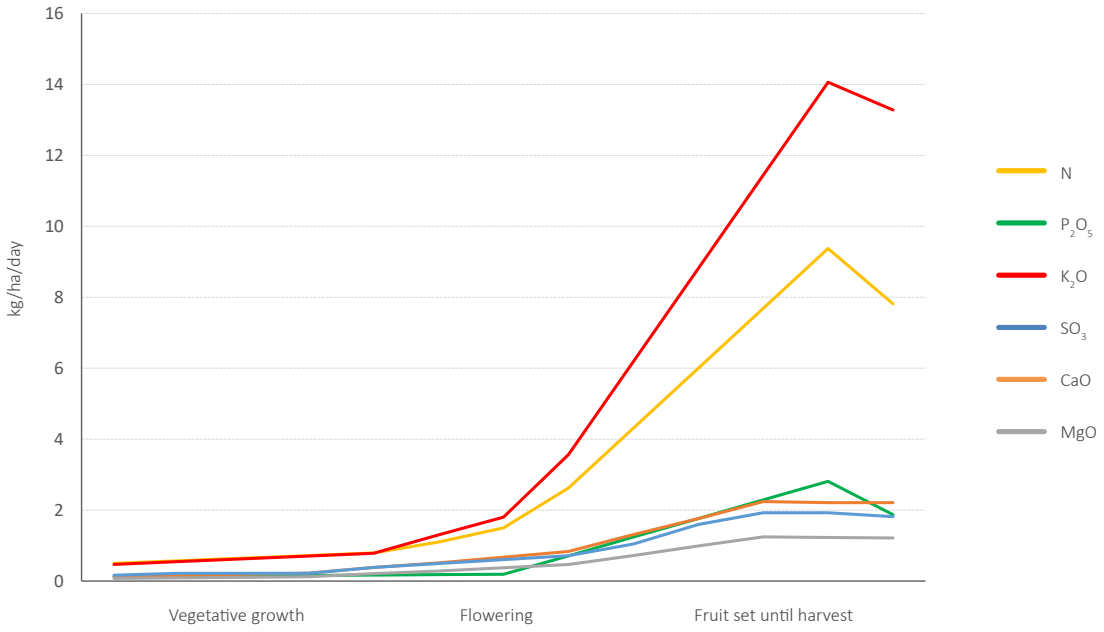
NUTRITIONAL REQUIREMENTS OF GREENHOUSE TOMATOES IN SUBSTRATE					
	VEGETATIVE GROWTH	FLOWERING	FRUIT SET	GENERATIVE ACTION	END OF CULTIVATION
	ppm				
N	178	199	213	185	185
P	31	31	31	31	31
K	332	371	410	410	471
S	173	165	165	197	197
Ca	236	216	196	196	176
Mg	70	58	52	52	52

ABSORPTION OF NUTRIENTS

Uptake of nitrogen is usually limited by the growers at the beginning of the cultivation to stimulate the plant to produce more flowers. After the flower formation, nitrogen uptake can once again be increased. In this phase, its uptake is about the same as that of potassium. However as more and more fruits start to grow on the plant the uptake of potassium increases which could even lead to a doubling of the uptake of potassium compared to nitrogen.

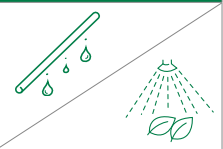
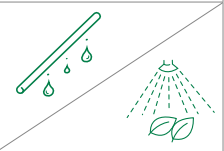
Calcium is important at the beginning of the cultivation for the plant growth and then later for producing firm fruit. The increased uptake of potassium has a negative impact on the uptake of magnesium. The uptake of magnesium is reduced during fruit set.

