

NATURALLY EFFECTIVE



ESTA® Kieserit: magnesium and sulfur – fully water-soluble and readily usable by the plant

www.ks-northamerica.com



NATURALLY EFFECTIVE

With many Advantages



- ✓ **Readily usable by the plant**
- ✓ **Flexible usage**
- ✓ **Completely water-soluble**
- ✓ **Closes gaps in nutrition**
- ✓ **Natural origin**
- ✓ **High level of effectiveness**
- ✓ **Very reliable**
- ✓ **Excellent spreading quality**
- ✓ **Recognized quality from Germany**

Characteristics and effectiveness

- Pure, ecologically valuable natural product
- Highly concentrated, fully water-soluble magnesium and sulfur fertilizer
- 100 % immediate plant availability
- pH-neutral effect
- Guarantees Mg and S requirements in times of high need
- Magnesium and sulfur have a positive effect on root development, water uptake, yield and quality characteristics of plants
- Increases nitrogen efficiency
- Protects against abiotic stress factors

Application

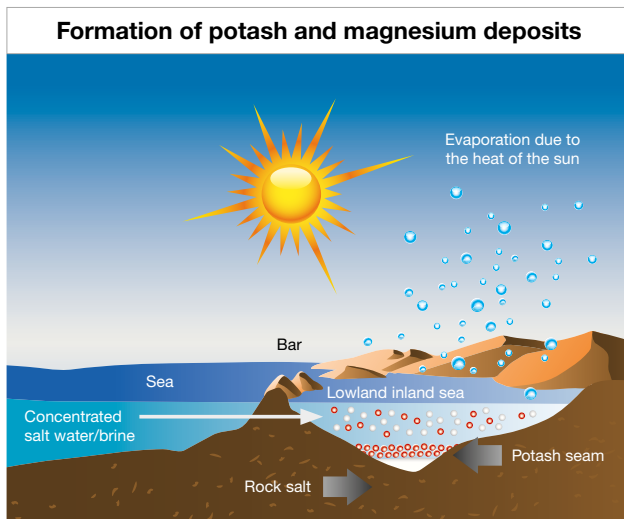
- Excellent granulate and spreading properties
- Covers all standard working widths
- Large coverage area due to high nutrient content
- More targeted use, independent of N fertilizer requirements
- Ideal mineral supplement (for organic fertilizer use)
- Ideal for use in blends
- Targeted use on partial areas possible
- Consistently available supply

Fertilization recommendation:

*Under root:
90-180 lb/ac*

*Surface or row:
180-360 lb/ac*

Kieserite – the most valuable mineral found in our crude salts



The potash deposits in Germany were formed more than 250 million years ago through evaporation of the Zechstein Sea. According to the barrier theory, salty seawater flowed over sea barriers into shallow interior basins. From there, the seawater evaporated due to extremely arid conditions. The salt concentration increased to a point where potash, magnesium and sodium salts were crystallized and deposited in order of their solubility. This sedimentation process was repeated over hundreds of thousands of years, creating multiple potash deposits at a depth of several hundred meters. Through the geological periods that followed, these salt deposits were covered by vast layers of sandstone, shale and limestone.



Manufacture

The base material is the natural magnesium-containing mineral kieserite ($\text{MgSO}_4 \cdot \text{H}_2\text{O}$), found alongside potash and rock salt in mined, hard salt deposits. Kieserite is isolated using electrostatic separation, an environmentally-friendly dry separation process, allowing the Kieserite to be used directly as fertilizer.

Characteristics

ESTA Kieserit consists of water-soluble magnesium sulfate, which is pH-neutral and does not acidify the soil. The nutrients magnesium and sulfur are immediately available and readily usable by plants.

ESTA® Kieserit – all-rounder for performance, energy and nutrient efficiency



ESTA® Kieserit

gran.

