Improving the growth and yield of crops in Europe and South America with polyhalite

杂卤石的施用促进欧洲和南美洲作物的生长和产量的提高

Eldad Sokolowski

International Potash Institute, Coordinator for China

国际钾肥研究所中 国区协调人

1st IPI Symposium on Polyhalite

第一届国际钾肥研究所硫酸钾钙镁研讨会

A New Potassium Fertilizer with Complete Secondary Nutrients

全中量元素解决方案

31 October 2017

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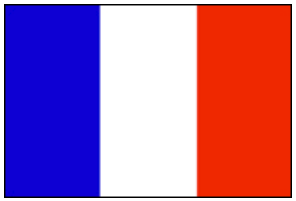

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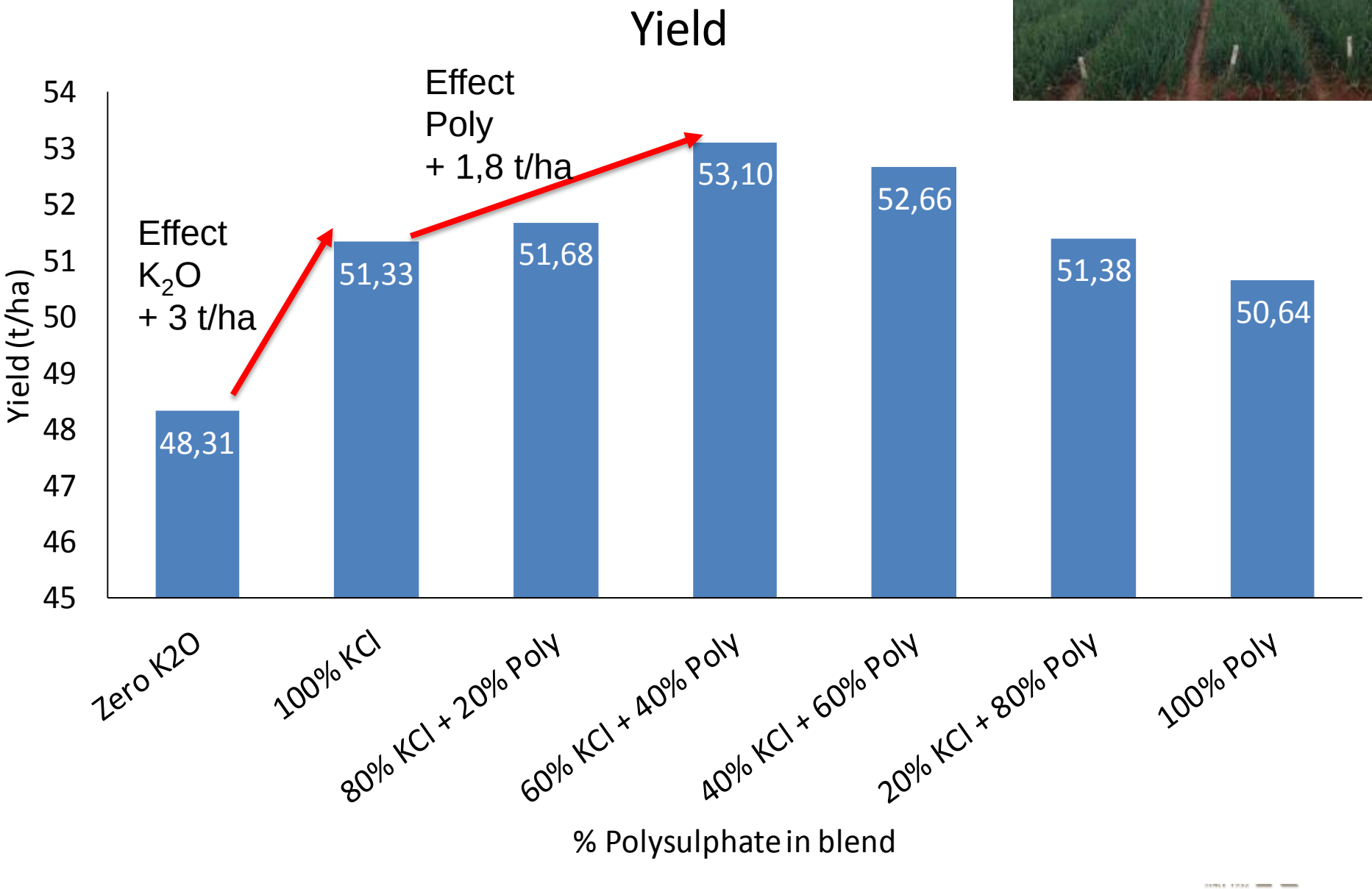
Onion - Brazil