Daily uptake for open field tomato



PRODUCTS

TESSENDERLO KERLEY FERTILIZERS

PRODUCTS	PRE PLANTING	VEGETATIVE GROWTH	FLOWERING	FRUIT SET
KTS				
CaTs				
K-Leaf				
GranuPotasse				
SoluPotasse				

Legend:

Foliar application 

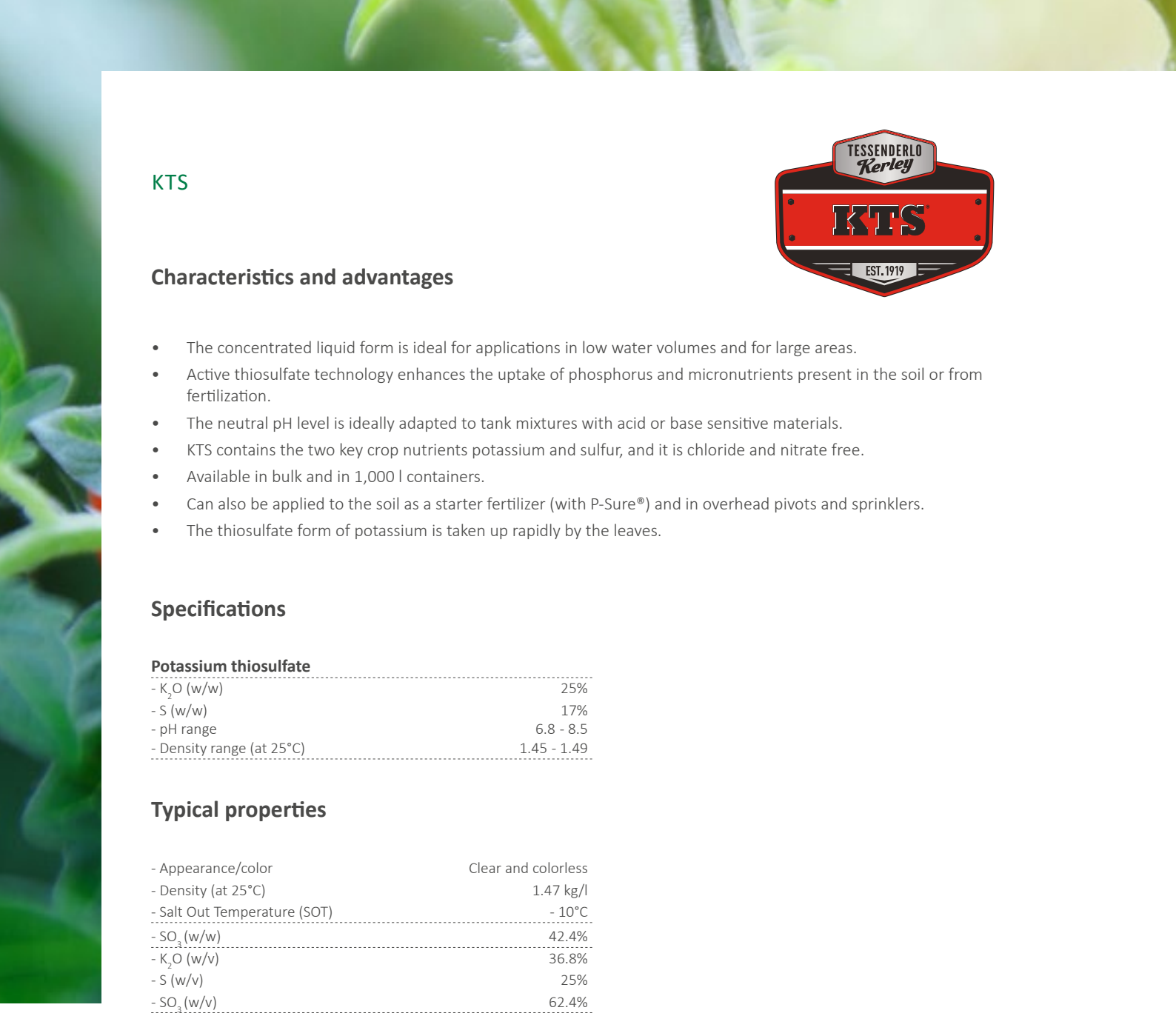
Soil application granules 

Fertigation 

NUTRIENT CONVERSION FACTORS*		
TO CONVERT	TO	DIVIDE BY
CaO	Ca	1.40
MgO	Mg	1.66
K_2O	K	1.20
P_2O_5	P	2.29
SO_3	S	2.50
SO_4	S	3.00