EC FERTILIZER

Kieserit 25+50

25 % MgO, water-soluble magnesium oxide

50 % SO₃, water-soluble sulfur trioxide (= 20 % S)

Granulometry:

- + 5 US mesh 25 %
- 10 to 5 US mesh 72 %
- - 10 US mesh 3 %
- Size Guide Number (SGN) 330

Bulk density:

- 80 lb/ft³

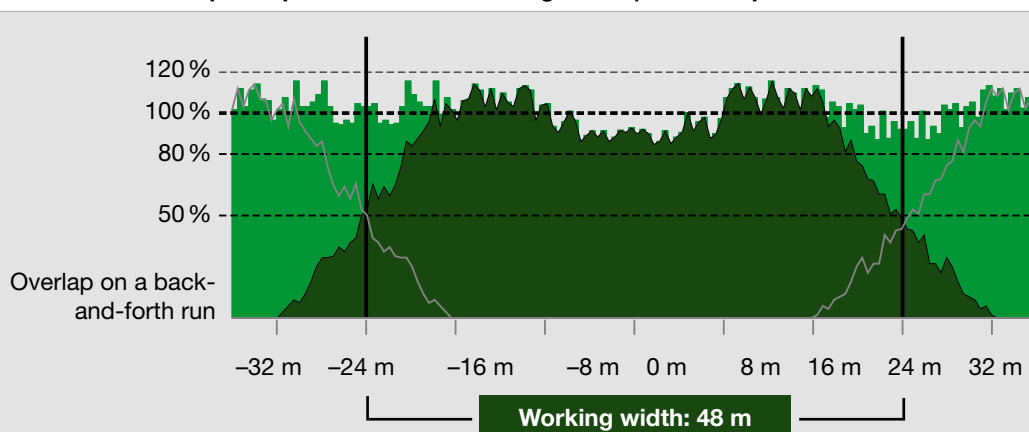
Magnesium

- is the central atom of the chlorophyll molecule and therefore important for photosynthesis.
- enables the transport of sugar and starch from photosynthesis from the leaf to the grains, kernels, seeds or tubers.
- plays an important role in overall protein and carbohydrate metabolism.
- promotes root growth, thereby enabling the plant to absorb sufficient water and nutrients from deeper soil layers, even in dry periods.

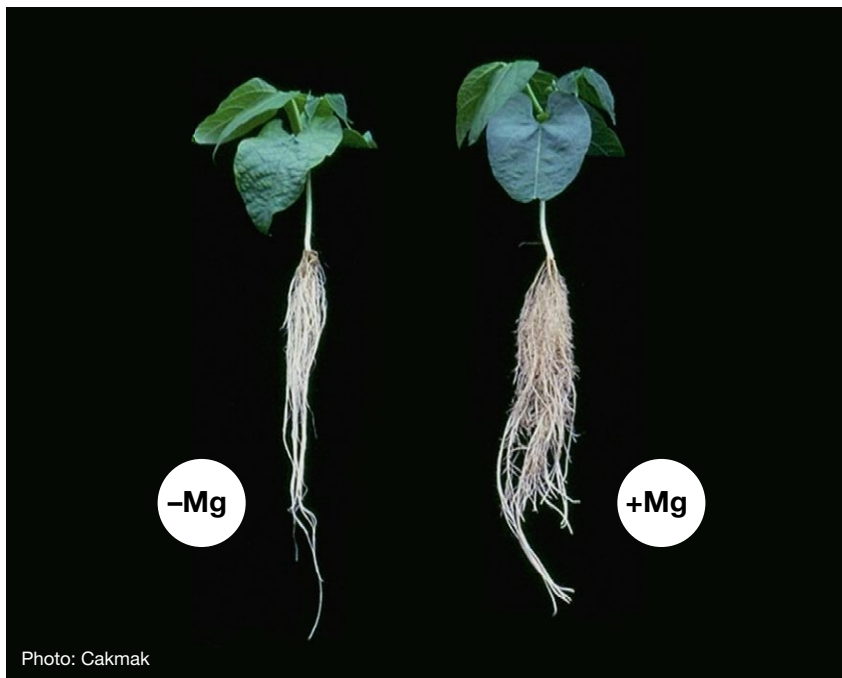
Sulfur

- improves nitrogen-use-efficiency.
- is a structural element of amino acids and therefore of proteins.
- plays a part in the synthesis of sugar, starch and vitamins.
- activates important enzymes in fatty acid metabolism and plays an essential role in the formation of oils.

