Residual Effect of Polyhalite Fertilizer for Maize Grown on Sandy Soil

Vale, F.[1]; Döwich, I.[2]
[1]International Potash Institute (IPI), Zug, Switzerland; IPI Coordinator for Latin America (fabio.vale@ipipotash.org);
[2]APDC, Luis Eduardo Magalhaes, Brazil

Introduction

Sandy soils in Brazil present low amounts of nutrients such as phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S). Normally, soybean and maize fertilizers are made to supply only P and K, as well as nitrogen (N) for maize. The use of fertilizers containing these other nutrients (S, Ca and Mg) is important for crop management in order to get greater sustainability in yields.

Polyhalite is a natural single crystal complex with two molecules of water of crystallization. It is not a mixture of salts. The chemical formula is: $K_2Ca_2Mg(SO_4)_4 \cdot 2(H_2O)$. The fertilizer contains 14% K_2O, 19.2% S, 12% Ca and 3.6% Mg.

An important characteristic of polyhalite is the prolonged release rate and availability of nutrients over a longer period.

Objective

The aim of the research was to evaluate the residual effect of the mineral fertilizer polyhalite on maize yield, when it was applied on soybean planted as the previous crop.

Materials and methods

- **Location:** Alvorada farm, Luiz Eduardo Magalhaes, Bahia state, Brazil.
- **Soil:** The trial was conducted in a light textured soil of the Brazilian Cerrado, with low natural fertility (low contents in P, K, S and micronutrients).
- **Soybean trial:** The plot was sown at the end of November 2015, cultivar M-Soy 8349 iPro with 180,000 plants per ha^{-1}. Soybean was harvested in March 2016.
- **Treatments on soybean:** Five treatments as detailed in Table 1. MAP was applied along the furrow, and KCl and polyhalite in broadcast before sowing.
- **Treatments on maize:** all treatments received same fertilization: 150 kg ha^{-1} N as urea, 100 kg ha^{-1} P_2O_5 as MAP and 60 kg ha^{-1} K_2O as KCl, in order to evaluate residual effect of potash sources applied on previous soybean fertilization.
  - Maize was sown in October 2016 and harvested in March 2017.

Table 1. Description of treatments in soybean

	Treatments	MAP	KCl	Polyhalite	P_2O_5	K_2O	S	Ca	Mg
		kg ha^{-1}							
1	No fertilization	0	0	0	0	0	0	0	0
2	Only MAP	200	0	0	104	0	0	0	0
3	MAP + KCl	200	100	0	104	60	0	0	0
4	MAP + KCl + polyhalite (20 S)	200	76	103	104	60	20	12.4	3.7
5	MAP + KCl + polyhalite (40 S)	200	52	206	104	60	40	24.7	7.4

Results and discussion

Soybean

- The soybean trial was strongly affected by the El Niño climatic phenomenon, which occurred in the 2015-16 season, with prolonged droughts and late rains with low rainfall.
- K fertilization had a high influence on yield under reduced rainfall conditions - KCl increased yields by 36% compared to MAP fertilization).
- Polyhalite further increased yields by 10.5% (20 S) and by 19.9% (40 S) as compared to KCl treatment.

