EFFECT OF DIFFERENT BLENDING RATIOS OF POLY4 AND MOP ON CORN GROWTH AND YIELD IN NORTH-EASTERN CHINA

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Abstract

Liaoning province is a major corn producing province in China. Potassium is an important nutrient to enhance corn yield. Polyhalite-based fertilizer POLY4 contains four macro nutrients: potassium (14% K_2O), sulphur (19% S), magnesium (6% MgO) and calcium (17% CaO).

Effects of different blend ratios of POLY4 with potassium chloride (MOP) on corn were investigated in Changtu, Liaoning province in 2018. Treatments were 100% K from MOP, 80% K from MOP + 20% K from POLY4, 60% K from MOP + 40% K from POLY4, and a control without K. All treatments received the same local recommendation rate of N and P from urea and diammonium phosphate.

Applying K increased corn yield compared with the N + P (control). The treatment with 60% MOP + 40% POLY4 had significantly higher yield than both the treatment with 100% MOP and the treatment with 80% MOP + 20% POLY4. The cobs of maize with 60% MOP + 40% POLY4 had 11% more kernels than with 100% MOP.

This study demonstrated that applying POLY4 combined with MOP had better performance on the corn yield than applying MOP alone.

Introduction

- China grows 39 million ha of corn annually – the largest corn-growing area in the world. North-eastern China is the main production area. This includes Liaoning province.
- Traditionally, Chinese farmers apply N, P, and occasionally K. This has caused a progressive K depletion in the soils. Therefore, crops could benefit from a balanced crop nutritional plan.

Trial location

Methodology

- The experiment was carried out at two sites – Changtu and Liaozhong – between May and October 2018.
- The trial at Changtu was rainfed, and at Liaozhong it was irrigated four times.
- The crop was managed according to local practices with application of 210 kg N ha^{-1} and 105 kg P_2O_5 ha^{-1} at Liaozhong and 270 kg N ha^{-1} and 100 kg P_2O_5 ha^{-1} at Changtu. Urea and diammonium phosphate (DAP) were the nitrogen and phosphorus sources.
- Cultivar Zhitai #3 was used at both sites.
- Treatments were applied at planting, along with 40% of the N. The remaining 60% was applied as top dressing.
- The trial was an RCBD design with four replications and 20 m^2 plots.
- Data analysed by Genstat ANOVA with Fisher's LSD test to separate means when significant ($P < 0.05$). Means represented by letters indicate significant differences of the results.

Application rate treatments

Treatments	Nutrient application rate (kg ha^{-1})			
	K_2O	S	MgO	CaO
N + P (control)	0	0	0	0
MOP	95	0	0	0
MOP + POLY4 (80:20)	95	25.9	8.1	22.6
MOP + POLY4 (60:40)	95	51.7	16.3	45.2

Pre-trial soil nutrient levels

Site	pH	EC (ms m^{-1})	N (mg kg^{-1})	P (mg kg^{-1})	K (mg kg^{-1})	Ca (mg kg^{-1})	Mg (mg kg^{-1})	S (mg kg^{-1})
Changtu	5.5	72	128	81	121	1420	239	20.2
Liaozhong	6.0	18	28	24	36	375	51.7	11.4

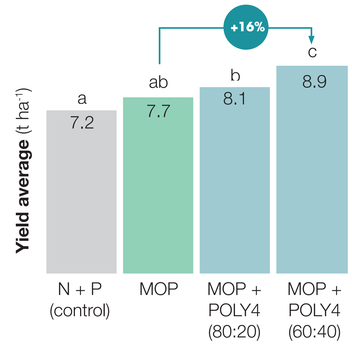
Results

Yield performance

- Grain yield was affected by fertilizer treatment ($P < 0.001$) and location ($P < 0.001$). There was no interaction between site and fertilizer treatment ($P > 0.1$).
- Changtu had an average yield of 9.5 t ha^{-1} which was significantly ($P < 0.001$) greater than the yield at Liaozhong of 6.4 t ha^{-1}.
- Across the two sites, the POLY4-containing treatments increased yield compared to N + P (control). MOP did not significantly increase yield compared to the control.
- MOP + POLY4 (60:40) had an average yield of 8.9 t ha^{-1} which was significantly greater than MOP and N + P (control) with 7.7 and 7.2 t ha^{-1}, respectively. MOP + POLY4 (80:20) had a yield of 8.1 t ha^{-1} which was significantly greater than N + P (control).

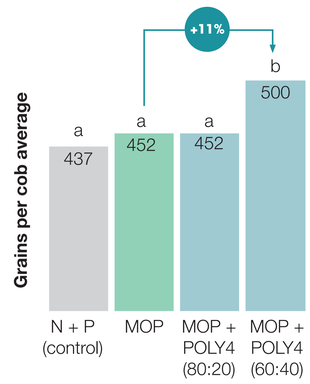
Changtu	N + P (control)	MOP	MOP + POLY4 (80:20)	MOP + POLY4 (60:40)
Yield (t ha^{-1})	8.6	8.8	9.8	10.9
Grains per cob	473	479	507	539
Thousand grain weight (g)	325	331	330	336

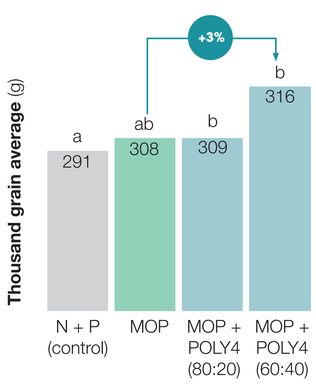
Liaozhong	N + P (control)	MOP	MOP + POLY4 (80:20)	MOP + POLY4 (60:40)
Yield (t ha^{-1})	5.7	6.5	6.5	6.9
Grains per cob	400	425	396	459
Thousand grain weight (g)	258	284	302	282



Yield components

- The number of grains per cob and weight of the grains are factors that influence the total yield. The higher yielding site Changtu had more ($P < 0.001$) grains per cob than Liaozhong (500 versus 420 grains) and a greater ($P < 0.001$) thousand grain weight (331 versus 282 g).
- The number of grains per cob was affected ($P = 0.002$) by fertilizer treatment. Across the two sites, MOP + POLY4 (60:40) had a significantly greater number of grains than the other treatments.
- The MOP + POLY4 treatments had significantly greater thousand grain weight than the N + P (control). MOP was not significantly different from the control or MOP + POLY4 treatments.





Conclusions

- Only POLY4-containing treatments increased corn yield compared to standard local N + P practice.
- This stresses the importance of having a balanced crop nutritional plan to achieve high yields.
- The best performing blend was MOP + POLY4 (60:40), which significantly outperformed MOP in terms of yield across the two trial sites.
- Enhanced grain set and grain weight were the key yield components behind the yield increase.

Notes

Sources: FAO (2016); 74000-IAE-74011-18, Institute of Applied Ecology, Chinese Academy of Sciences.

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