



POLY4
A SIRIUS MINERALS PRODUCT

TRIAL RESULTS

SOYBEAN

MINNESOTA, USA (2015)

HIGHLIGHTS

POLY4+MOP fertilizer programme consistently delivered greater potassium and sulphur uptake.

POLY4+MOP programme achieved higher soybean yield with an additional US\$32/ha margin compared to MOP and an additional US\$26/ha compared to MOP+gypsum.

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TRIAL OBJECTIVE

To compare the value of potassium (K) and sulphur (S) in POLY4 to standard fertilizers for soybean production on a low K testing soil.

In the World Agricultural Supply and Demand Estimates report (WASDE), the USDA estimated that the 2016/2017 soybean production was 348 million tonnes. The key drivers in the increasing soybean production are USA, Brazil and Argentina, who collectively contribute 81% to the global export market. China, who is also among one of the largest soybean producers, has gained the status of the leading importer of soybeans.

COUNTRY	SHARE OF GLOBAL PRODUCTION
USA	33%
Brazil	31%
Argentina	17%

TREATMENT TABLE^{3,4}

NUTRIENT	NUTRIENT APPLIED IN TRIAL (kg ha ⁻¹)				
	K ₂ O	MgO	CaO	S	Cl ⁻
Control	0	0	0	0	0
MOP	56	0	0	0	45
MOP+gypsum	56	0	57	38	45
POLY4+MOP 25:75	56	6	17	19	37

OVERVIEW

PARTNER: UNIVERSITY OF MINNESOTA
LOCATION: MINNESOTA, USA
YEAR: 2015

- In 2014, the USA produced 35% of the global soybean crop.¹
- The state of Minnesota was the third largest producer of soybeans in the USA (10.2 million tonnes produced in 2014).²
- In the USA, soybeans typically remove at least twice the K applied in fertilizer.
- Soybean crops do not typically require or receive N or P in Minnesota, but S can help efficient N fixation in deficient soils.
- Treatments consisted of varying rates of K with and without S, replicated four times. The factsheet presents average results from these treatments.
- POLY4+MOP, MOP+gypsum and MOP treatments were applied with the same amount of K fertilizer.

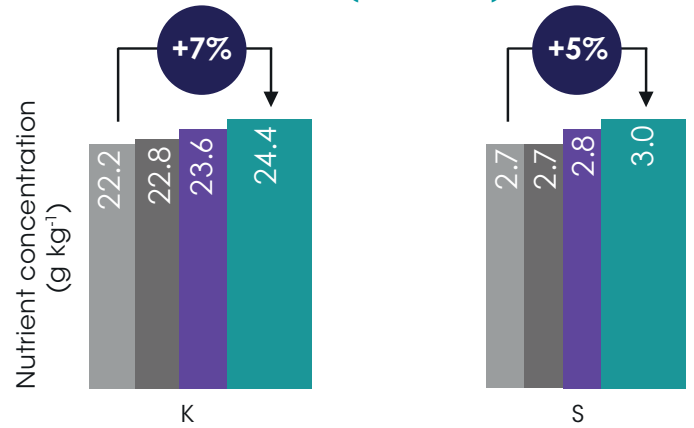


CROP NUTRIENTS DURING GROWTH

- Conservation tillage, combined with compacted and cooler soils, can stratify soil K, reduce rooting and induce K deficiency.
- Greater K concentration aids soybean resistance to pests and diseases (pod rot, purple seed stain, soybean cyst nematode).
- Sulphur aids root nodulation and crop yield.
- The POLY4+MOP treatment had the greater tissue concentration of both potassium and sulphur at both growth stages.

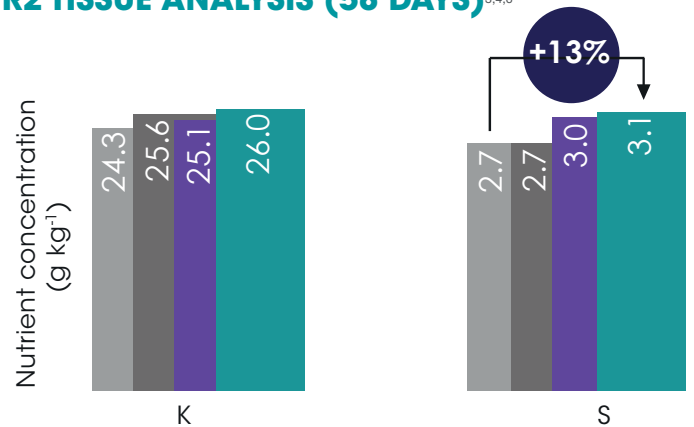


V5 TISSUES ANALYSIS (30 DAYS)^{3,4,5}



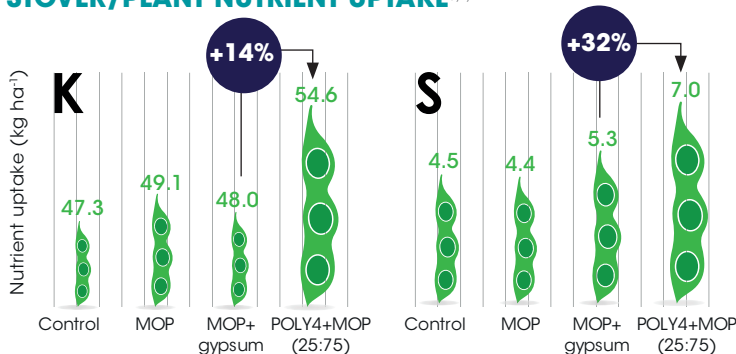
At the V5 stage, soybean crops are small with five unrolled leaves.