Spread pattern at 48 m working width (fertilizer spreader Amazone ZA-MI)

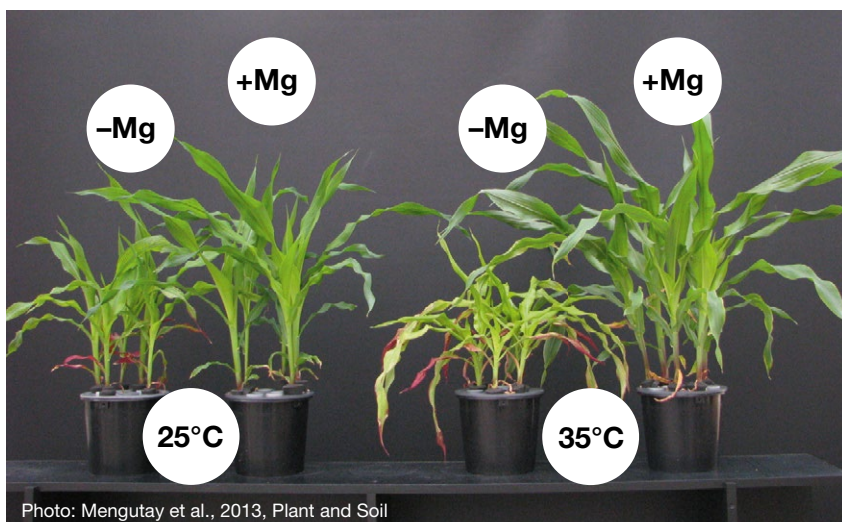
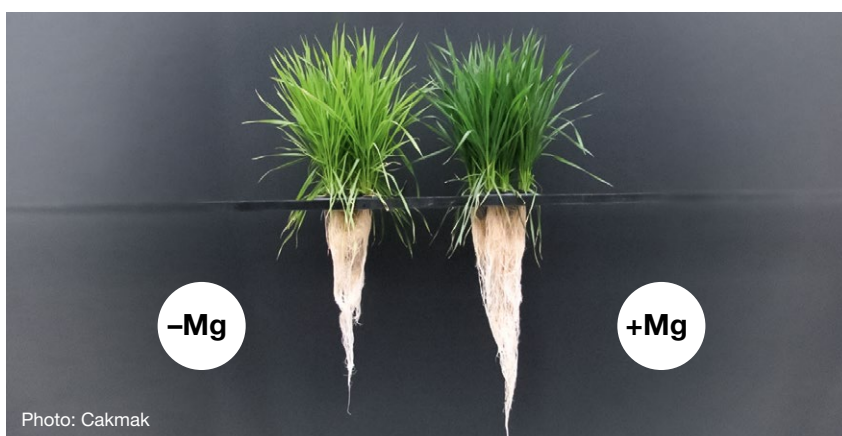


Magnesium promotes root growth and counters stress factors



Magnesium for assimilate transport to roots

Magnesium deficiency is visible in older leaves by showing leaf yellowing in form of interveinal chlorosis. The first reaction of plants having Mg deficiency is a large accumulation of sucrose in fully expanded younger leaves. The phloem export of sucrose is inhibited and leads to poor root growth. Mg deficient plants are producing less roots compared to plants with sufficient Mg supply! The development of a good and deep root system is essential for nutrient and water uptake especially from deeper soil levels during dry periods. The root growth is affected by a Mg deficiency even before shoot growth. Therefore, special attention should be given to the Mg status of plants before visible deficiency symptoms are present.



Magnesium alleviates heat stress

Mg deficient plants react more sensitively to high temperatures than those that are well-supplied with magnesium. Caused by Mg deficiency the growth of the whole plant is negatively impacted as temperatures rise, leading to severe limitations in root and shoot growth. This Mg deficiency leads to a reduction in nutrient and water absorption and ultimately to an overall loss in yield.

