

Polysulphate - a new multi-nutrient fertilizer

with sulphur, potassium, magnesium and calcium - for better nitrogen use efficiency

Patricia Imas, Chief Agronomist, ICL Fertilizers, Israel



Granular Polysulphate fertilizer



Polyhalite rock

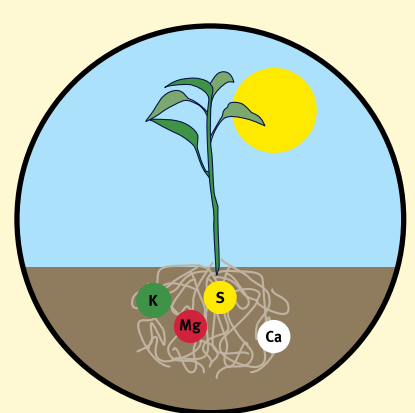
Introduction

Polysulphate is a new multi-nutrient fertilizer, available in its natural state, and mined in the UK. Polysulphate is the trademark of the mineral 'polyhalite', which is one of several evaporite minerals containing potassium. Polyhalite is a single-crystal complex with 2 molecules of water of crystallization. It is not a mixture of salts. The chemical formula is $K_2Ca_2Mg(SO_4)_4 \cdot 2(H_2O)$. Polysulphate comes from the polyhalite layer of bedrock, over 1000m below the North Sea off the North Yorkshire coast in the UK.

Composition

S	K	Mg	Ca
48% SO_3 (19.2% S) As sulphate	14% K_2O (11.6% K) As potassium sulphate	6% MgO (3.6% Mg) As magnesium sulphate	17% CaO (12.2% Ca) As calcium sulphate
An essential constituent of all proteins	Secures yield and quality	For high photosynthesis	For strong and healthy crop

Properties



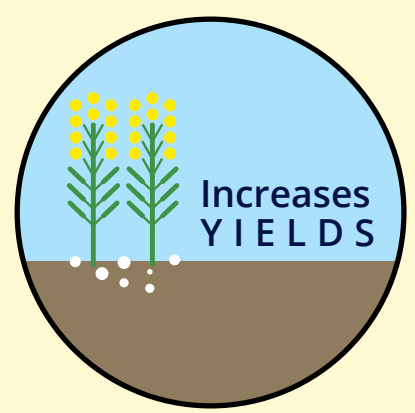
Fully soluble, with all nutrients available for plant uptake



Prolonged release of sulphate; less prone to leaching



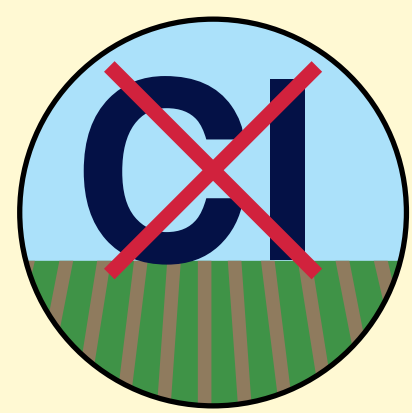
Natural product; organically approved



Increases yields



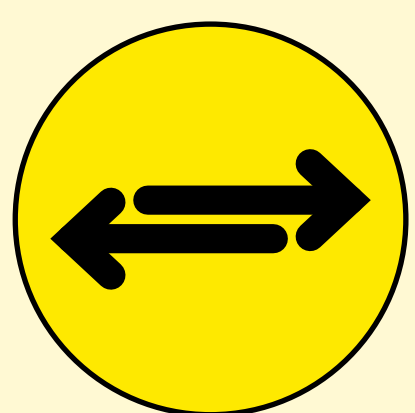
Improves crop health and vigour



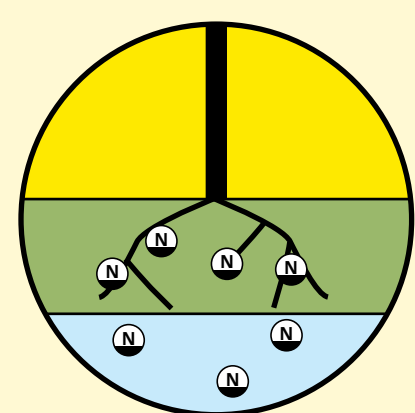
Ideal product for chloride-sensitive crops

Nitrogen-free fertilizer

Being nitrogen (N) free, farmers can separate S and K from N application thus giving full flexibility with the N source and dose. Polysulphate can be applied before planting, while N can be applied after germination: at the right time for the crop, in the right form, and in the right weather conditions. This avoids N overdose or leaching. Higher N use efficiency can be achieved without waste and unnecessary cost to the farmer or the environment.