R2 TISSUE ANALYSIS (58 DAYS)^{3,4,6}

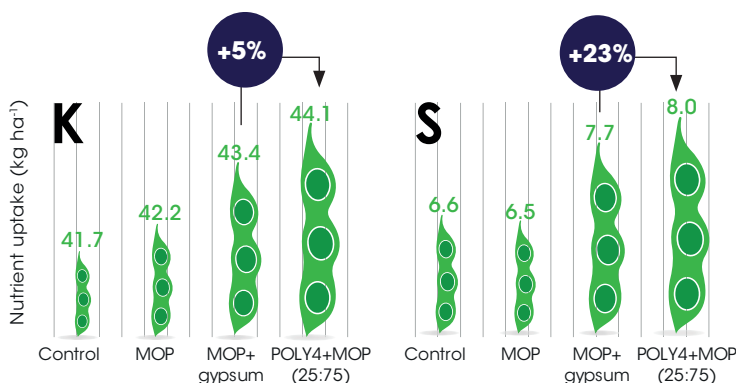


At R2 stage, soybean crops have reached full bloom with flowers visible.

STOVER/PLANT NUTRIENT UPTAKE^{3,4,7}



GRAIN NUTRIENT REMOVAL^{3,4,7}



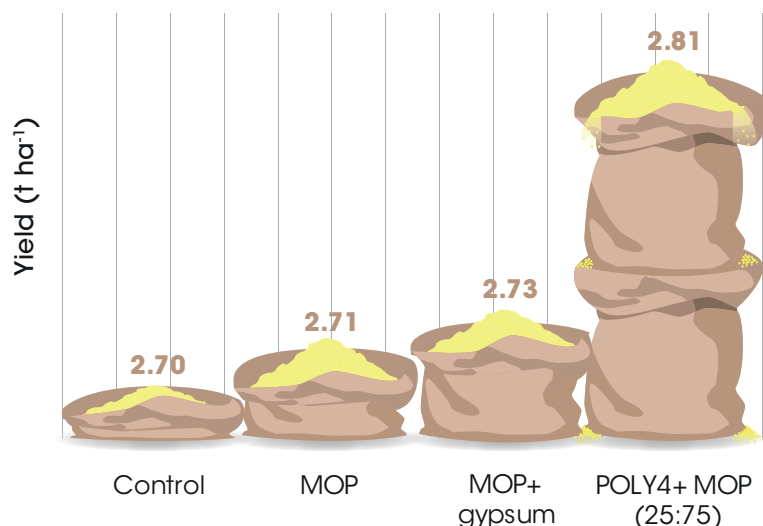
CROP NUTRIENTS AT HARVEST

- At harvest, the soybean treated with POLY4+MOP continued to have higher concentrations and offtake of K and S.
- Greater plant uptake, in addition to delivering a larger, more resilient plant, also supports yield improvement.

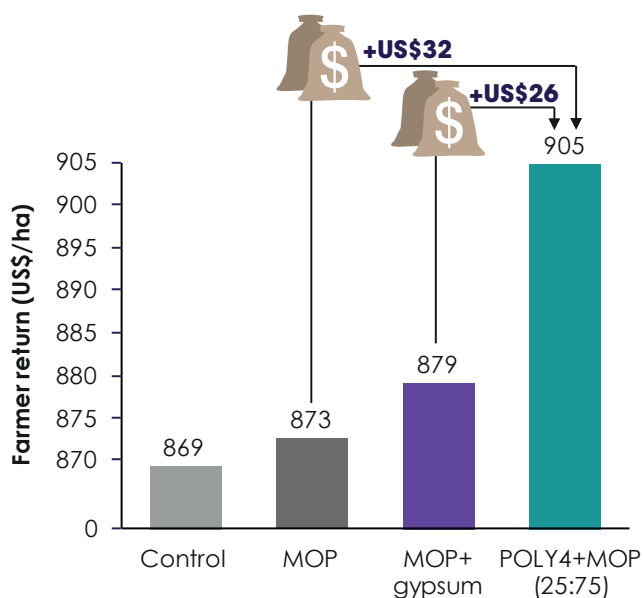
YIELD AND QUALITY

- Application of potassium in MOP was not sufficient to match the higher yield achieved with application of multi nutrients.
- The POLY4+MOP yield was higher than the MOP+gypsum, even though both treatments applied similar quantities of K, S and Mg.

GRAIN YIELD^{3,4}



SOYBEAN YIELD VALUE^{3,4,8}



- The POLY4+MOP fertilizer programme gave the greatest financial margin over fertilizer costs⁹ compared to standard programmes.
- Scaled to an average farm size and typical rotation, the POLY4+MOP programme can increase a farmer's income by an extra of US\$1,856 per year.¹⁰

Notes: 1) FAOSTAT 2017; 2) USDA 2017; 3) GENSTAT means; 4) POLY4 and MOP were used in a ratio of 25:75 to meet K₂O requirement; 5) Based on assessment from June 2015; 6) Based on assessment from July 2015; 7) Based on assessment from October 2015; 8) USDA 2015 national soybean price of US\$322/t; 9) MOI costs for MOP US\$847/ha, MOP+gypsum US\$838/ha, POLY4+MOP US\$859/ha based on soybean price, US Mid-West 2016 annual fertilizer prices and spreading costs; 10) Average farm size of 174 ha⁻¹ with assumed three year rotation meaning 58 ha⁻¹ soybeans per year. Initial soil analysis pH 6.4, organic matter 0.22%, P 26 mg kg⁻¹, K 60 mg kg⁻¹, Mg 167 mg kg⁻¹, Ca 1209 mg kg⁻¹, S 4 mg kg⁻¹.

Source: University of Minnesota (2015) 14000-UMN-14013-15

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