EPSO Top®

EPSO Microtop® EPSO Combitop®

® = registered trademark of K+S KALI GmbH

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Meet the EPSO family

Yield assurance with foliar fertilisation

A K+S Group Company

The Authority in Potassium and Magnesium

Foliar **fertilisation**

In many situations, a crop cannot receive all of its nutritional requirements from the soil:

- In calcareous soils where there is only limited availability of Mg, Mn and B.
- After liming or heavy application of sugar factory waste lime.
- Following excessive rainfall during autumn and winter (with resultant leaching of S, Mg, B and Mn).
- In a cold spring or summer which limits sulphur mineralisation and availability of micronutrients.
- Where ammonium or urea fertilisers are used or fertilisation with slurry resulting in poor absorption of Mg due to NH_4^+ saturation.
- In dry or compacted soils where nutrient absorption by the roots is restricted.

By supplementing the crop with foliar nutrients during these times, yield and quality can be improved.

Where our **products come from**

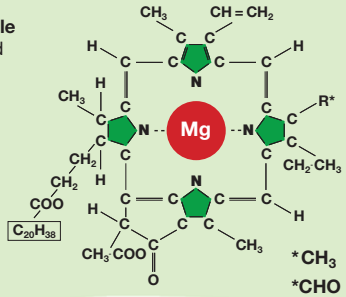
- EPSO products are magnesium sulphates directly derived from ESTA® Kieserit, a natural product itself derived from crude salt extracted from mines operated by K+S KALI GmbH.
- **EPSO Top** is magnesium sulphate heptahydrate ($MgSO_4 \cdot 7\ H_2O$) obtained after crystallisation of ESTA® Kieserit in solution.
- **EPSO Top**, commonly known as bittersalz, epsomite or Epsom salts, comes in the form of fine white crystals which are 100 % water-soluble.
- The products in the EPSO range are rapidly acting magnesium and sulphur fertilisers developed especially for foliar application (at 5–7% concentration). Due to the rapid dissolution and low residue properties of EPSO products they are also highly suited to use in fertigation systems.
- EPSO products dissolve instantly and completely in water.
- They are rapidly absorbed by the leaves once the solution is applied (more than 90 % absorption within 24 hours).
- They act independently of the soil pH, as the nutrients (Mg, S and, if required, Mn, B or Zn) are directly absorbed through the leaves.

Magnesium and Sulphur
Two essential elements

Magnesium:

- Is an essential component of chlorophyll and therefore is critical for efficient photosynthesis.
- Is required for the formation of cell walls.
- Is indispensable for synthesis, transport and storage of sugars, proteins and lipids.
- Magnesium deficiency frequently arises during periods of intensive growth and accumulation of reserves.
- The deficiencies first appear on the oldest leaves as a yellowing between the veins, which themselves remain green.

Chlorophyll molecule
Magnesium is found at the heart of chlorophyll



*CH_3 Chlorophyll a
*CHO Chlorophyll b

Sulphur:

- Is particularly important for the formation and the quality of proteins. Improves the effectiveness of nitrogen application. Essential for lipid formation.
- Absorbed directly in sulphate form (SO_4^{2-}) by the leaves and roots.
- Deficiencies limit growth, yield and quality.
- Deficiencies appear as chlorosis and as a uniform yellowing, on the youngest leaves to begin with.

Magnesium Deficiency

Sulphur Deficiency

EPSO Top®

EC FERTILISER
Magnesium Sulphate 16+32

16 % MgO water-soluble Magnesium oxide (= 9 % Mg)
32 % SO_3 water-soluble Sulphur trioxide (= 13 % S)

- **EPSO Top** is a rapidly acting magnesium and sulphur fertiliser, developed especially for foliar application. It is no substitute for the application of ESTA® Kieserit, but it complements it effectively when applied during peak crop demand.
- **EPSO Top** is 100 % soluble and plant available.
- **EPSO Top** prevents deficiencies of Mg and S and supports chlorophyll activity. By introducing these two elements at a critical phase, it allows crops to realise their full potential.
- **EPSO Top** can also be used in fertigation as a source of magnesium when developing nutrient solutions in greenhouse crops and field crops under irrigation.
- **EPSO Top** can be used in organic farming in the European Union as it conforms to EC Regulations 834/2007 and 889/2008 and is also certified by the Soil Association.