* To convert elemental units to oxide units multiply by the same factors

CONVERSION FACTOR PPM TO MMOL PER LITER	
NUTRIENT	DIVIDE BY
N	14.00
P	30.97
K	39.10
S	32.06
Ca	40.08
Mg	24.31



KTS

Characteristics and advantages

- The concentrated liquid form is ideal for applications in low water volumes and for large areas.
- Active thiosulfate technology enhances the uptake of phosphorus and micronutrients present in the soil or from fertilization.
- The neutral pH level is ideally adapted to tank mixtures with acid or base sensitive materials.
- KTS contains the two key crop nutrients potassium and sulfur, and it is chloride and nitrate free.
- Available in bulk and in 1,000 l containers.
- Can also be applied to the soil as a starter fertilizer (with P-Sure®) and in overhead pivots and sprinklers.
- The thiosulfate form of potassium is taken up rapidly by the leaves.

Specifications

Potassium thiosulfate	
- K_2O (w/w)	25%
- S (w/w)	17%
- pH range	6.8 - 8.5
- Density range (at 25°C)	1.45 - 1.49

Typical properties

- Appearance/color	Clear and colorless
- Density (at 25°C)	1.47 kg/l
- Salt Out Temperature (SOT)	- 10°C
- SO_3 (w/w)	42.4%
- K_2O (w/v)	36.8%
- S (w/v)	25%
- SO_3 (w/v)	62.4%
- K_2O (g/l)	368
- S (g/l)	250
- SO_3 (g/l)	624
- Chemical formula	$K_2S_2O_3$

APPLICATION	RATE PER APPLICATION	GROWTH STAGE	COMMENT
Fertigation for soil cultivation open field	20-50 l/ha	Begin of flowering	Every 7-10 days from begin of flowering
Fertigation for soil cultivation greenhouse	20-40 l/1000 liter, 100 x concentrated	From the beginning	Depending on how generative the crop is to be steered
Foliar	5-10 l/ha	Fruit set	Repeat every 7-14 days Diluted 200-500 liter water/ha

CATS

Characteristics and advantages

- CaTs is a neutral to basic, chloride and nitrate free, clear solution.
- CaTs may be applied by drip, sprinkler, or flood irrigation.
- It may be blended with other fertilizers or applied as a foliar treatment on selected crops.
- When used as a foliar fertilizer, CaTs should first be diluted with water before application.
- Blends of CaTs should not be acidified below a pH of 6.0.
- CaTs may be used as a fertilizer for the correction of calcium deficiency.
- CaTs is an effective water soluble source of calcium and thiosulfate sulfur which assists in the correction of these nutrient deficiencies in crops.
- CaTs may be used to improve water infiltration and assists in terms of leaching of harmful soil salts.
- CaTs is compatible with most fertilizer solutions.
- CaTs is not compatible with phosphate, sulfate and ammonium thiosulfate fertilizers.

Specifications

Calcium thiosulfate	
- Ca (w/w)	6%
- S (w/w)	10%
- pH range	6.5 - 8.8
- Density range (at 25°C)	1.22 - 1.26

Typical properties

- Appearance/color	Clear and colorless
- Density (at 25°C)	1.25 kg/l
- Salt Out Temperature (SOT)	0°C
- CaO (w/w)	8.4%
- SO_3 (w/w)	25%
- Ca (w/v)	7.5%
- S (w/v)	12.5%
- CaO (w/v)	10.5%
- SO_3 (w/v)	31.2%
- Ca (g/l)	75
- S (g/l)	125
- CaO (g/l)	105
- SO_3 (g/l)	312
- Chemical formula	CaS_2O_3