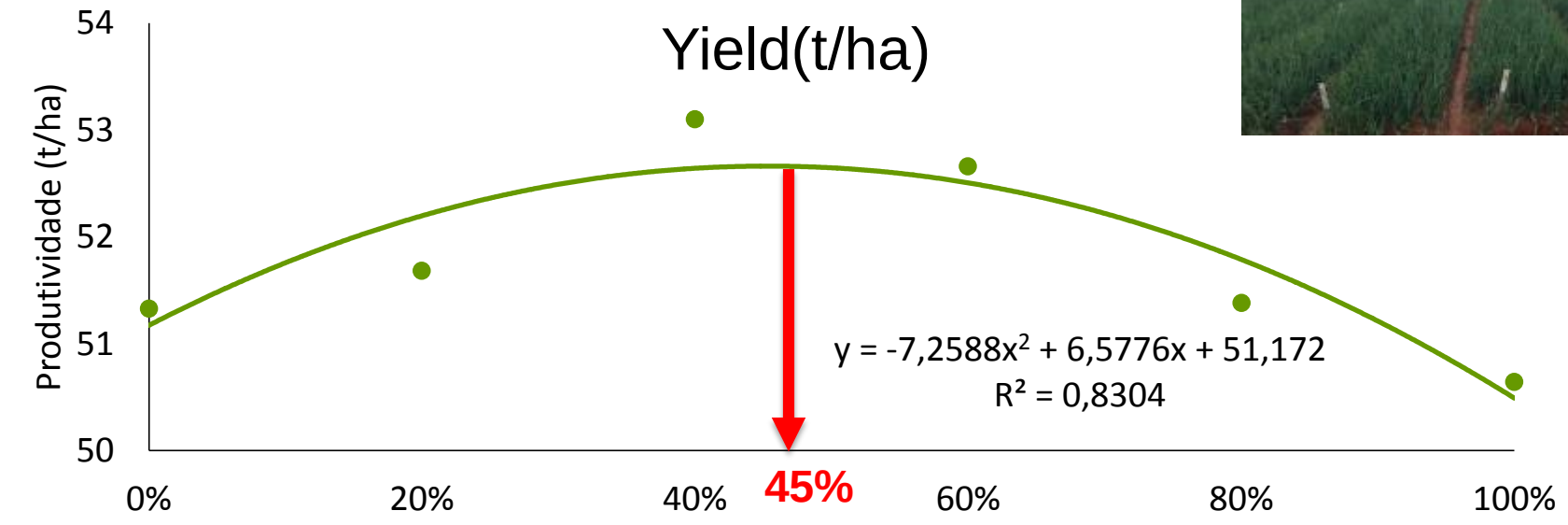
Treatments

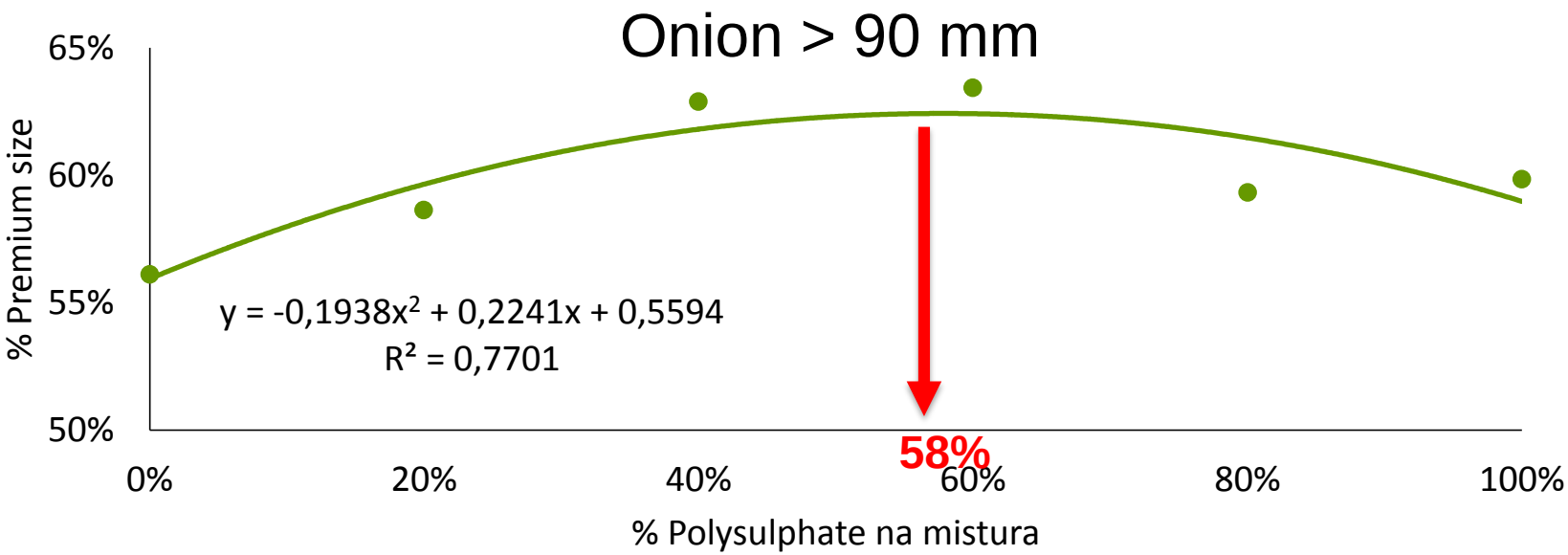
1. Zero potash (only N and P_2O_5)
2. 100% KCl (13 kg/Mu K_2O)
3. 80% KCl / 20% Polysulphate
4. 60% KCl / 40% Polysulphate
5. 40% KCl / 60% Polysulphate
6. 20% KCl / 80% Polysulphate
7. 100% Polysulphate

Onion


Yield
Effect
Poly
+ 1,8 t/ha
Effect
K_2O
+ 3 t/ha
Yield (t/ha)
54
53
52
51
50
49
48
47
46
45
48,31
51,33
51,68
53,10
52,66
51,38
50,64
Zero K2O
100% KCl
80% KCl + 20% Poly
60% KCl + 40% Poly
40% KCl + 60% Poly
20% KCl + 80% Poly
100% Poly
% Polysulphate in blend

Onion


Yield(t/ha)
Produtividade (t/ha)
54
53
52
51
50
0%
20%
40%
60%
80%
100%
45%
y = -7,2588x² + 6,5776x + 51,172
R² = 0,8304


Onion > 90 mm
% Premium size
65%
60%
55%
50%
0%
20%
40%
60%
80%
100%
58%
y = -0,1938x² + 0,2241x + 0,5594
R² = 0,7701
% Polysulphate na mistura

Banana

Treatments

1. 100% KCl (13kg/Mu K_2O)
2. 80% KCl / 20% Polysulphate
3. 60% KCl / 40% Polysulphate
4. 50% KCl / 50% Polysulphate
5. 40% KCl / 60% Polysulphate
6. 20% KCl / 80% Polysulphate
7. 100% Polysulphate

