POLY4
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The response of corn yield to POLY4 fertilizer programmes compared to conventional programmes in Mexico

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Abstract

Polyhalite (POLY4) is a multi-nutrient fertilizer containing potassium, calcium, magnesium and sulphur ($K_2SO_4.MgSO_4.2CaSO_4.2H_2O$). The objective of this study was to compare yield of corn grown using a POLY4 fertilizer programme with conventional fertilizers in Mexico. Trials were conducted in three states across 16 trials. The POLY4 fertilizer programme consistently outperformed the conventional fertilizer programmes.

Introduction

Corn is the most important crop in Mexico. Depending on the technology input, average yields range from 2 to 14 t/ha. Mexico is responsible for the production of more than 25 million tonnes of corn each year, 86.9% of which is white corn destined to human consumption. However, yellow corn production only covers 24% of the national demand, leading to importations for the industrial and the livestock sectors.

Despite having the genetic potential to reach much higher yields with commercial hybrids, the lack of implementation of new technologies results in a relatively low average yield. Of the 7.8 million hectares (19.2M acres) planted in 2016, about 76% were not mechanised.

Standard practice is to supply ammonium sulphate, and the majority of farmers apply K but never the amount typically required by the crop to reach 10 t/ha.

POLY4 supplies potassium associated with sulphur in the sulphate form, plus Mg, Ca and micronutrients. POLY4 gives a sustained nutrient delivery throughout the growing season. The aim of this study was to evaluate corn production fertilised with POLY4 and conventional NPK fertilizers.

Standard practice

In Mexico, many farmers grow corn in a low NPK input system, while larger scale farmers have higher input systems.

The use of POLY4 to improve these two types of systems was tested.

Generally, an NPK blend is applied at planting with addition N as urea at a late vegetative stage. Common blends are 20-10-10, 21-7-14 and 21-12-6.

In total, 16 corn trials were conducted in Jalisco, Sinaloa, and Guanajuato in central and western Mexico between 2018 and 2020.

	Average	Min	Max
pH	7.5	6.4	8.5
SOM (%)	1.6	0.7	3.3
P (mg kg^{-1})	41	8	234
K (mg kg^{-1})	354	102	1014
Mg (mg kg^{-1})	400	81	1926
Ca (mg kg^{-1})	2000	642	4943
S (mg kg^{-1})	19.8	1.4	30

Nutrients applied in low input system (kg ha^{-1})

	Sites	Fertilizer rate	POLY4 rate	N	P_2O_5	K_2O	S	Mgo	CaO
Standard programmes	**16**	**294**	**0**	**80**	**25**	**0**	**21**	**0**	**9**
1/ N only	6	200	0	92	0	0	0	0	0
2/ N+low P DAP	4	186	0	61	40	0	0	0	0
3/ N+low PDAP+AS	4	368	0	80	40	0	60	0	0
4/ N+low PSSP+AS	4	507	0	80	40	0	54	0	37
POLY4 programmes	**16**	**463**	**214**	**80**	**25**	**30**	**48**	**13**	**37**
1/ N+POLY4	6	414	214	92	0	30	41	13	37
2/ N+low PDAP + POLY4	4	400	214	61	40	30	41	13	37
3/ N+low PDAP+AS+POLY4	2	488	214	80	40	30	60	13	37
4/ N+low PSSP+POLY4	4	588	214	80	40	30	61	13	37

Yield was improved with POLY4 in low input systems

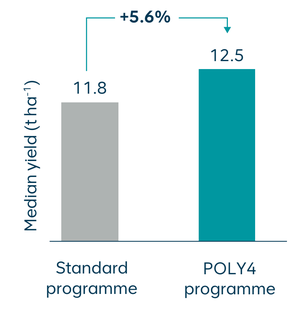
The median yield of the standard practice was 11.8 t ha^{-1}.

When 214 kg POLY4 ha^{-1} was included in a low input fertilizer programme, yield was increased in 15 out of 16 trials. The 16th trial had a lot of variability among plots – yield of standard practice plots at this site ranged from 12.7 to 15.1 t ha^{-1}.

The median yield improvement was 656 kg ha^{-1} or 5.6%.

The POLY4 programmes consistently outperformed standard programmes and there's no evidence changing N and P fertilizers and rates affected these benefits.

Some of the standard programmes added S in the fertilizer but there was no evidence this was enough to consistently reduce the benefits of increased yield after adding POLY4.



Nutrients applied in high input systems (kg ha^{-1})

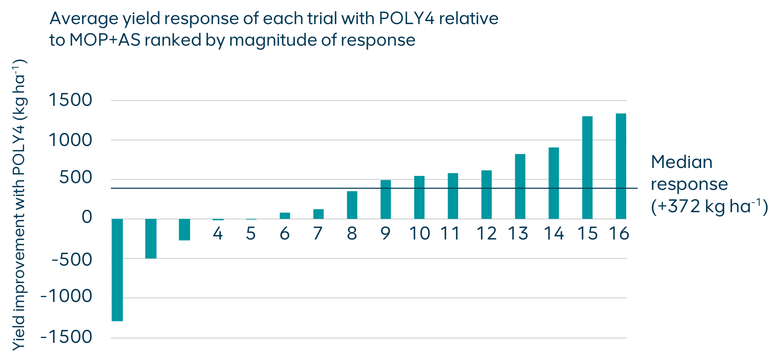
	Product rate	POLY4 rate	N	P_2O_5	K_2O	S	MgO	CaO
Standard programme (MOP+AS)	465	0	80	80	60	36	0	0
MOP+POLY4 (143 kg/ha) + AS	511	143	80	80	60	36	9	24

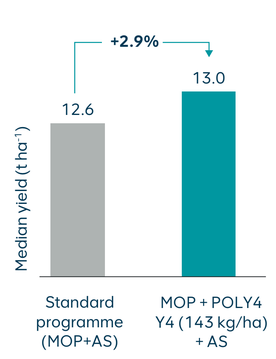
Treatments received 61-92 kg N ha^{-1} and 64-80 kg P_2O_5 ha^{-1} from urea + DAP depending on the recommended rate for the site.

Yield was improved with POLY4 in high input systems

The median yield of the standard practice (MOP+AS) was 12.6 t ha^{-1}.

With 143 kg POLY4 ha^{-1} yield was increased in 11/16 trials and no difference in two trials. Overall, the median yield improvement was 372 kg ha^{-1} or 2.9%.





Conclusion

Yield was consistently improved in field conditions with POLY4.

Including POLY4 consistently increased maize yields in both low input systems (little or no P and no K), and higher input systems (recommended rates of P and K).

POLY4 provides a sustained release form of K, Mg, Ca and sulphate-S. Even where K and S are included in standard fertilizer programmes, they were strongly outperformed by POLY4 programmes.

This yield improvement was seen in three states in Mexico (Sinaloa, Jalisco and Guanajuato) across 13 different corn varieties.