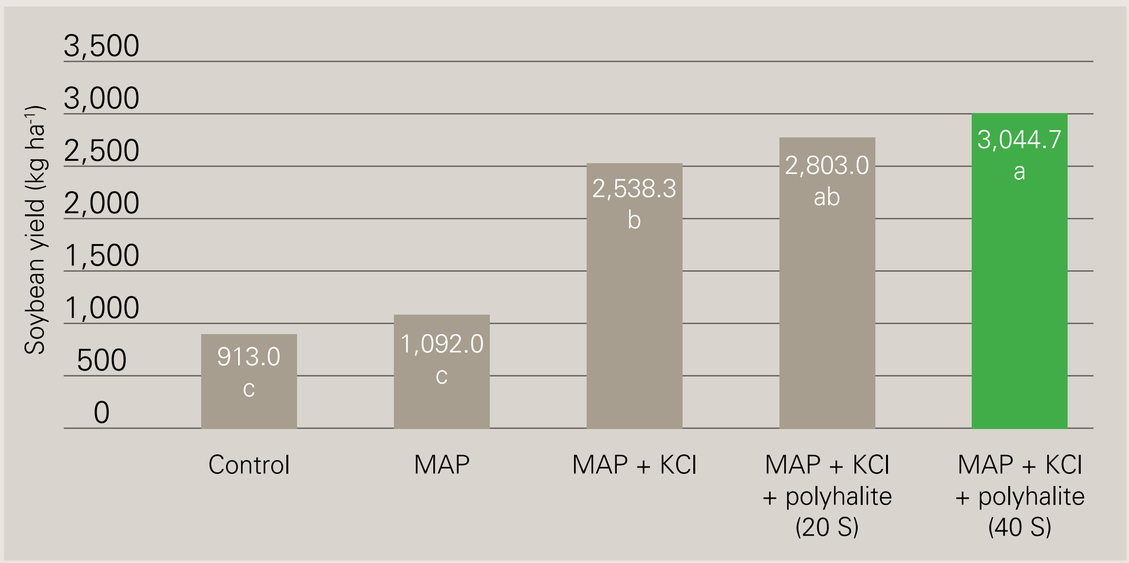

Fig. 1. The averages (4 replicates) followed by same letters do not differ statistically by Tukey test 5% of probability.

Soybean trial - potassium deficiency in MAP treatment

Maize

- Polyhalite showed residual effect of previous soybean fertilization, increasing the maize yield by 6% as compared to KCl treatment.

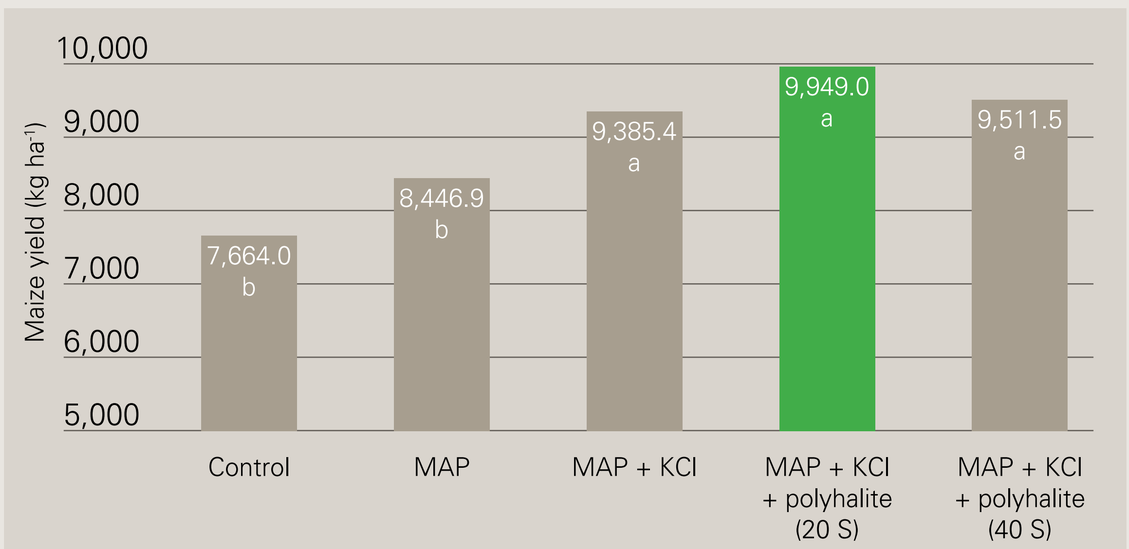

Fig. 2. The averages (4 replicates) followed by same letters do not differ statistically by Tukey test 5% of probability.

Conclusions

- Fertilization with polyhalite increased soybean yield and maintained a residual effect for the next crop.
- The residual effect of polyhalite increased maize yields by 6% in comparison with KCl fertilization, showing the importance of the S, Ca and Mg in crop management.