Banana

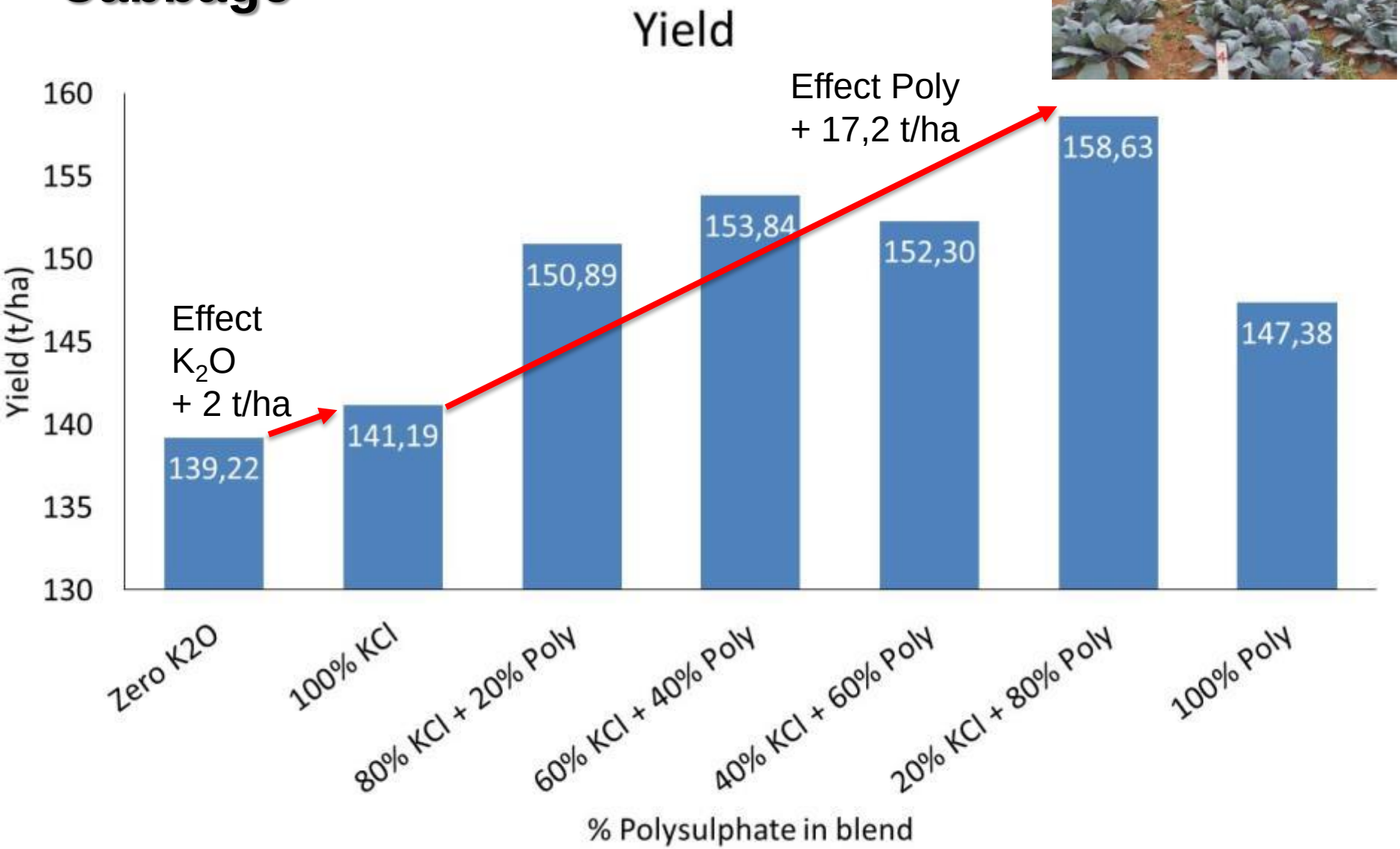
Yield
32
30
28
26
24
22
t/ha banana
Effect Poly
+ 3,5 t/ha
26,4
27,4
27,1
29,1
29,9
28,7
26,9
100% KCl
80% KCl + 20% Poly
60% KCl + 40% Poly
50% KCl + 50% Poly
40% KCl + 60% Poly
20% KCl + 80% Poly
100% Poly
% Polysulphate blend

Cabbage

Treatments

1. Zero potash (only N and P_2O_5)
2. 100% KCl (13 kg/Mu K_2O)
3. 80% KCl / 20% Polysulphate
4. 60% KCl / 40% Polysulphate
5. 40% KCl / 60% Polysulphate
6. 20% KCl / 80% Polysulphate
7. 100% Polysulphate

Cabbage


Yield
Yield (t/ha)
160
155
150
145
140
135
130
Effect
K_2O
+ 2 t/ha
Effect Poly
+ 17,2 t/ha
139,22
141,19
150,89
153,84
152,30
158,63
147,38
Zero K2O
100% KCl
80% KCl + 20% Poly
60% KCl + 40% Poly
40% KCl + 60% Poly
20% KCl + 80% Poly
100% Poly
% Polysulphate in blend

