

Using Polyhalite As a Multi-Nutritional Fertilizer for Corn

Introduction

Polyhalite has potential to be a multi-nutrient fertilizer for maize production. However, little information is available for the response of maize to polyhalite. This study was conducted for two consecutive seasons (2013 and 2014) to compare effects of polyhalite (POLY), to muriate of potash (MOP), sulfate of potash (SOP) and sulfate of potash magnesia (SOPM), on maize grown in a sandy soil in greenhouse and in open field excluding SOPM.

Materials and Methods

For both studies, treatments were arranged in a complete randomized design with three and four replicates for the greenhouse and the open field respectively. Fertilizers were applied at the rates of 50, 100, 200, and 300 K₂O Kg ha⁻¹, for the greenhouse and 50, 100, 150, and 250 K₂O Kg ha⁻¹ for the open field. Soil used in both studies was the Ankona sandy soil (Sandy, siliceous, hyperthermic, ortstein Arenic Ultic Alaquods). All treatments received 200 N kg ha⁻¹ as urea and 125 P₂O₅ kg ha⁻¹ as triple super phosphate (TSP). POLY was provided by Sirius Minerals Plc, Scarborough, UK and MOP, SOP, SOP-M, urea and TSP were acquired from a local fertilizer dealer.

Evaluated variables

Soil analysis before planting and after harvest, plants height, plants basal stem diameter, kernel size, grain yields, leaves greenness, elemental concentration in leaves and in grains at 30 and 100 days after planting respectively were analyzed for both studies. For the greenhouse study, the germination rate and number of leaves were also assessed. Treatments effects over variables were quantified using analysis of variance ($\alpha > 0.05$) and marginal means were separated using Student's LSD or Tukey's HSD.

Results

Germination rate from seeds in pots receiving MOP at 300 K₂O kg ha⁻¹ was 33% and 42% for the 2013 and 2014 season, respectively while other treatments had 75%-100% germination rates. MOP effect over seeds germination was not observed in the open field study at the rate of 250 K₂O kg ha⁻¹, the highest rate used in that study. Maize responded well to polyhalite under greenhouse and field conditions. POLY does not affect maize seed germination nor kernel size.

Number of leaves and basal stem diameter for plants receiving POLY were similar to those receiving MOP, SOP and SOPM. Plants receiving POLY were taller than those receiving SOPM and MOP. Leaves were greener for plants receiving SOP and POLY than those receiving SOPM and MOP. Total fresh and dry weight from those plants receiving POLY were similar to those receiving SOP, but greater than the ones receiving SOPM and MOP. K uptake by leaves from those plants receiving POLY was similar to SOP but greater than SOPM and MOP. Ca uptake by leaves from those plants receiving POLY was greater than those receiving MOP, SOP or SOPM. Mg uptake by leaves and grains from those plants receiving POLY was similar to those receiving SOPM, but greater than those receiving SOP or MOP. K and Ca uptake by grains from those plants receiving POLY was greater than SOP, SOPM and MOP. After harvest, more available Ca and SO₄ were found in the soil treated with POLY than those treated with MOP and SOP.

Conclusions:

This study demonstrated that POLY is an alternative source of K, Ca, Mg and S and can meet the nutritional requirements of maize plants for healthy growth and production.

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