EVALUATION OF POLYHALITE FOR ITS NUTRIENT AVAILABILITY AND ACCUMULATION IN RICE, SESAME AND PEANUT

K. Vijay Krishna Kumar[1], Kiran Pavuluri[2], K. V. Naga Madhuri[3], P. Kishore Varma[1] N. Raja Kumar[1] and K. JayaChandra[1]

1. Acharya N G Ranga Agricultural University, RARS, Anakapalle-531001, AP, India; 2. Anglo American, Resolution House, Lake View, Scarborough, YO11 3ZB, United Kingdom 3. Acharya N G Ranga Agricultural University, RARS, Tirupati-517502, AP, India

Abstract

Plants need nutrient-rich diet for sustained yields and for contributing to healthy life of humans and animals. In this context, balanced fertilization that dictates effective uptake of nutrients by plants assumes significance. Potassium is a major plant nutrient that regulates metabolism, helps in protein building, photosynthesis, quality of produce and in imparting disease resistance.

Our study evaluated polyhalite ($K_2SO_4.MgSO_4.2CaSO_4.2H_2O$; POLY4), a multi-nutrient potash-based mineral, as an alternative or complementary to other conventional fertilizers such as KCl (MOP), K_2SO_4 (SOP), $MgSO_4$ (kieserite), $K_2SO_4.2MgSO_4$ (SOP-M), and $CaSO_4$ (gypsum) for accumulation of nutrients in rice, peanut and sesame.

Greenhouse studies were undertaken in Andhra Pradesh, India, in pots filled with low potassic soils comparing ten treatments with six replications. Crop biomass, nutrient composition and uptake were recorded at harvesting.

Polyhalite application enhanced plant K uptake more than MOP at the recommended K rate in rice. Peanut plant N, P, K and S nutrients were significantly enhanced by POLY4 application compared to MOP application at 400 kg K_2O rate. Soil has supplied enough nutrients for sesame crop resulting in no significant differences among treatments including control.

Introduction

- Among different plant nutrients, K, Ca, Mg and S are important in contributing to growth and yields in agricultural crops besides N and P. Each of these elements has a specific role to play in biochemical pathways.
- Rice, peanut and sesame are major food crops of India, and nutrient requirement for these crops is supplemented through either straight or complex fertilizers.
- POLY4 is an alternate potassium sources to MOP and SOP having advantages in terms of unit cost and is also available on a large scale. This could ultimately lead to decreased reliance on SOP and MOP as a source for potassium.
- The effect of polyhalite on crops as an alternative or supplements to S, Ca, K, and Mg through routinely applied fertilizers in major food crops of India need to be studied.

Objectives

- To assess whether rice, peanuts and sesame crops respond to potassium and other nutrients present in POLY4 added to soils of Andhra Pradesh, India.
- To know the effect of POLY4 on bioaccumulation of N, P, K, Ca, Mg and S nutrients in rice, peanuts and sesame.

Methods

- The location was Regional Agricultural Research Station, Tirupati ANGRAU, India.
- The soil used for the pot culture studies was slightly acidic, non-saline, medium in organic carbon status, low in available nitrogen, high in phosphorus and low in potassium.
- Test crops were rice, peanut and sesame.
- Nutrients were added before sowing of test crops as per treatments.
- The treatments were randomized and replicated five times.

Design of experiment

- Six seeds of the respective crops were sown per each pot and four plants were maintained after thinning and were used to record the data.
- The crops were grown under irrigated conditions.
- Yield and nutrient uptake were studied at the time of harvesting using standard protocols (Piper, 1950).

Statistical analysis

Statistical analysis was carried out using GenStat software version 17 (VSN International, 2011) using ANOVA and regression analysis. Treatments of interest in source study were compared by using single degree of freedom contrasts.