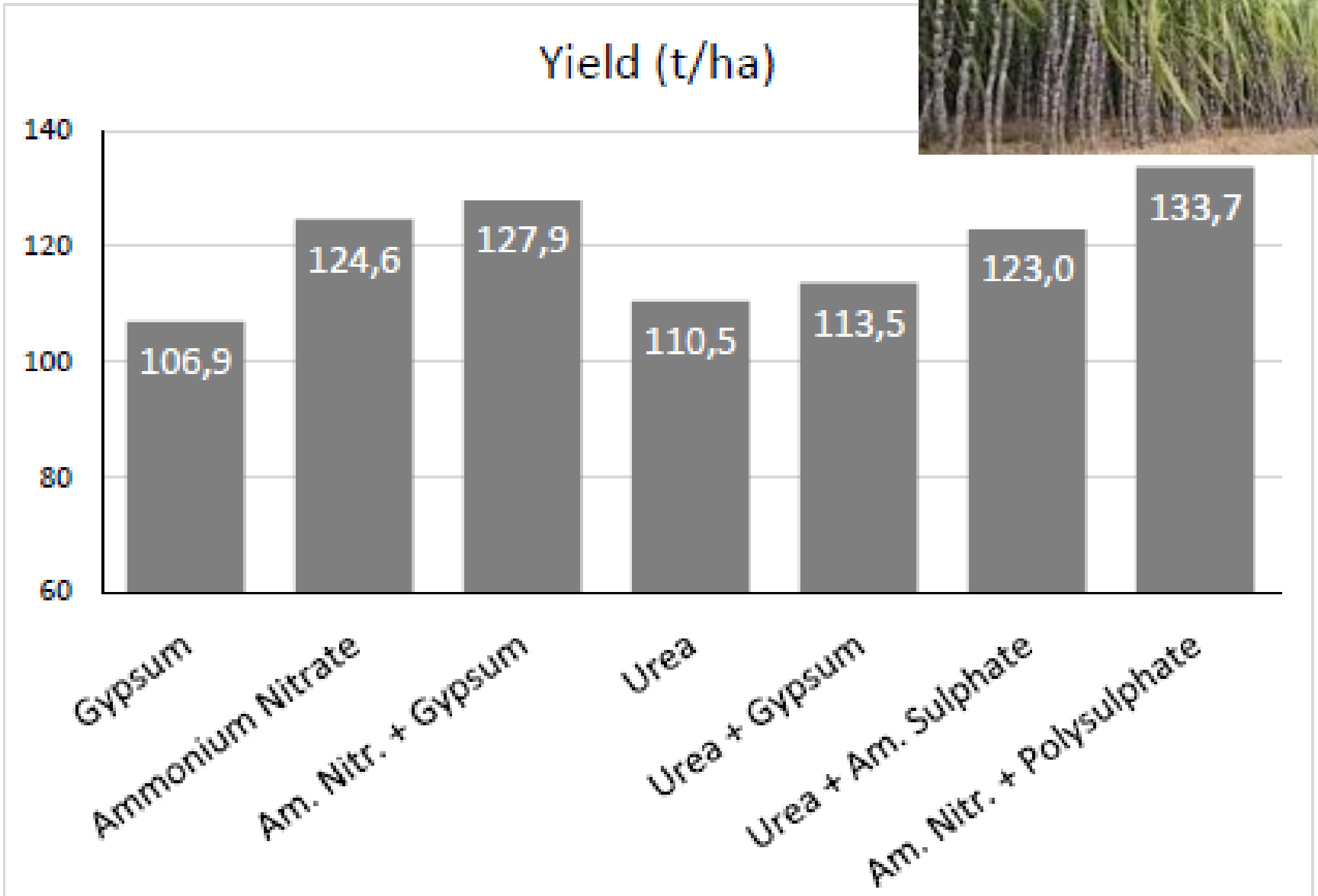
Cabbage

Yield
160
155
150
145
140
Yield (t/ha)
y = -40,741x² + 48,252x + 141,52
R² = 0,784
59%
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
% Polysulphate in blend