APPLICATION	RATE PER APPLICATION	GROWTH STAGE	COMMENT
Fertigation (drip) soil cultivation in open field	20-50 l/ha	After transplanting and at fruit set	1st and 2nd week after transplanting and repeat when fruit 1-2 cm big
Fertigation (drip) soil cultivation in greenhouse	20-30 l/ha	After transplanting and at fruit set	1st and 2nd week after transplanting and repeat 2 times when fruit is 1-2 cm big, with an interval of 1 week Can also be applied to steer the crop to more generative
Foliar	5-10 l/ha	Fruit set	Repeat every 7-14 days. Diluted in 200-300 liter water/ha

K-LEAF

Characteristics and advantages

- The highly soluble potash booster is suitable for foliar applications using regular spray volumes.
- K-Leaf is well suited for foliar application at higher potash rates per hectare.
- K-Leaf dissolves three times as fast as regular water soluble SOP, leaving no residues.
- The acidification effect may in some cases have a beneficial impact on absorption of tank mix partners.
- K-Leaf is a cost-effective source of potassium and sulfur and is chloride and nitrate free.
- Available in 20 kg bags.
- K-Leaf can be applied at higher rates than certain other foliar potassium fertilizers.
- K-Leaf has now been verified as compliant for use in organic agriculture according to EC Regulation no. 834/2007.

Specifications

Potassium sulfate	
- K_2O (w/w)	Min. 51.5%
- Cl (w/w)	Max. 0.5%
- S (w/w)	18.7%

Typical properties

- Appearance/color	Fine white powder
- Bulk density (struck/loose)	1.53 kg/l / 1.25 kg/l
- Angle of repose	35°
- pH (1% solution)	2.9
- Residues (5% solution)*	0.03%
- Solubility at 25°C	120 g/l pure water
- Dissolved after 1 min with stirring	90%
- K_2O (w/w)	52%
- Cl (w/w)	0.2%
- SO_3 (w/w)	47%
- H_2O (w/w)	0.07%
- Chemical formula	K_2SO_4

* After stirring for 10 minutes at 25°C

APPLICATION	RATE PER APPLICATION	GROWTH STAGE	COMMENT
Foliar	6-10 kg/ha	Fruit set	2-4% spray solution concentration recommended 2-4 applications For greenhouses every 2 weeks from beginning of fruit set

GRANUPOTASSE

Characteristics and advantages

- GranuPotasse is a cost-effective source of potassium and sulfur, and it is chloride and nitrate free.
- GranuPotasse provides a high concentration of these important crop nutrients.
- GranuPotasse is virtually dust-free.
- GranuPotasse has a consistent granulometry that ensures uniform application, with a spreading range of up to 28 meters.
- GranuPotasse is suitable for both pre-emergence and post-emergence application during early stages of crop growth.
- GranuPotasse has excellent stability, which makes it ideal for producing a wide variety of NPK blends.
- Available in 25 kg bags or big bags (600 kg, 1,000 kg or 1,200 kg).

Specifications

Potassium sulfate	
- K_2O (w/w)	Min. 50%
- Cl (w/w)	Max. 2.5%
- S (w/w)	18%

Typical properties

- Appearance/color	Light grey to beige granules
- Bulk density (struck/loose)	1.40 kg/l / 1.27 kg/l
- Angle of repose	33°
- Sieve analysis	97% between 1.6 mm and 5 mm
- K_2O (w/w)	50.2%
- Cl (w/w)	2.3%
- SO_3 (w/w)	45%
- H_2O (w/w)	0.2%
- Chemical formula	K_2SO_4

APPLICATION	RATE PER APPLICATION	GROWTH STAGE	COMMENT
Soil application open field	600 kg/ha	Pre-planting	Basal application

SOLUPOTASSE

Characteristics and advantages

- SoluPotasse is a cost-effective source of potassium and sulfur and is chloride and nitrate free.
- SoluPotasse provides a high concentration of these important crop nutrients.
- SoluPotasse dissolves rapidly and completely, leaving no residues.
- SoluPotasse has an extremely low salt index and is ideal for use in chloride sensitive crop or regions at risk from salinity.
- The acidification effect ensure optimal uptake of all nutrients and helps prevent clogging of the drippers.
- SoluPotasse is of a consistently high quality and is the market leading water soluble SOP for fertigation.
- Available in 25 kg bags and big bags (1000 kg or 1200 kg).