Gives full flexibility with the N source and dose



Prevents N overdosing and unnecessary leaching of N



Less waste, less costs for farmers, less environmental damage

Benefit for legumes

Polysulphate, having a high S content and lacking N, but with the additional benefit of three other essential nutrients – K, Mg and Ca – is an useful fertilizer for legumes. In a Lucerne trial in Scotland, the N:S ratio in the Polysulphate treatment was improved to the 12:1 target value required for optimal digestibility. At the same time the crude protein content improved by about 10%.

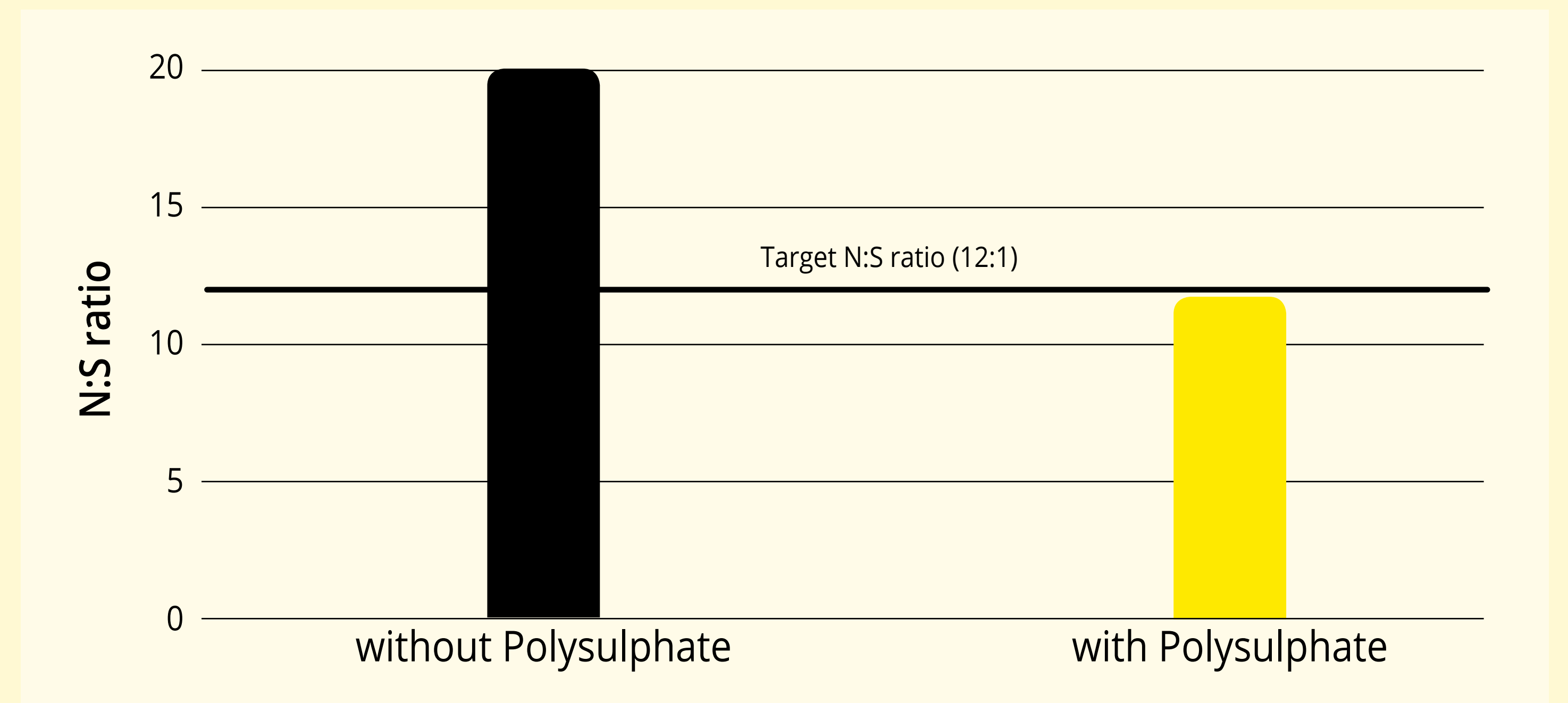


Figure 1. Beneficial effects of an application of 96 kg SO_3 /ha from Polysulphate on the N:S ratio of Lucerne.

Improving baking quality

In wheat trials in USA, application of Polysulphate resulted in smaller N:S ratios in grains inferring better baking quality for optimum dough and bread-making properties.

Additionally, an S deficiency or an N surplus may lead to asparagine and glutamine accumulations. During the baking process, free asparagine may promote acrylamide synthesis, a compound considered to be a neurotoxin and a potential carcinogen. Thus, Polysulphate not only increases wheat yield, but also promotes a more nutritional processed product.