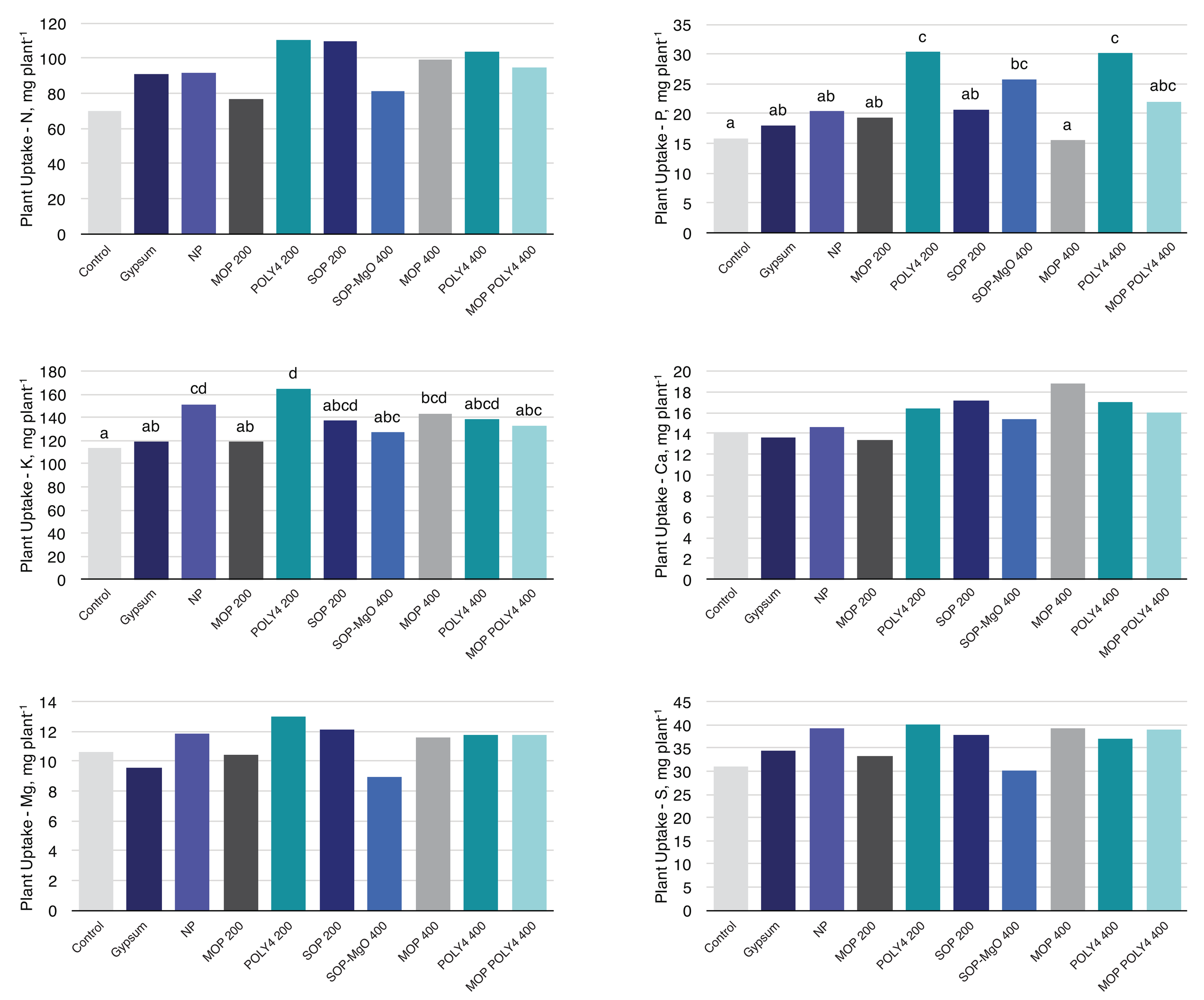
Summary of soil analysis at the experimental sites

pH	OC, %	P_2O_5, kg ha^{-1}	K_2O kg ha^{-1}	Ca cmol kg^{-1}	Mg, cmol kg^{-1}	S, mg kg^{-1}
6.47	0.68	141	104	1680	432	6.8

