



VALIDATION OF PROGRAMMES WITH DIFFERENT PROPORTIONS OF K, S, Mg AND Ca DELIVERED BY POLY4 IN REPLACEMENT OF TRADITIONAL CORN FERTILIZATION IN MEXICO

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Abstract

Two trials were established in 2018 in the State of Jalisco, Mexico, during the rainy season. Soils at both locations were of a varying fertility level. Different cultivars were sown on each field.

Corn response to POLY4, polyhalite-based fertilizer, was evaluated as an alternative to standard potassium (K) sources. POLY4 was applied in varying K:K proportions with potassium chloride (MOP).

The highest mean yields for both trials were obtained with treatments containing 100% of K from POLY4 (13 t ha⁻¹) and 33% of K₂O from POLY4 (12.9 t ha⁻¹) compared to a treatment with MOP as the sole K source (12.2 t ha⁻¹) and an MOP + S treatment (12.1 t ha⁻¹). Likewise, the response to 30 kg K₂O ha⁻¹ from POLY4 in a low P fertilizer context (40 kg P₂O₅ ha⁻¹) was evaluated. POLY4 obtained an 8% increase in yield.

Trials showed the viability of POLY4 as a partial nutrient alternative for balanced fertilizer programmes for corn in Jalisco's soils.

Introduction

- With 7.3 million hectares harvested¹, corn is the largest crop by area in Mexico.
- Jalisco state is Mexico's third largest unirrigated grain corn producing region with 530 thousand hectares harvested.¹
- To achieve high yields and maintain good soil nutrient legacy, a balanced fertilization programme is required.
- Rainfed crops need sufficient supply of K to reduce drought stress.
- N + P blends are commonly used fertilizers in the region with a high variability in application rates. These blends are applied at planting, with a possible second N application at around 30 days after sowing. Because of this, a low P treatment is also considered for fertilizer plans.
- POLY4 (polyhalite-based fertilizer) provides potassium (K) alongside sulphur (S), magnesium (Mg) and calcium (Ca) achieving a balanced nutritional programme.

Trial location



Methodology

- Trials were carried out at two corn-growing locations with varying soil fertility profiles: San Isidro Mazatepec (low fertility) and Sayula (high fertility). Plant density was 82,000 pl ha⁻¹. This trial was executed during the rainy season of 2018.
- Randomized block design with four replicates, with experimental units of 7 m x 0.75 m.
- Different cultivars were used at each location: Berrendo and B7372 were used at San Isidro, and DK2037 at Sayula.
- Treatments were applied at planting. MOP to POLY4 ratio is on a K:K basis.
- All treatments received 220 kg N ha⁻¹ from DAP and urea, with 61 kg ha⁻¹ applied at planting and 159 kg N ha⁻¹ at V4.
- Standard application rate treatments received 80 kg ha⁻¹ of P₂O₅ from DAP, and non-control treatments received 60 kg K₂O. Low application rate treatments received 40 kg P₂O₅ ha⁻¹ and non-control treatments received 30 kg K₂O ha⁻¹.
- Yield results were adjusted to 14% moisture.
- Data was analysed with Genstat 19th Edition (VSNi, United Kingdom) with mean separation by Fisher's LSD test. Results presented are average of all three trials.

Standard application rate treatments

Treatments	Nutrients applied (kg ha ⁻¹)				
	P ₂ O ₅	K ₂ O	MgO	S	CaO
N + P (control)	80	0	0	0	0
MOP	80	60	0	0	0
MOP + AS	80	60	0	33	0
MOP + POLY4 (66:33)	80	60	9	27	24
POLY4 (100%)	80	60	25	82	73

Low application rate treatments

Treatments	Nutrients applied (kg ha ⁻¹)				
	P ₂ O ₅	K ₂ O	MgO	S	CaO
N + P (control) - low P	40	0	0	0	0
POLY4 - low PK	40	30	8	41	37

