





Polyhalite use in pasture

Maize and grass integrated system fertilized with polyhalite and KCI

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Introduction

- ✓ Crop-livestock integrated systems (CLIS) have been used as a strategy of sustainable agricultural intensification which integrates annual crops and livestock activities on the same area and in the same season
- ✓ Providing an adequate supply of nutrients is important for high yields and is essential to maintain high quality and profitable yields in integrated systems.
- ✓ Potassium chloride potash (58 to 62% of K_2O) = the most potash fertilizer used in Brazil accounting for over 95% of the market.
- ✓ However, there are other minerals composed of sulfates = langbeinite, kainite, and polyhalite.
- ✓ Polyhalite (K₂MgCa₂(SO₄)4.2H₂O) is a mineral of natural occurrence with large existing deposits and has potential to be a multi-nutrient (ratio of 11.7%-K, 19%-S, 3.6%-Mg, and 12.1%-Ca) fertilizer for forage crop production.
- ✓ Little information is available for the response of maize and grass to polyhalite.
 - ✓ Polyhalite may provide a slow-release fertilizer source of K, Ca, Mg, and S.

Goal

The objective of this research was to evaluate the effect of K sources fertilizer on maize Piatã grass yield and nutritional status in the ICLS.





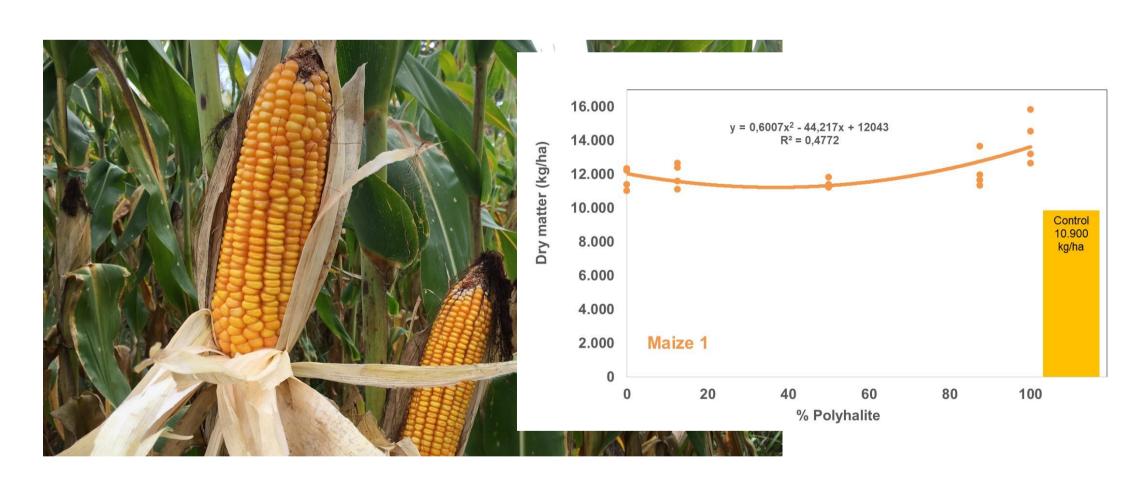






Material & methods

- Embrapa Pecuária Sudeste in São Carlos, Brazil (21 ° 57'S, 47 ° 50'W, 860 m)
- Growing season of 2016/2017 and 2017/18.
- ICLS: sown with maize (Zea mays cv. AG 8690-Pro3) together with Piatã grass (Urochloa brizantha).
- Red-yellow Latosol, i.e. Haplorthox
- Soil testing samples (0-0.2 m):
 - \square pHCaCl₂ = 5.6, organic matter = 46 g/dm³, P_{resine} = 11 mg/dm³, K = 1.5 mmol_c/dm³, Ca = 36 mmol_c/dm³, Mg = 14 mmol_c/dm³, CEC = 72 mmol_c/dm³, V= 73%; S-SO₄ = 5 mg/dm³. 580 g/kg of sand, 46 g/kg of silt and 374 g/kg of clay.
- Lime was not necessary,
- Sowing fertilization: N, 40 kg/ha, P₂O₅, 140 kg/ha; K₂O, 80 kg/ha
- Topdressing fertilizations: N, 100 kg/ha, P₂O₅, 20 kg/ha; K₂O, 100 kg/ha
- Treatments comprised two K sources: polyhalite and KCI (60% K₂O), five ratios (polyhalite:KCI)
- K₂O levels (0, 50, 10 e 200 kg/ ha) with 4 replications:
 - ✓ i) Control (no K, S, Mg or Ca);
 - ✓ ii) KCI 100%;
 - √ iii) KCI 87,5% + Polyhalite 12,5%;
 - √ iv) KCl 50% + Polyhalite 50%;
 - √ v) KCl 12,5% + Polyhalite 87,5%;
 - ✓ vi) Polyhalite 100%;