Crops: suitable for all crops

EPSO Microtop®

EC FERTILISER
Magnesium Sulphate with micro-nutrients 15+31

15 % MgO water-soluble Magnesium oxide (= 9 % Mg)
31 % SO_3 water-soluble Sulphur trioxide (= 12 % S)
1 % B water-soluble Boron
1 % Mn water-soluble Manganese

- **EPSO Microtop** is a foliar fertiliser containing magnesium and sulphur with the additional micronutrients boron and manganese.
- **EPSO Microtop** prevents and alleviates magnesium and sulphur deficiency effectively and provides for a maintenance fertilisation with boron and manganese.
- **EPSO Microtop** is permitted for use in organic farming in the European Union as it conforms to EC Regulations 834/2007 and 889/2008.

Crops: oilseed rape, sugar beet, potatoes, vegetables, suflowers, grape vines, fruit crops

EPSO Combitop®

Effect on yield

EC FERTILISER
Magnesium Sulphate with micro-nutrients 13+34

13 % Mg water-soluble Magnesium oxide (= 8 % Mg)
34 % SO_3 water-soluble Sulphur trioxide (= 13 % S)
4 % Mn water-soluble Manganese
1 % Zn water-soluble Zinc

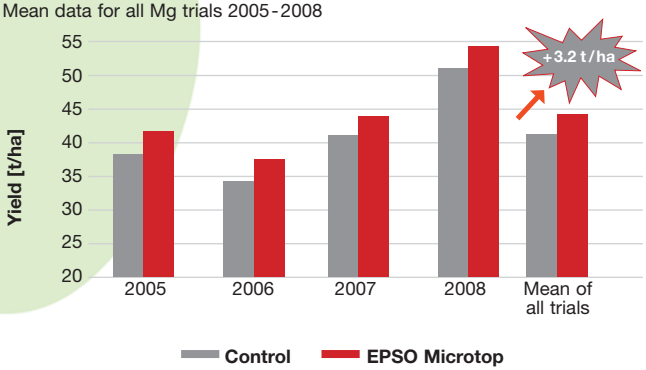
- **EPSO Combitop** is a fast acting magnesium and sulphur fertiliser with added manganese and zinc, developed specifically for foliar fertilisation of cereals.
- **EPSO Combitop** – All nutrients are 100 % soluble and are directly and rapidly plant available.
- **EPSO Combitop** provides the minimum crop requirements of the micronutrients manganese and zinc.
- **EPSO Combitop** is recommended as a preventive measure to avoid latent deficiencies.
- **EPSO Combitop** is permitted for use in organic farming in the European Union as it conforms to EC Regulations 834/2007 and 889/2008.

Crops: cereals, maize

The nutrients contained in the three products in the EPSO family are 100 % soluble and are rapidly absorbed by foliage. Their immediate action is effective in prevention and treatment of symptoms and effects of magnesium and sulphur deficiency; **EPSO Microtop** also contains fast acting boron and manganese and **EPSO Combitop** contains zinc and a higher level of manganese.
The products in the EPSO range are particularly cost-effective since they are generally applied together with crop protection products.

Since 2004, K+S UK & Eire Ltd. have commissioned an independent research program in the UK to investigate responses to foliar fertiliser products in modern high yielding situations. In addition to improvements in crop quality, average yield responses for field trials with EPSO products have been recorded at 5% for cereals, 7% for OSR, 4% for sugar beet and 8% in potatoes proving that the effects are certainly more than just cosmetic greening of crops.