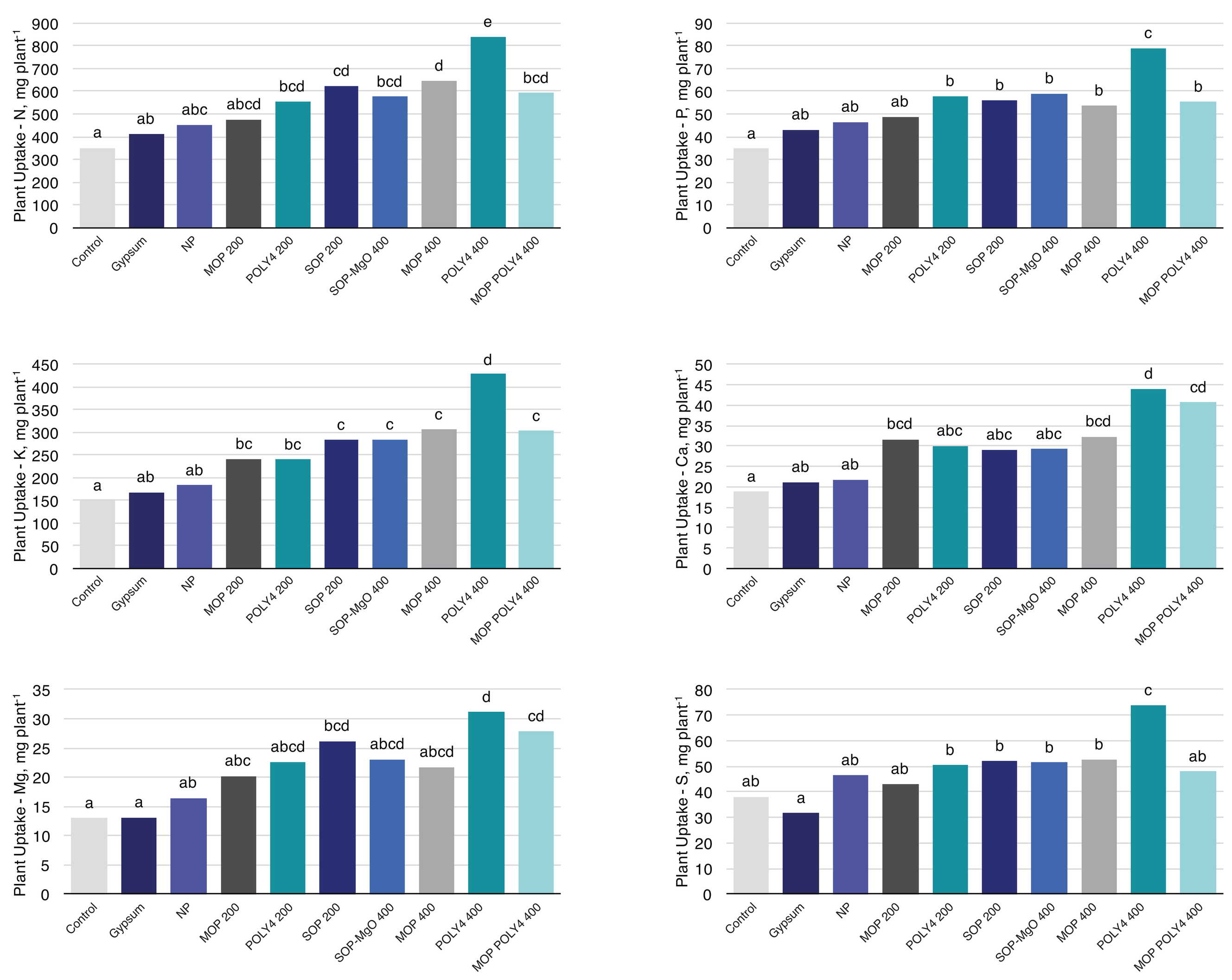
Table: treatment details - groundnut

	Nutrients, kg ha^{-1}					
K blend name	K_2O rate	N	P	CaO	MgO	S
Control	0	0	0	0	0	0
Gypsum	0	20	40	0	0	0
NP	0	20	40	0	0	0
MOP 200	50	20	40	0	0	0
POLY4 200	50	20	40	60	21	68
SOP 200	50	20	40	60	0	16
SOP-MgO 200	50	20	40	60	21	16
MOP 400	400	20	40	0	0	0
POLY4 400	400	20	40	479	171	543
MOP POLY4 400	400	20	40	27	9	30