Specifications

Potassium sulfate	
- K_2O (w/w)	Min. 51%
- Cl (w/w)	Max. 1%
- S (w/w)	18.7%

Typical properties

- Appearance/color	Fine white powder
- Bulk density (struck/loose)	1.46 kg/l / 1.21 kg/l
- Angle of repose	40°
- pH (1% solution)	2.9
- Residues	0.03%
- Solubility at 25°C	120 g/l pure water
- Dissolved after 3 mins with stirring	90%
- K_2O (w/w)	51.5%
- Cl (w/w)	0.6%
- SO_3 (w/w)	47%
- H_2O (w/w)	0.02%
- Chemical formula	K_2SO_4

APPLICATION	RATE PER APPLICATION	GROWTH STAGE	COMMENT
Fertigation (open field)	4 kg/ha per day 6 kg/ha per day 8 kg/ha per day	Vegetative stage Flowering stage and begin fruit set Fruit set until harvest	Based on 100 ton tomatoes/ha and basal application of 300 kg K_2O/ha
Fertigation (soil cultivation)	10-25 kg/B tank 1000 liter 100 x concentrated	During the whole season	A high amount of SoluPotasse is required when the aim is to steer the crop to more generative
Fertigation (greenhouse substrate)	35-70 kg/B tank 1000 liter 100 x concentrated	During the whole season	A high amount of SoluPotasse is required when the aim is to steer the crop to more generative Recommendation is based on an EC of 0.0-0.1 mS/cm for the irrigation water

FERTIGATION RECOMMENDATIONS

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The fertigation recommendations presented are for illustrative purposes only. Many different products are available for use in fertigation and the final product choice will depend on many different factors. Recommendations will depend on soil type, climate, crop type (industrial, fresh), variety and soil analysis. Always consult a qualified agronomist beforehand.

FERTILIZATION FOR OPEN FIELD TOMATOES BASED ON NUTRIENT REQUIREMENTS					
	TOTAL	PRE PLANTING	VEGETATIVE GROWTH	FLOWERING	FRUIT SET
Nitrogen (kg N/ha)	200-600	50-150	50-150	30-90	70-210
Phosphorus (kg P_2O_5/ha)	50-150	35-75	10-30	5-15	-
Potassium (kg K_2O/ha)	300-900	150-450	45-135	50-160	80-250
Sulfur (kg SO_3/ha)	50-150	20-60	12.5-37.5	5-15	12.5-37.5
Calcium* (kg CaO/ha)	250-300	-	125-150	-	125-150
Magnesium (kg MgO/ha)	0-45	0-31.5	0-9	0-4.5	-

Based on the quantity of nutrients mobilized – *except calcium (quantity exported)

FERTIGATION RECOMMENDATIONS FOR TOMATOES IN OPEN FIELD			
	VEGETATIVE GROWTH	FLOWERING	FRUIT SET
LIQUIDS (PER PERIOD)			
KTS (l/ha)	-	-	40-140
CaTs (l/ha)	40-60	-	40-60
WATER SOLUBLES (PER PERIOD)			
SoluPotasse (kg/ha)	90-270	100-320	160-500

GranuPotasse, as a solid fertilizer, can be applied on soil as a potassium and sulfur source. Foliar sprays of K-Leaf potash booster can also complement fertigation.

