THE POTENTIAL OF POLYHALITE AS A MULTI-NUTRIENT FERTILIZER FOR SUGARCANE IN BRAZIL

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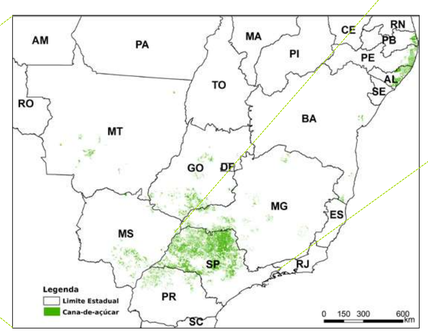
INTRODUCTION

SUGARCANE PRODUCER
- ✓ 25% World production
- ✓ 50% World exports

ETHANOL PRODUCER
- ✓ 20% World production
- ✓ 20% World exports

FAO, 2015



- ✓ Cultivated area (2015/16): 9 million hectares
- ✓ Production(2015/16): 665 million tonnes
- ✓ Average yield (2015/16): 76 t ha^{-1}
- ✓ São Paulo State is the major producer in Brazil, 52% cultivated area

CONAB, 2016

Table 1. Macronutrients extraction and export by sugarcane

Plant part	N	P_2O_5	K_2O	CaO	MgO	S
	kg x 100 t^{-1} of stalks					
Leaves	83	25	94	66	55	26
Stalks	60	18	115	56	26	18
TOTAL	143	43	209	122	81	44

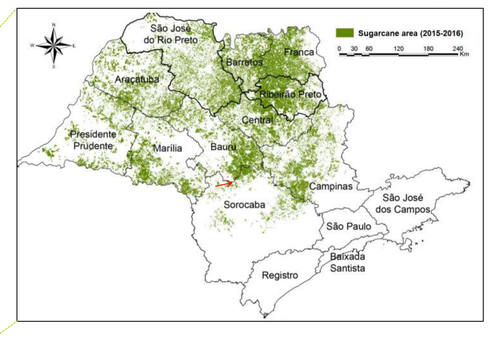
* Production: 100 t of stalks

Orlando Filho, 1993

OBJETIVE

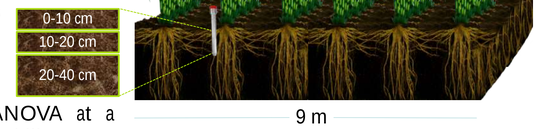
To evaluate the effect of polyhalite (POLY) as a multi-nutrient source on sugarcane ratoon yield and soil K, S, Ca, Mg content changes, compared to combined applications of a commercial K fertilizer (potassium chloride – MOP) and a Ca, S source (gypsum – GYP).

MATERIAL AND METHODS



CONAB, 2016

- ✓ *Saccharum ssp.* cultivar. CV 7870
- ✓ Randomized block design
- ✓ 10 treatments. 3 replications
- ✓ Plot area: 90 m^2
- ✓ Harvest: 3 central rows, manually
- ✓ Weight: Dynamometer coupled to a loader
- ✓ Soil sampling: 3 layers



- ✓ Statistical analysis: ANOVA at a 0.05 level of error probability. Means of yield and each soil nutrient content were separated using the least significant difference (LSD).

Table 2- Initial soil chemical and physical properties for a Typic Haplortox from the experimental site in Agudos-SP, Brazil, 2014.

Soil layer	pH	P	S-SO_4	K*	Ca‡	Mg†	H+Al§	BS¶	CEC#	V††	Clay
cm	$CaCl_2$	---------- mg dm^{-3} ----------								%	g kg^{-1}
0-10	4.8	4	9	39	341	61	287	441	728	61	110
10-20	4.5	3	11	31	280	36	293	347	640	54	112
20-40	4.1	3	20	23	162	35	341	220	561	39	138

* Exchangeable K^+: low, between 0 to 58 mg dm^{-3} Sulphur-sulfate
‡ Calcium, low, between 0 to 80 mg dm^{-3}
† Magnesium, low, between 0 to 73 mg dm^{-3}
§ Exchangeable acidity.
¶ Sum of bases.
# Cation exchange capacity.
†† Bases saturation index.

Table 3. Treatments applied in sugarcane ratoon, corresponding to the dosages of polyhalite (POLY), muriate of potassium (MOP) and gypsum (GYP), Agudos-SP, Brazil, 2014.