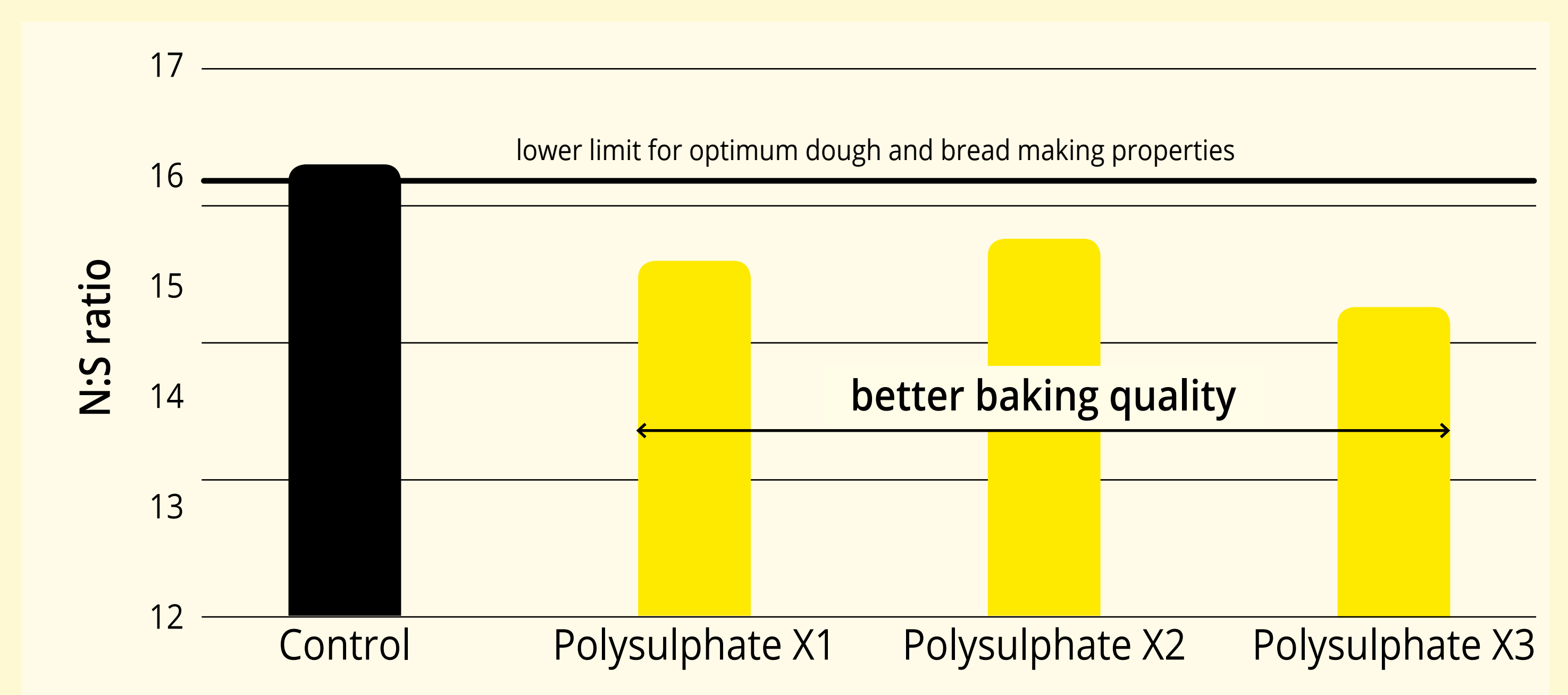


Figure 2. N:S ratio of wheat grains at harvest. A wheat grain N:S ratio of 16.0 is the lower limit for optimum dough and bread-making properties.

Conclusions

- Polysulphate is a nitrogen-free fertilizer which provides four nutrients in one application, avoiding N overdosing or leaching.
- It delivers comprehensive nutrition for nitrogen-fixing legumes, where no nitrogen fertilization is needed.
- An increased nitrogen use efficiency can be achieved along with better quality of grain proteins and improved baking quality.



References Barbarick K. 1991. Polyhalite application to sorghum-sudangrass and leaching in soil columns. Soil Sci. 151(2):159-166. | Dugast P. 2015. Use of polyhalite as a source of sulfur for oilseed rape and winter wheat in France. International Potash Institute (e-ipc) 43:21-26. | Tiwari D., Pandey S., Katiyar N. 2015. Effects of polyhalite as a fertilizer on yield and quality of the oilseed crops mustard and sesame. International Potash Institute (e-ipc) 42:13-20. | Vale F. 2016. Calcium and magnesium movement in soil profile with polyhalite as potassium fertilizer for soybean crop. Proceedings of FERTBIO 2016, Goiana, Brazil, October 16-20, 2016. | Yermiyahu U., Zipori I., Faingold I., Yusopov L., Faust N., Bar-Tal A. 2017. Polyhalite as a multi nutrient fertilizer – potassium, magnesium, calcium and sulfate. Israel Journal of Plant Sciences, 64: 145-156.