Magnesium

guarantees yield formation

Effects of different magnesium levels in wheat grain formation



Magnesium deficiency

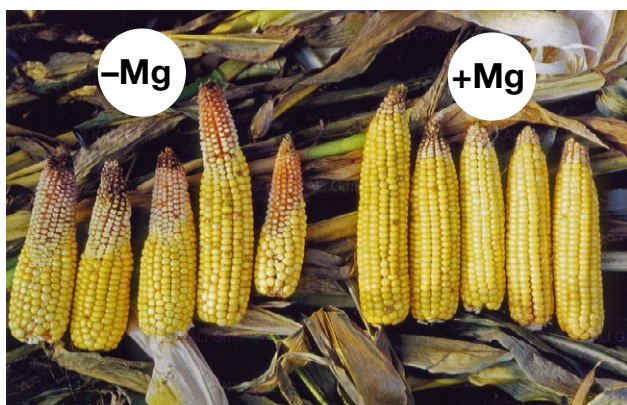


Magnesium deficiency and later Mg fertilization

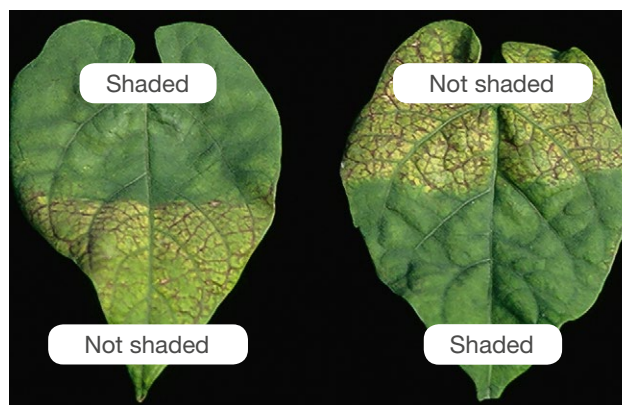


Optimal magnesium supply with ESTA Kieserit

Photos: Ceylan et al., 2014, 2nd International Magnesium Symposium, São Paulo, pp. 53



Effect of ESTA Kieserit fertilization on cob and grain formation



A magnesium deficiency makes leaves light-sensitive

Magnesium for grain filling

The most well-known function of magnesium in plants is its role as the central atom of the chlorophyll molecule. Besides being an integral part of the chlorophyll, magnesium is important in almost all enzyme activating processes, yield formation and root growth. Mg deficiency can effect yields not only when soil levels are low, but also during dry periods, imbalanced fertilization and antagonistic effects. Plants convert light, carbon dioxide and water to sugars and oxygen (photosynthesis). These sugars are not only sources of energy, but can also be processed to starch or cellulose. Sufficient magnesium must be present to transport both for root growth and grain filling.

Magnesium against sunburn

Plants with low magnesium content have considerably higher sensitivity to light. With a Mg deficiency the 'unspent' electrons are left over from photosynthesis. These electrons form oxygen radicals which destroy plant cells in leaves resulting in plant chlorosis. Thus, the more intense the sun, the greater the light damage and the lower the magnesium content in leaves.

'Feed' energy plants in a targeted way with magnesium



Deprivation example for energy maize at 28% dry-matter content

Yield bu/ac fresh mass	Phosphate lb P ₂ O ₅ /ac	Potassium lb K ₂ O/ac	Magnesium lb MgO/ac
880 bu/ac silo corn	78	221	44
1280 bu/ac ethanol-corn	114	321	64

Biomass yield and energy content are the primary aim when cultivating ethanol-based corn. To ensure high yields magnesium fertilizer must be part of the fertilizer program.

Under-root and row fertilization tests with ESTA® Kieserit

K+S field tests over four years in 14 locations

Standard fertilization	Plus 178 - 376 lb/ac ESTA Kieserit gran.
100 %	108 %

Magnesium for energy crops

Magnesium as the central atom of the chlorophyll molecule is essential for converting light energy into plant biomass. Energy corn is characterized through high growth rates in a short time accompanied by high nutrient uptakes. ESTA Kieserit contains the nutrients magnesium and sulfur in water-soluble and therefore plant-available form to guarantee a sufficient nutrient uptake within a short time period.

Proven fertilizing process with ESTA Kieserit for energy corn:

- ideally suited for pre-plant application, with N or NP.
- also see positive results from side-dress fertilizer application.