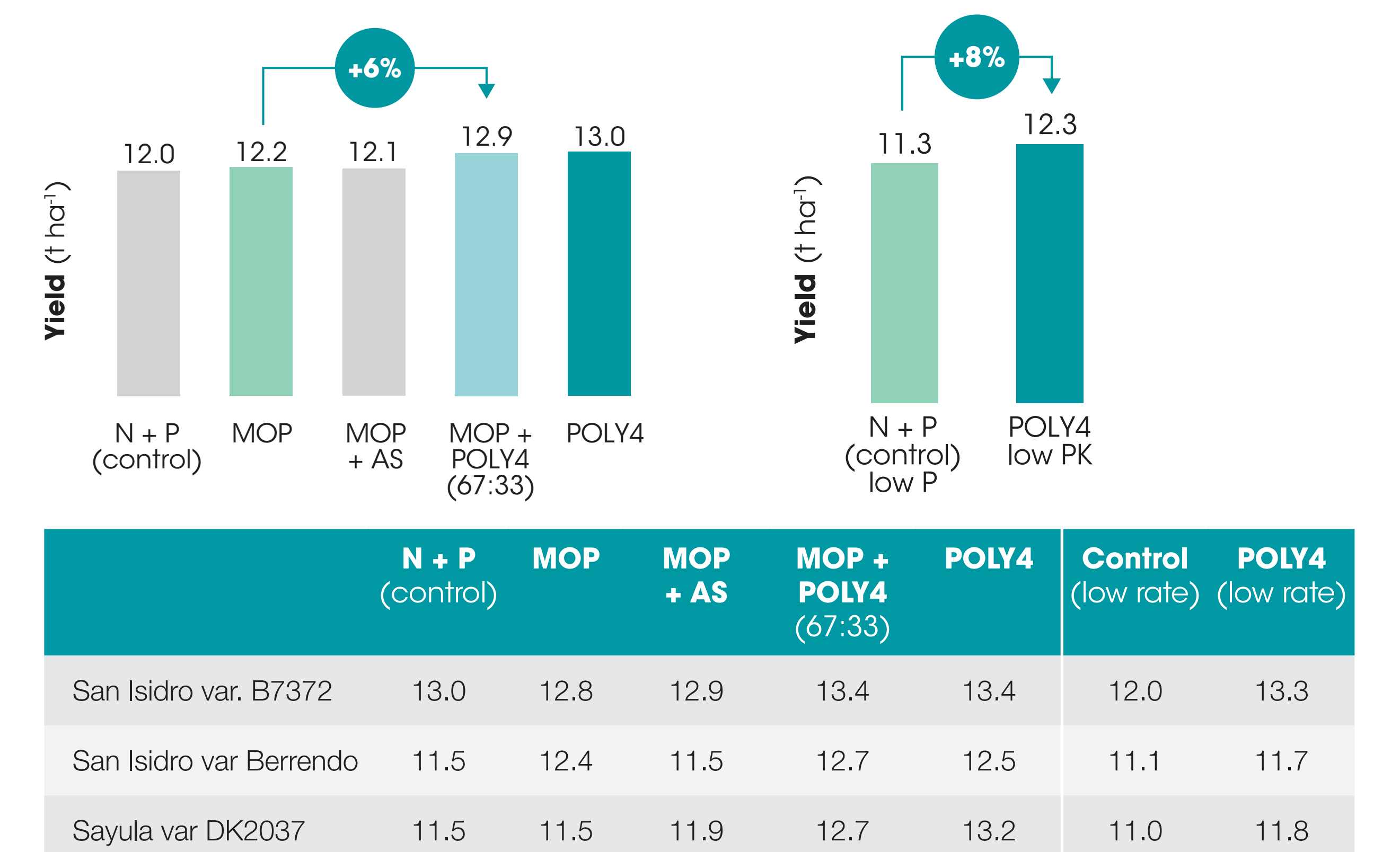
Pre-trial soil information

Site	OM (%)	pH	EC (mS cm ⁻¹)	P (mg kg ⁻¹)	K (mg kg ⁻¹)	Ca (mg kg ⁻¹)	Mg (mg kg ⁻¹)	Na (mg kg ⁻¹)	CEC (cmol _c kg ⁻¹)
San Isidro Mazatepec	2.6	6.4	0.8	18.4	128	642	81	184	5.1
Sayula	3.26	6.7	0.8	65.8	374	1479	399	17	11.7

Results

Yield performance

- The potential yield for the region is 14 t ha⁻¹. The Sayula trial yields were slightly decreased due to three hail storms between V2 and V7. In addition, the trial at San Isidro Mazatepec was affected by water stress during the first 65 days.
- Despite these weather conditions, the highest mean yield was obtained with the POLY4 treatment. Consequently, there was a difference in revenue of US\$139/ha considering corn price at the time.
- A 6% mean yield increase was observed with MOP + POLY4 (66:33) compared to the MOP treatment.
- The POLY4 treatment, under the low application rate regime, had half the P and K fertilizer input, but a similar yield (12.3 t ha⁻¹) to the standard rate MOP treatment (12.2 t ha⁻¹).



Conclusions

- The POLY4 treatments, both alone and in a blend, achieved a better crop performance despite challenging soil fertility and abiotic stress conditions.
- Even at low nutrient application rates, POLY4 either increased corn yields or had a similar yield to the MOP treatment at the standard nutrient application rate.
- The trial results highlight the importance of a balanced nutritional supply for the corn crop.

Notes

Notes: 1) SIAP (2018) Anuario Estadístico de la Producción Agrícola, Gobierno de México; 2) Corn price: US\$191/t (FAOSTAT).

Source: 115000-CHEM-115010-18, Chemello y Asociados S.C

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