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Embrapa

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Polyhalite use in pasture

Maize and grass integrated system fertilized with polyhalite and KCl

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Introduction

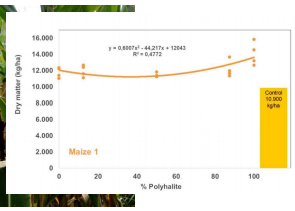
- ✓Crop-livestock integrated systems (CLIS) have been used as a strategy of sustainable agricultural intensification which integrates annual crops and livestock activities on the same area and in the same season
- ✓Providing an adequate supply of nutrients is important for high yields and is essential 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 ($K_2MgCa_2(SO_4)4.2H_2O$) 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.

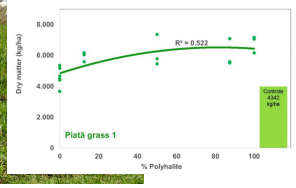
Goal

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):
  - ❑ pHCaCl$_2$ = 5.6, organic matter = 46 g/dm^3, P$_{resine}$ = 11 mg/dm^3, K = 1.5 mmol$_c$/dm^3, Ca = 36 mmol$_c$/dm^3, Mg = 14 mmol$_c$/dm^3, CEC = 72 mmol$_c$/dm^3, V= 73%; S-SO$_4$ = 5 mg/dm^3. 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, P_2O_5, 140 kg/ha; K_2O, 80 kg/ha
- Topdressing fertilizations: N, 100 kg/ha, P_2O_5, 20 kg/ha; K_2O, 100 kg/ha
- Treatments comprised two K sources: polyhalite and KCl (60% K_2O), five ratios (polyhalite:KCl)
- K_2O levels (0, 50, 10 e 200 kg/ ha) with 4 replications:
  - ✓ i) Control (no K, S, Mg or Ca);
  - ✓ ii) KCl 100%;
  - ✓ iii) KCl 87,5% + Polyhalite 12,5%;
  - ✓ iv) KCl 50% + Polyhalite 50%;
  - ✓ v) KCl 12,5% + Polyhalite 87,5%;
  - ✓ vi) Polyhalite 100%;





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

Treatments	K		Ca		Mg		S	
	kg/ha							
POLH 100%	125,0	A	12,2	-	19,4	A	13,4	A
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	B
KCl 87,5% + POLH 12,5%	94,4	BC	9,0	-	14,8	BC	10,4	BC
KCl 100%	93,8	BC	9,2	-	13,9	C	8,9	C
Controle	74,0	C	12,3	-	18,3	AB	10,7	BC

Tratamentos	K				Ca		Mg				S			
	mmol$_c$/dm^3						mg/dm^3							
	0-20cm		20-40cm		0-20cm	20-40cm	0-20cm		20-40cm		0-20cm		20-40cm	
POLH 100%	1,25	A	1,0	B	31,0	27,0	11,8	A	7,5	B	9,0	Ba	24,5	A a b
KCl 12,5% + POLH 87,5%	1,08	A	0,9	B	37,5	41,3	10,3	A	7,3	B	9,0	Ba	31,0	A a
KCl 50% + POLH 50%	1,15	A	0,7	B	27,8	31,3	8,8	A	6,0	B	8,0	Ba b	25,0	A a b
KCl 87,5% + POLH 12,5%	1,18	A	0,88	B	40,0	29,0	11,0	A	7,0	B	5,3	Bb	19,0	A b c
KCl 100%	1,50	A	0,93	B	26,3	28,5	10,8	A	7,5	B	6,3	Ba b	16,3	A c
Controle	0,98	A	0,95	A	31,3	27,0	10,8	A	7,8	B	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.