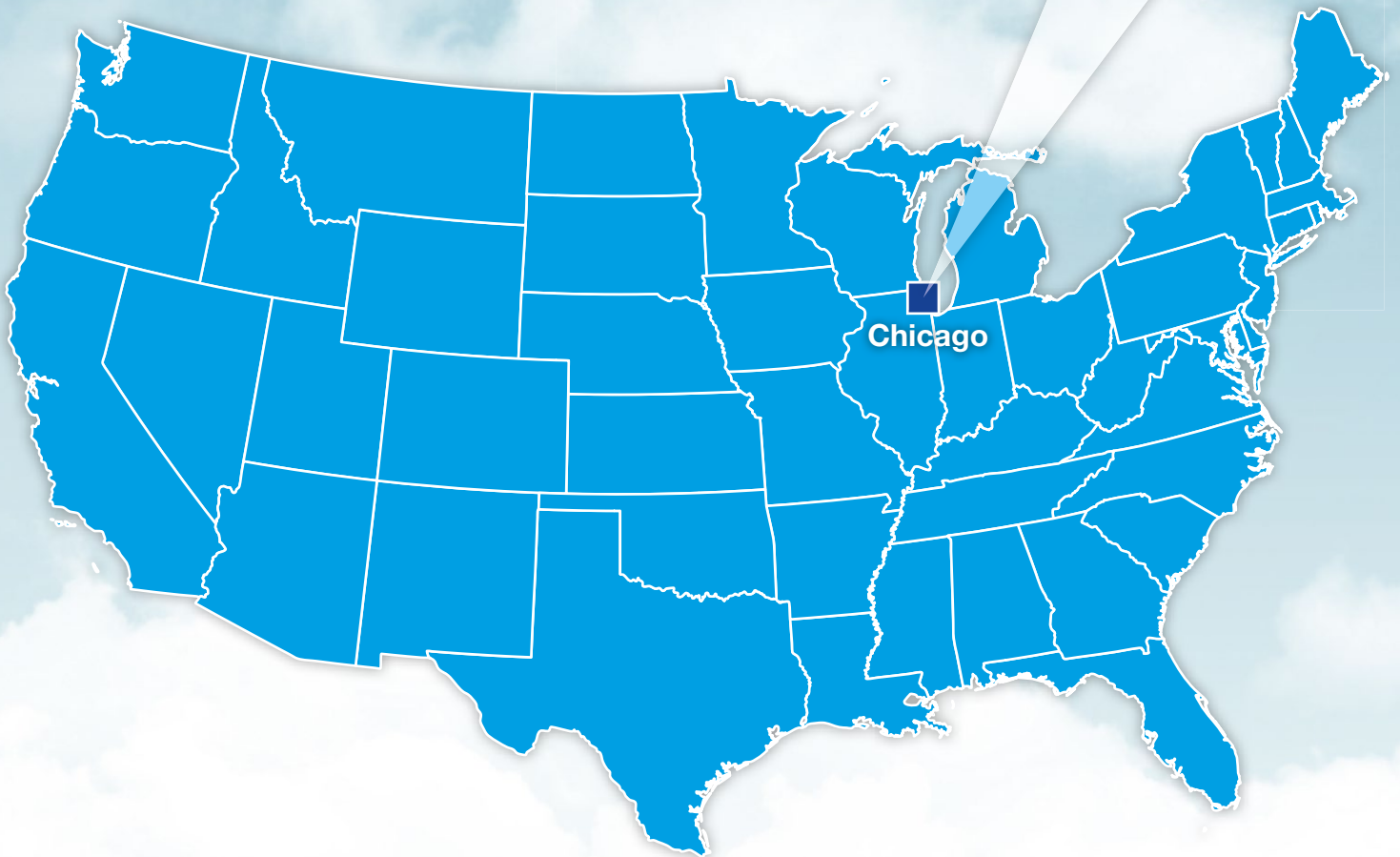
Your K+S NA Regional Adviser

Trey Few

Director Sales & Marketing

Phone: +1 917-697-2115

E-mail: trey.few@ks-northamerica.com





K+S North America Corporation

123 North Wacker Drive · Chicago, IL 60606 · USA
Phone: +1 844-789-3991 · sales@ks-northamerica.com
www.ks-northamerica.com

A K+S Group Company