FERTILIZATION FOR GREENHOUSE TOMATOES IN SOIL BASED ON NUTRIENT REQUIREMENTS					
	VEGETATIVE GROWTH	FLOWERING	FRUIT SET	GENERATIVE ACTION	END OF CULTIVATION
	ppm				
N	131	138	145	131	131
P	16	16	16	16	16
K	176	196	223	223	243
S	64	56	49	65	65
Ca*	90	80	70	70	60
Mg	36	36	32	32	32

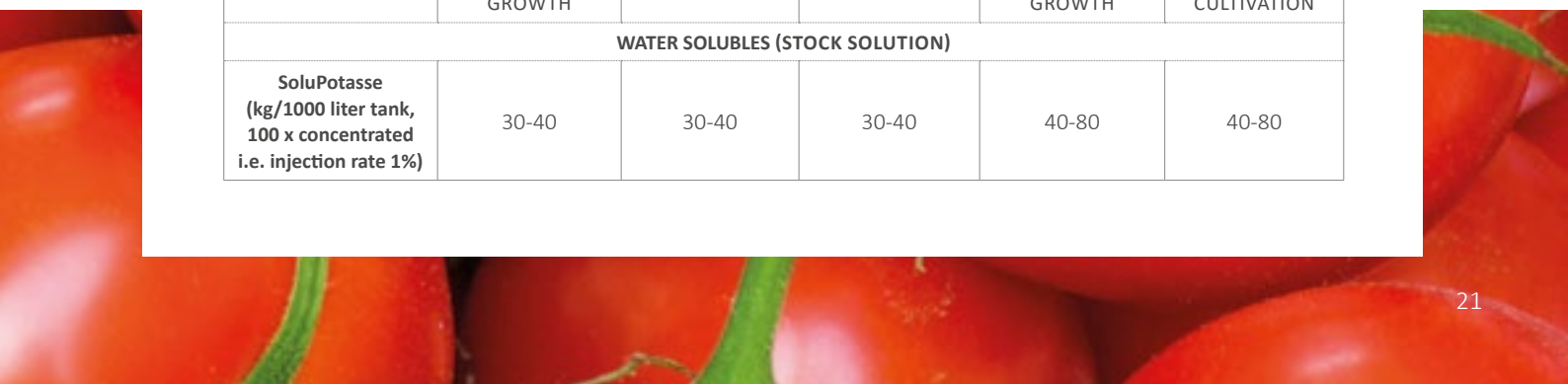
Based on the quantity of nutrients mobilized – *except calcium (quantity exported)

FERTIGATION RECOMMENDATIONS FOR GREENHOUSE TOMATOES IN SOIL					
	VEGETATIVE GROWTH	FLOWERING	FRUIT SET	GENERATIVE GROWTH	END OF CULTIVATION
LIQUIDS (STOCK SOLUTION)					
KTS (l/1000 liter tank, 100 x conc.)	20-30	20-30	20-30	30-40	-
CaTs (l/1000 liter tank, 100 x conc.)	20-30	-	20-30	20-30	-
WATER SOLUBLES (STOCK SOLUTION)					
SoluPotasse (kg/1000 liter tank, 100 x conc.)	10-15	10-15	10-15	15-25	15-25

FERTILIZATION FOR GREENHOUSE TOMATOES IN SUBSTRATE BASED ON NUTRIENT REQUIREMENTS					
	VEGETATIVE GROWTH	FLOWERING	FRUIT SET	GENERATIVE ACTION	END OF CULTIVATION
	ppm				
N	178	199	213	185	185
P	31	31	31	31	31
K	332	371	410	410	471
S	173	165	165	197	197
Ca*	236	216	196	196	176
Mg	70	58	52	52	52

Based on the quantity of nutrients mobilized – *except calcium (quantity exported)

FERTIGATION RECOMMENDATIONS FOR GREENHOUSE TOMATOES IN SUBSTRATE					
	VEGETATIVE GROWTH	FLOWERING	FRUIT SET	GENERATIVE GROWTH	END OF CULTIVATION
WATER SOLUBLES (STOCK SOLUTION)					
SoluPotasse (kg/1000 liter tank, 100 x concentrated i.e. injection rate 1%)	30-40	30-40	30-40	40-80	40-80