Magnesium trials – foliar Mg in potatoes
Mean data for all Mg trials 2005 - 2008

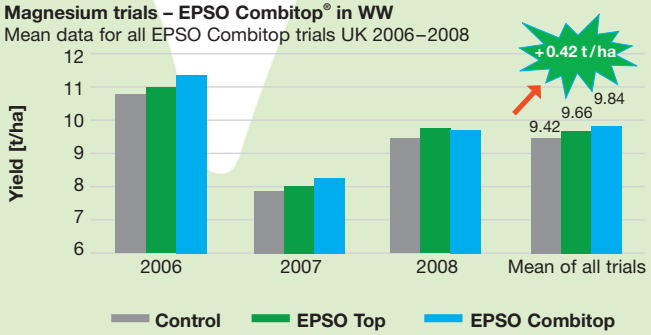


Product applied with fungicide program at total of 50 kg/ha

Armstrong-Fisher

Foliar application technique

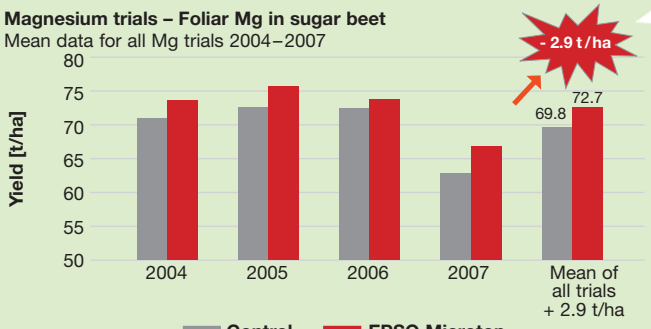
Magnesium trials – EPSO Combitop® in WW
Mean data for all EPSO Combitop trials UK 2006–2008



EPSO applied @ 2 x 10 kg/ha

Armstrong-Fisher

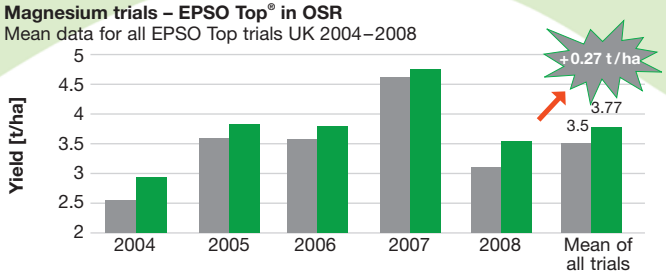
Magnesium trials – Foliar Mg in sugar beet
Mean data for all Mg trials 2004–2007



EPSO Microtop applied @ 2 x 25 kg/ha

Armstrong-Fisher

Magnesium trials – EPSO Top® in OSR
Mean data for all EPSO Top trials UK 2004–2008



EPSO Top applied @ 2 x 12.5 kg/ha

Armstrong-Fisher

- EPSO Products are supplied as fine white free-flowing crystals and are conveniently supplied in 25 kg recyclable polyethylene bags.
- Recommended concentration of EPSO Products is not more than 7% w/v of spray solution (7 kg per 100 l spray volume).
- EPSO Products can be combined with most crop protection products. Nevertheless, we recommend that you carry out a simple preliminary compatibility test in a bucket and that you follow the recommendations of the pesticide manufacturers: add 5% EPSO Product to a given volume of water, stir well and then add the crop protection product(s). If it dissolves completely, the products are compatible.
- To use the product, proceed as follows:
  1) Start filling the tank partially with water.
  2) Always dissolve the EPSO Product first of all, adding it continuously into the tank with agitation.
  3) Continue filling the tank and add the other products.
- EPSO Products are very crop safe although application during midday sun and extreme temperatures should be avoided.
- Proprietary wetting agents can be safely used and may increase the uptake of the nutrients.