	К		Ca		M	3	S						
Treatments	g/kg												
POLH 100%	16,58	-	2,60	В	1,79	В	1,56	-					
KCl 12,5% + POLH 87,5%	16,89	-	2,64	В	1,72	В	1,68	-					
KCl 50% + POLH 50%	16,47	-	2,44	В	1,57	В	1,50	-					
KCl 87,5% + POLH 12,5%	16,62	-	2,51	В	1,66	В	1,50	-					
KCI 100%	16,74	-	2,59	В	1,69	В	1,49	-					
Controle	15,54	-	3,37	Α	2,31	Α	1,67	-					
	K	Ca		Mg		S							
Treatments					- /1								

Treatments	K		Ca		M	3	S						
	kg/ha												
POLH 100%	125,0	Α	12,2	-	19,4	Α	13,4	Α					
KCl 12,5% + POLH 87,5%	110,2	AB	11,7	-	16,5	ABC	11,9	AB					
KCl 50% + POLH 50%	104,2	AB	11,7	-	15,5	ABC	10,9	В					
KCl 87,5% + POLH 12,5%	94,4	ВС	9,0	-	14,8	ВС	10,4	ВС					
KCI 100%	93,8	ВС	9,2	-	13,9	С	8,9	С					
Controle	74.0	С	12.3	_	18.3	AB	10.7	ВС					

$R^2 = 0.522$

	K				Ca			Mg				S					
Tratamentos	mmol _c /dm³													mg/dm³			
	0- 20c		20- 40cm		0-20cm		20-40cm		0-20cm		20- 40cm		0-20cm		20-40cm		
POLH 100%	1,2 5	Α	1,0	В	31,0		27,0		11,8	Α	7,5	В	9,0	Ва	24,5	A a b	
KCl 12,5% + POLH 87,5%	1,0 8	Α	0,9	В	37,5		41,3		10,3	Α	7,3	В	9,0	Ва	31,0	A a	
KCl 50% + POLH 50%	1,1 5	Α	0,7	В	27,8		31,3		8,8	Α	6,0	В	8,0	Ba b	25,0	A a b	
KCl 87,5% + POLH 12,5%	1,1 8	Α	0,88	В	40,0		29,0		11,0	Α	7,0	В	5,3	Bb	19,0	A b c	
KCl 100%	1,5 0	Α	0,93	В	26,3		28,5		10,8	Α	7,5	В	6,3	Ba b	16,3	A C	
Controle	0,9 8	Α	0,95	Α	31,3		27,0		10,8	Α	7,8	В	7,0	Ba b	18,5	A b c	

Conclusion

- ✓ Maize and grass yield obtained with the polyhalite and KCl mixture was significantly higher (p <0.05) than the control.
- ✓ The best results of dry matter yield of maize and Piatã grass were obtained with the treatments with the highest ratios of polyhalite.
- ✓ These values were 20% to 36% higher than the best yield obtained in control (without fertilization).
- ✓ Treatments were also efficient in increasing S in soil and exportation of K, Mg, and by maize.
- ✓ This study demonstrated that polyhalite is an alternative source of K, Ca, Mg, and S and can meet the nutritional requirements of annual crops and pastures in a CLIS for healthy growth and production.