Treatments	N	K_2O	CaO	MgO	S	Description
	---------- kg ha^{-1} ----------					
1	0	0	0	0	0	Control
2	100	105	0	0	0	N* K† farmer's dosage
3	100	35	43	15	48	N farmer's dosage + 250 kg POLY‡
4	100	70	86	30	96	N farmer's dosage + 500 kg POLY
5	100	105	129	45	144	N farmer's dosage + 750 kg POLY
6	100	140	172	60	192	N farmer's dosage + 1000 kg POLY
7	100	105	73	0	58	N K farmer's dosage + 317 kg GYP§
8	100	105	146	0	116	N K farmer's dosage + 633 kg GYP
9	100	105	219	0	174	N K farmer's dosage + 950 kg GYP
10	100	105	292	0	232	N K farmer's dosage + 1266 kg GYP

* N farmer's souce: Ammonium nitrate (30% N, 1% P_2O_5)
† K farmer's source: Muriate of potassium (60% K_2O)
‡ POLY: Polyhalite (14% K_2O, 19.12% S, 12% Ca, 3.6% Mg)
§ GYP: Gypsum (18% S, 22% Ca)

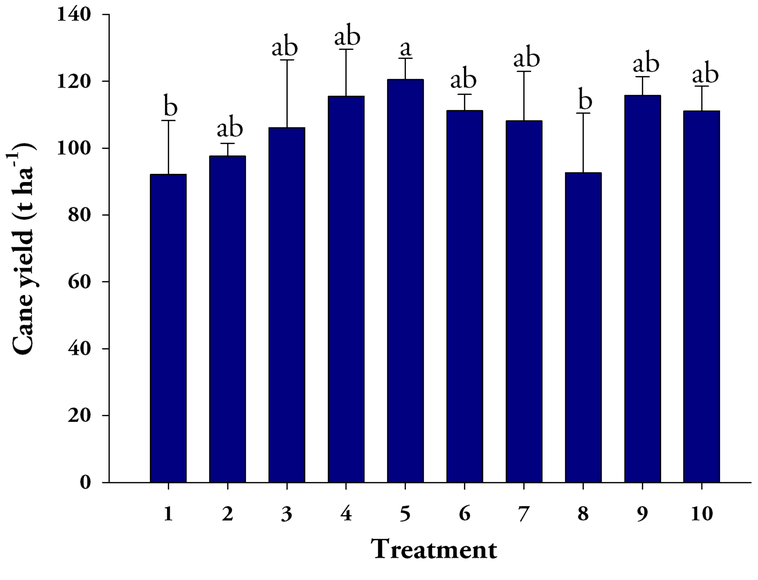
RESULTS

Table 4. Soil K, S, Ca, Mg contents in the 0-10; 10-20; 20-40 cm soil layers, in sugarcane ratoon – Agudos-SP, Brazil. 2015.

Treatment	pH	S-SO_4	K	Ca	Mg	V
	$CaCl_2$	----------mg dm^{-3}----------				%
Soil layer 0-10 cm						
1	4.9 ns	7 ns	43 ns	281 a	57 ns	56 a
2	4.3	9	39	114 c	33	34 c
3	4.4	9	59	146 bc	36	40 bc
4	4.6	23	59	220 abc	45	48 abc
5	4.9	10	70	200 abc	36	47 abc
6	4.7	7	66	220 abc	52	51 ab
7	4.5	7	43	134 c	33	36 bc
8	4.7	10	55	154 bc	24	41 abc
9	4.6	14	55	246 ab	33	51 ab
10	4.9	7	47	275 a	40	56 a
Soil layer 10-20 cm						
1	5 ns	7 ns	23 ns	214 ns	33 ns	46 ns
2	4.3	11	20	140	21	30
3	4.3	10	35	146	33	36
4	4.3	9	27	160	28	36
5	4.6	9	35	174	21	36
6	4.5	7	27	186	24	40
7	4.4	7	23	126	16	28
8	4.3	8	35	134	12	30
9	4.5	11	27	194	21	39
10	4.5	40	23	220	24	39
Soil layer 20-40 cm						
1	4.5 ns	8 ns	12 ns	166 ns	33 ns	33 ns
2	4.1	6	20	114	21	26
3	4.1	10	12	86	21	21
4	4.1	15	23	154	24	29
5	4.3	11	23	166	28	33
6	4.2	9	16	140	24	28
7	4.1	8	16	94	24	22
8	4.1	14	16	80	16	17
9	4.1	9	16	126	12	23
10	4.2	12	20	106	24	23

*Mean values within each treatment followed by the same letter in the columns do not differ by LSD test ($p < 0.05$). ns: non significant

Figure 1. Sugarcane ratoon yield under fertilizer sources, Agudos-SP, Brazil. 2015.



*Mean values within each treatment followed by the same letter do not differ by LSD test ($p < 0.05$)

CONCLUSIONS

- ✓ In a restrictive soil available nutrients (sandy soil) under sugarcane ratoon with a high nutrient demand, it was achieved high response to polyhalite fertilizer application compared to commercial K , Ca and Mg sources.
- ✓ The study showed that higher soil K contents increase sugarcane yield, mainly when is used polyhalite as a source, in commercial field conditions.

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COLCIENCIAS

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