GUIDELINES

General

- Do not apply products to crops which are sensitive to the effects of sulfur.
- The use of thiosulfates on crops grown in substrates is not generally recommended.
- Micronutrient blends should be jar tested first before mixing with thiosulfates. In most situations, micronutrient chelates of neutral pH are preferred for blending with thiosulfates. Strongly acidic and/or weak chelates do not blend well with thiosulfates. Blends of thiosulfates should not be acidified below a pH of 6.0.
- Use the correct type of spray nozzles that are recommended for foliar applications.
- Use of tissue and soil analysis to determine crop and soil nutrient status is recommended.
- Contact a representative of Tessenderlo Kerley International if you require any additional information on the properties, benefits and use of the products in this guide.
- The purpose of this brochure is to provide information about fertilizer products and to make suggestions regarding their use in tomatoes. The exact quantities of nutrients required by the crop will depend on local growing conditions including, but not limited to, soil type and nutrient content, climate conditions; crop variety, target yield, etc.
- Use of tissue and soil analysis to determine crop and soil nutrient status is recommended.
- Tessenderlo Kerley International recommends that you seek advice on your specific fertilization program from a qualified agronomist.

Liquids

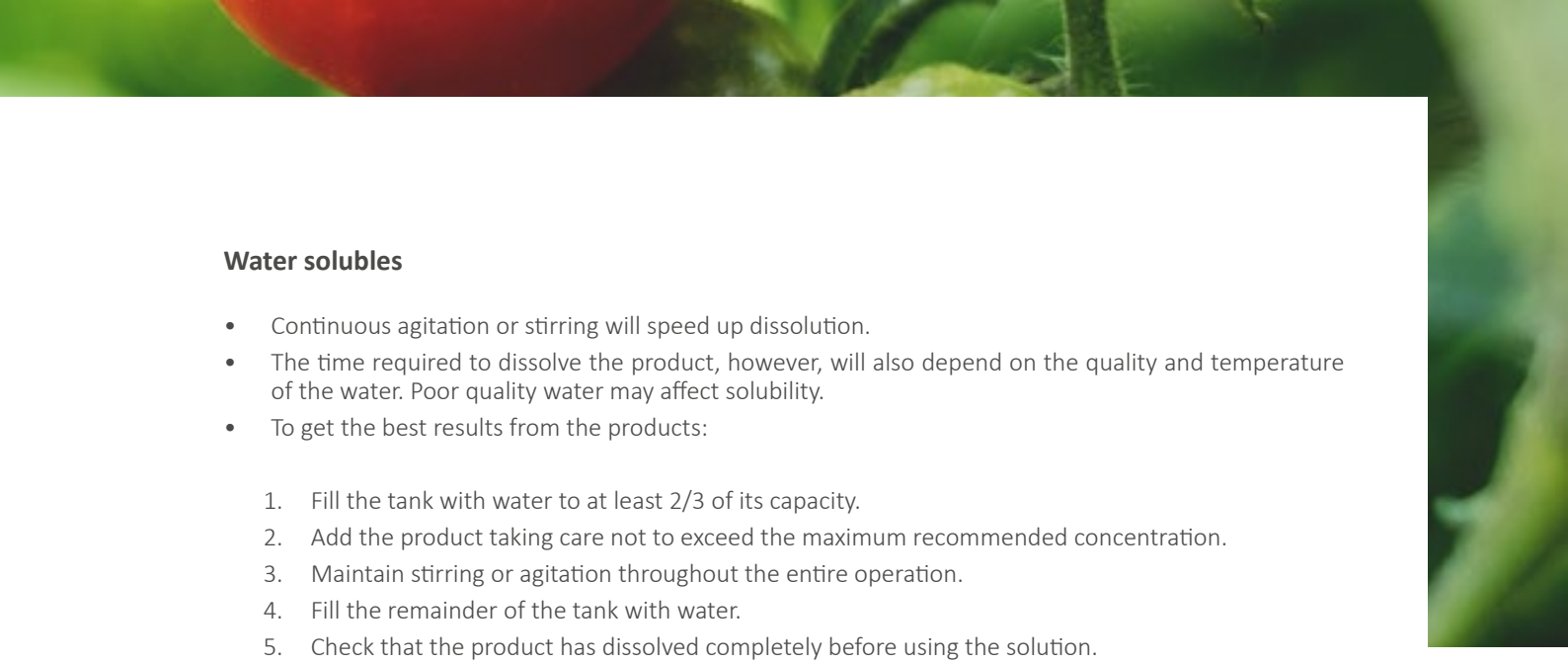
- Do not apply products to soils that have a very low pH level.
- Do not apply products as a foliar spray when temperatures are, or will be, above 30°C or when humidity drops below 30%. Ensure you apply products (preferably) early in the morning or in the evening.
- ALWAYS CONSULT WITH OUR EXPERT if intending to apply foliar thiosulfate with a crop oil spray, or shortly before and/or after an oil spray.