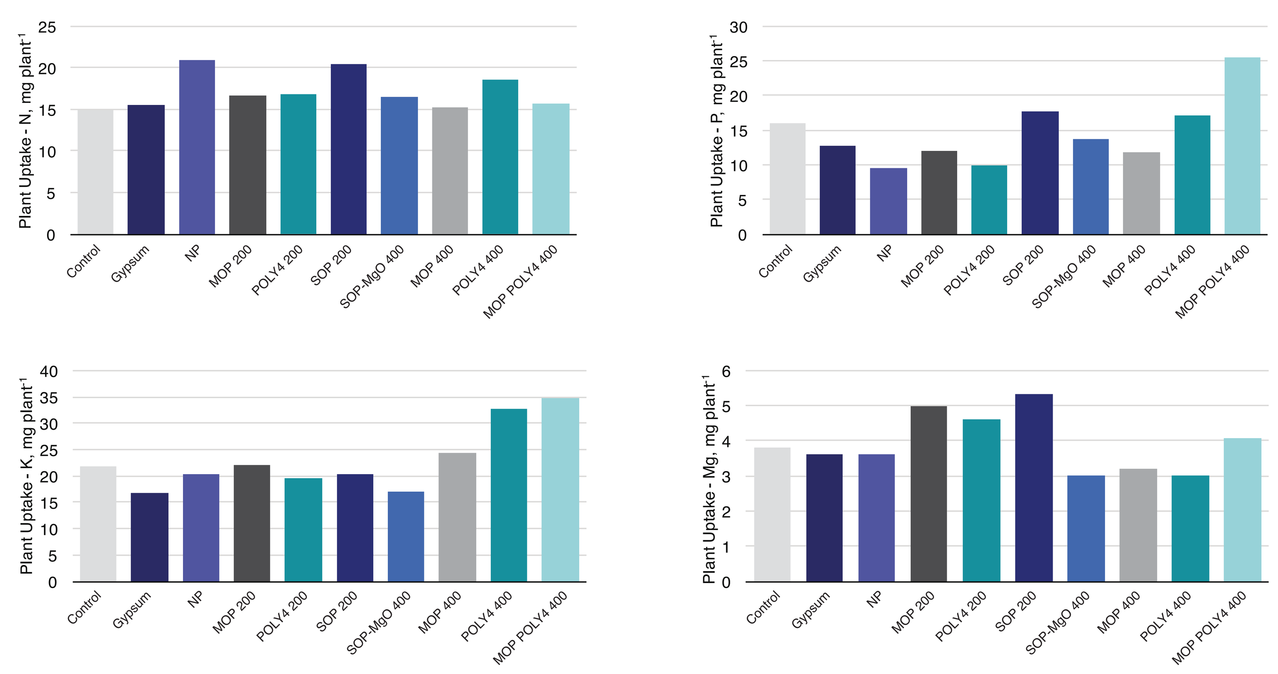
Results – rice



Results – peanuts



Results – sesame



Conclusions

- In rice, POLY4 application at 50 kg K_2O ha^{-1} resulted in higher N, P, K, Mg and S uptake than other treatments.
- In peanuts, POLY4 application at 400 kg K_2O ha^{-1} resulted in higher N, P, K, Ca, Mg and S uptake than other treatments.
- Response to the nutrients was not observed in sesame, possibly due to its lower nutrient requirements that were met by inherent soil nutrients.