

SUL-PO-MAG[®] AGRI-FACTS

Maize

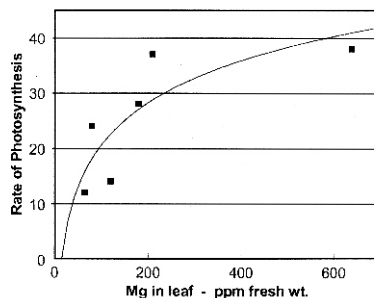
Sul-Po-Mag can play a very important role in the production of high-yielding, high-quality maize. It is a naturally-occurring mineral (langbeinite) that is extracted from 300 meters below the Earth's surface in the southwestern U.S.A. This fertilizer material contains three nutrients that are essential for the growth of all plants: potassium (21-22% K₂O), magnesium (10.5-11% Mg), and sulfur (21-22% S).

Potassium (K). Much has been written about the importance of K in the production of maize. Potassium is essential for the process of photosynthesis. Studies have shown that in K-stressed maize leaves, photosynthesis can be reduced over 95% compared to leaves containing adequate K. Potassium plays an important role in water use efficiency: maize plants well-supplied with K withstand periods of drought much better than K-deficient plants. Weak stalks and lodging can be particularly severe under conditions of low K supply. Maize requires large amounts of K, and a 10-ton maize crop will absorb about 240 kg K₂O. Peak demand occurs just before pollination, when absorption rates approach 10 kg per hectare, *per day*.

Magnesium (Mg). Magnesium is a component of chlorophyll, the green coloring matter of plants. So magnesium is also essential for the process of photosynthesis. Figure 1 shows the relationship between the Mg content of maize leaves and the rate of photosynthesis.

When Mg content of leaves fell below 200 ppm on a fresh-weight basis (0.15 - 0.20% Mg, dry-weight basis) the rate of photosynthesis markedly declined. As photosynthetic rates decline, many different growth processes likewise decline and yield and quality are seriously affected.

Figure 1. Leaf Mg Content Affects Rate of Photosynthesis - Maize.



Yield responses of maize to Mg fertilization have been reported from many areas. A study in Nigeria involving over 20 soil types showed good correlations between Mg soil test levels and yield response (Table 1).



Table 1. Soil test Mg vs. yield. Maize - Nigeria.

Response to Mg	No. Soils	Exchangeable Mg (meq/100g)	%Mg Saturation	Relative Yield
Responsive	9	0.09 - 0.28	1.9 - 4.6	33 - 70
Questionable	2	0.42 - 0.44	3.6 - 7.8	94 - 95
No Response	12	0.77 - 3.78	8.5-43.6	99-105

A great many Sul-Po-Mag trials have been carried out in South China where there are extensive areas of soils deficient in both K and Mg. In a greenhouse study involving nine soil types, responses to Sul-Po-Mag were generally observed at exchangeable soil Mg levels below 80 ppm. Table 2 shows the average yields of soils testing below 80 ppm exchangeable Mg.

Table 2. Maize Response to Sul-Po-Mag. China.

Treatment	Yield g/pot	Relative Yield
N-P	9.3	100
N-P-K	12.1	130
N-P-K+Sul-Po-Mag	14.6	157

In these trials, N and P rates were equal in all treatments. Sul-Po-Mag was applied at a rate to provide K equal to the amount in the N-P-K treatment (supplied by muriate of potash).

A major reason for the use of Mg in maize fertilization programs is the fact that maize has a high demand for K and is thus often heavily fertilized with this nutrient. There is competition between K and Mg for plant absorption. In soils that are low in Mg, applications of K can actually induce deficiencies of Mg.

Studies in the U.S. showed that the depressing effect of K on Mg absorption was consistent throughout the growth cycle. Results in Table 3 show how applications of K strongly depressed Mg levels in maize, 38 and 86 days after planting.

Table 3. Effect of K Applications on Nutrient Levels in Maize. U.S.A.

K Applied kg/ha	Days After Planting			
	38	86	38	86
	% K		% Mg	
0	0.98	0.59	0.91	0.72
56	2.03	1.17	0.61	0.37
112	3.04	1.56	0.47	0.26
224	4.13	1.76	0.35	0.20

Sulfur (S). Deficiencies of this nutrient are increasing worldwide, in some areas at an alarming rate. A major reason for this is the increasing use of high-analysis N-P-K fertilizers that do not contain any S. Sulfur is a component of proteins, so S deficiency can seriously affect crop quality as well as yield. Sulfur is also essential for the synthesis of several important vitamins in plants. Studies in the U.S. have shown that S applications to maize markedly increased yield and net returns (Table 4).

Table 4. Sulfur Increases Yield and Profitability of Maize. U.S.A.

S Applied kg/ha	Yield kg/ha	Gross Return \$/ha	Production	
			Cost \$/ha	Net Return \$/ha
0	8969	884	741	143
11	10223	1008	756	252
22	10662	1050	763	287
34	10474	1032	768	264

An extensive S study was carried out in Central America over a 3-year period involving over 50 field experiments in 6 countries. A positive response to S was observed in 60 to 70 percent of the locations, depending on whether or not phosphorus was applied. Countless other experiments could be cited to demonstrate the beneficial effects of S in maize production.

Sul-Po-Mag and Balanced Fertility.

Sul-Po-Mag can be used in various ways as part of a total, balanced fertility program for maize.

1. In the row or starter fertilizer: This is an excellent way to apply Sul-Po-Mag. Its lack of chloride, low salt index, and high degree of water solubility make Sul-Po-Mag a “natural” for inclusion in row fertilizers. Many growers use simple mixtures of Sul-Po-Mag and either DAP (18-46-0) or MAP (10-50-0) in the row at planting to maximize growth of the young seedlings.

2. Broadcast applications: Sul-Po-Mag can also be applied broadcast — either by itself or as part of a complete N-P-K mixture.

Application Rates.

Sul-Po-Mag is applied at rates sufficient to supply the Mg and/or S requirements of maize. In most situations, additional potash will be required, which is normally supplied by muriate of potash (MOP). Application rates should be determined by a soil analysis: typical broad-cast rates are 150-300 kg/ha. When applying as a row fertilizer, rates are somewhat lower. A typical recommendation would be to apply a N-P-K mixture containing from 2-5% Mg, at rates of 150-250 kg/ha.

SUMMARY

There are many benefits in using Sul-Po-Mag as part of a balanced fertility program for maize.

A highly water soluble, plant-available source of potassium, magnesium and sulfur three very important nutrients for high yields of quality maize.

A “neutral” fertilizer material Sul-Po-Mag has no effect on soil pH.

Essentially a chloride-free material especially beneficial when applying as a row or starter fertilizer.