Dosage and application periods

Crop	Recommended application (5-7% concentration)	Stage of application	Growth stage according to BBCH
Cereals	20–30 kg/ha (2–3 x 10 kg/ha)	Autumn application at mid-tillering, again at stem extension and again at early ear emergence	21–25, 30–32 and 51–59
Maize	20–30 kg/ha (2–3 x 10 kg/ha	Ideally more than one application between 4 and 8 leaf stage	14–18
Sugar beet	25 kg/ha (2 x 12.5 kg/ha)	From 8 leaf stage onwards as required	18–49
Oilseed rape	25 kg/ha (2 x 12.5 kg/ha)	Stem extension to flower bud formation	30–59
Potato	50 kg/ha (5 x 10 kg/ha)	Rows closing onwards with fungicide program (commonly with every other blight spray)	31+
Peas and beans	25 kg/ha (2 x 12.5 kg/ha)	Early stem branching to flower bud formation	21–59
Open field vegetables	25–50 kg/ha 2–4 x 12.5 kg/ha	6 leaf stage onwards as required	16+
Fruit trees	25–37.5 kg/ha 2–3 x 12.5 kg/ha	Prior to flowering to onset of fruit formation	51–71
Salads and tender vegetables	25 kg/ha (5 x 5 kg/ha) 2–3% w/v	From 5 leaf stage as required	15+
Other minor crops	Telephone technical helpline on 0800 0322480		

EPSO products for fertigation

The addition of dissolved nutrients into the irrigation system (fertigation) is a widely used technique for both protected and field horticultural crops. Great improvements can be made in terms of water use efficiency and nutrients are delivered precisely according to the physiological growth stage of the crop. Fertigation techniques can be used for drip and sprinkler irrigation systems or in field scale boom or underground piped supply.

Due to the high solubility, EPSO products are perfect for use in fertigation systems. They provide Mg, S and micronutrients in the most plant available form and ensure an optimal supply to the plant during the entire growth cycle. EPSO products dissolve rapidly and completely without residues. In fertigation systems, they mix well with a wide range of other fertiliser components. EPSO products are a cost-effective way of supplying Mg, S and micronutrients via fertigation programmes.

Solubility and pH value of EPSO products

	Solubility in water at 20 °C	pH value in 10 % solution
EPSO Top	51 %	7.0
EPSO Microtop	42 %	5.5
EPSO Combitop	50 %	4 – 5

Application guide based on substrate

Different optimum concentrations are required for the EPSO products depending on the used substrate system (soil or soil-less).

Substrate System	Application rate [mg/l MgO]	EPSO application rate [g/l] Continuous	Periodical
Soil based substrate	80 – 120	0.5 – 0.75	0.6 – 0.75
Soil-less culture	40 – 250	0.5 – 1.5	1.0 – 1.5

Miscibility

The EPSO products are 100 % water-soluble and are a valuable component of any nutrient solution for fertigation. The EPSO products mix well with other fertilisers. However, care should be taken when fertilisers containing calcium (Ca) are used owing to the precipitation of water insoluble gypsum ($CaSO_4$)

Mg and S uptake of crops

The typical magnesium and sulphur uptake of crops is shown in the following table. Data are based on the uptake of the whole crop including non-harvested parts.

Crops	Nutrient removal (kg/ton*) MgO	SO_3
Asparagus	2.4	12.5
Barley	4	8
Beans (phaseolus)	1.2	-
Brussels sprouts	1.1	4
Calabrese	3.3	8.25
Carrots	0.5	1.25
Cauliflower	0.9	4.75
Leeks	0.5	3.5
Maize	3.5**	5**
Onion	0.7	2
Peas	1.3	-
Potatoes	1.5	2
Oats	4.3	9.5
Oilseed rape	10.6	31
Sugar Beet	1.5	1.75
Wheat	4.2	7.5

* All removal figures based on the whole crop including non-harvested parts if crop residues are returned to the soil, a proportion of the nutrients will also be returned.

** Maize figures are as % of dry matter.