Blending of Liquids

- The original salt out temperature (SOT) of each liquid in a blend can change when mixed with other liquid fertilizers or other liquid micronutrients and/or pesticides.
- When mixing with other products, and in the absence of specific recommendations and data, you are strongly advised to conduct a small-scale trial (jar test) in order to check the physical compatibility of the mixture before operating on a larger scale and applying.
- For blending the sequence should be to add:

    1. 50% of the total water volume
    2. Liquid fertilizers for other N and/or P sources
    3. Thiosulfate fertilizers
    4. Compatible micronutrients
    5. Pesticides
    6. Complete the filling of the spray tank with the remaining 50% of the water

- KTS is compatible with urea and APP in any ratio. When blending KTS with UAN, always have as much water, by weight, in the blend as the UAN solution. Potassium (from KTS) may react with nitrates to form potassium nitrate crystals. If this should happen the addition of water and/or gentle heating should bring it back to clear solution.
- CaTs is not compatible with phosphate, sulfate and ammonium thiosulfate fertilizers
- The recommendations in this guide are for KTS and CaTs and applied alone (not in blends). The addition of other products to the mix is the responsibility of the operator and not of Tessenderlo Kerley International. In case of doubt always consult a qualified agronomist.



Water solubles

- Continuous agitation or stirring will speed up dissolution.
- The time required to dissolve the product, however, will also depend on the quality and temperature of the water. Poor quality water may affect solubility.
- To get the best results from the products:

1. Fill the tank with water to at least 2/3 of its capacity.
2. Add the product taking care not to exceed the maximum recommended concentration.
3. Maintain stirring or agitation throughout the entire operation.
4. Fill the remainder of the tank with water.
5. Check that the product has dissolved completely before using the solution.
6. The use of filters is recommended, as generally advised for most solid fertilizers when used in solution.

- Do not apply products as a foliar spray when temperature exceeds 30°C - apply products preferably early in the morning or in the evening.
- Do not mix sulfates with materials containing calcium.
- When mixing with other products it is recommended to conduct a small-scale trial to check the physical compatibility of the mixture before operating on a larger scale.
- Store products in dry conditions, avoiding extreme heat or cold.

Always respect and comply with local legislation and regulation regarding the use of fertilizer products.

SUSTAINABLE CROP NUTRITION FOR AGRICULTURE

For over 100 years Tessenderlo Kerley International has demonstrated its commitment to nurturing crop life through innovation, research and the development of novel fertilizers for a more sustainable agriculture. Our diverse product portfolio addresses the challenges of modern agriculture by delivering essential nutrients in forms that protect soil health and optimize nutrient use efficiency.

We provide an extensive range of both liquid and solid/soluble fertilizers

HIGH-PERFORMANCE LIQUIDS

HIGH QUALITY SOLID/SOLUBLES

Our experts are familiar with your region and crops. Their support includes:

- Agronomic advice
- Providing technical information
- Carrying out field studies that are specific to your issues
- Providing application and storage tips

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