Sugarcane Brazil
Ratoon, after second harvest

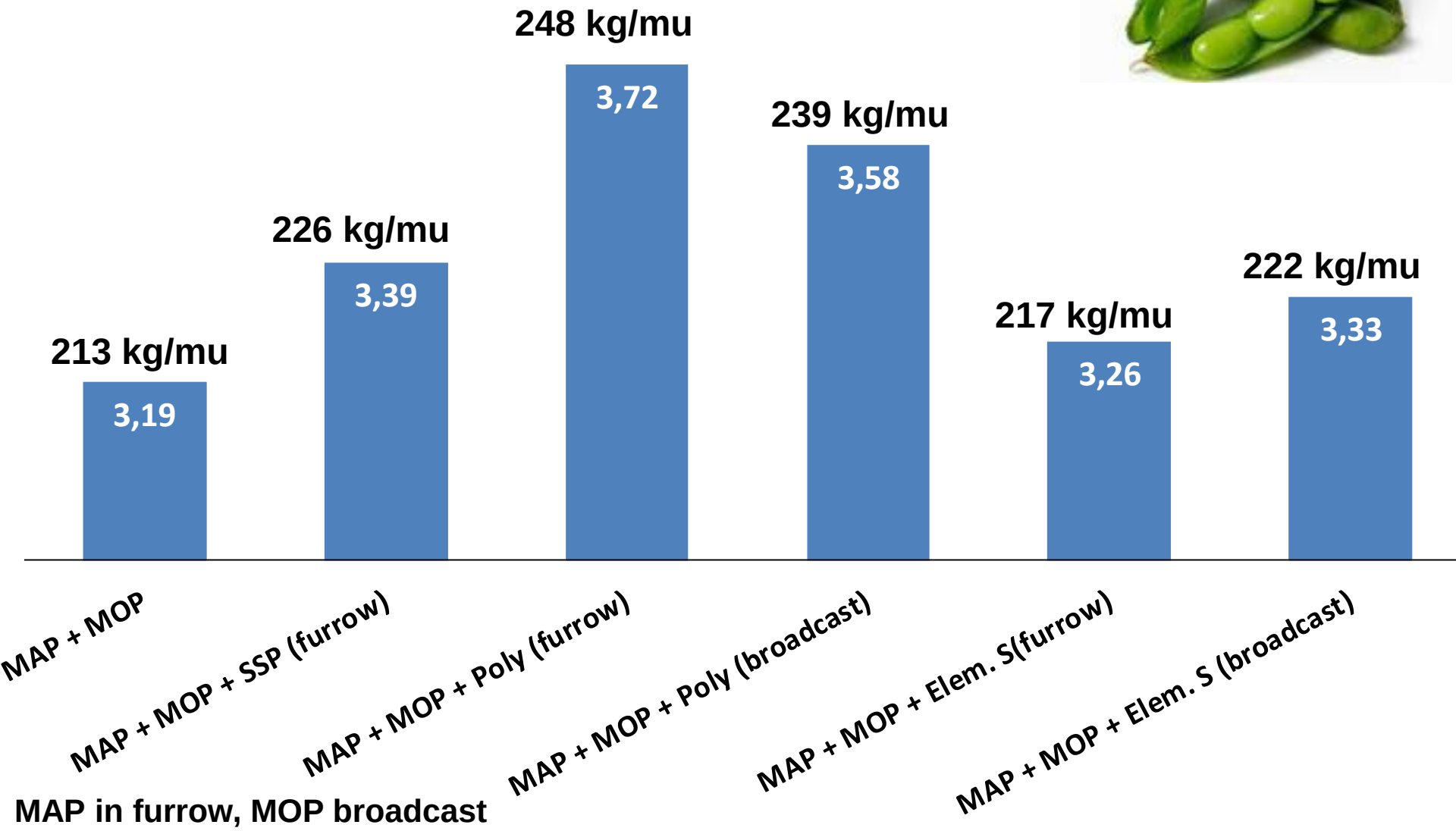
T	Ammonium nitrate	Ammonium sulphate	urea	KCl	Gypsum	Poly sulphate	S	Ca	Mg	N	K2O
	kg/Mu										
1				13.3	67					0	8
2	25.5			13.3						8.7	8
3	25.5			13.3	67					8.7	8
4			19	13.3						8.7	8
5			19	13.3	67					8.7	8
6		8	15	13.3						8.7	8
7	25.5			11		10.5	2	1.3	0.4	8.7	8

Sugarcane Brazil



Soybean – Brazil

Grain yield (t/ha)



MAP in furrow, MOP broadcast

All treatments : 80 kg/ha P_2O_5 + 80 kg/ha K_2O

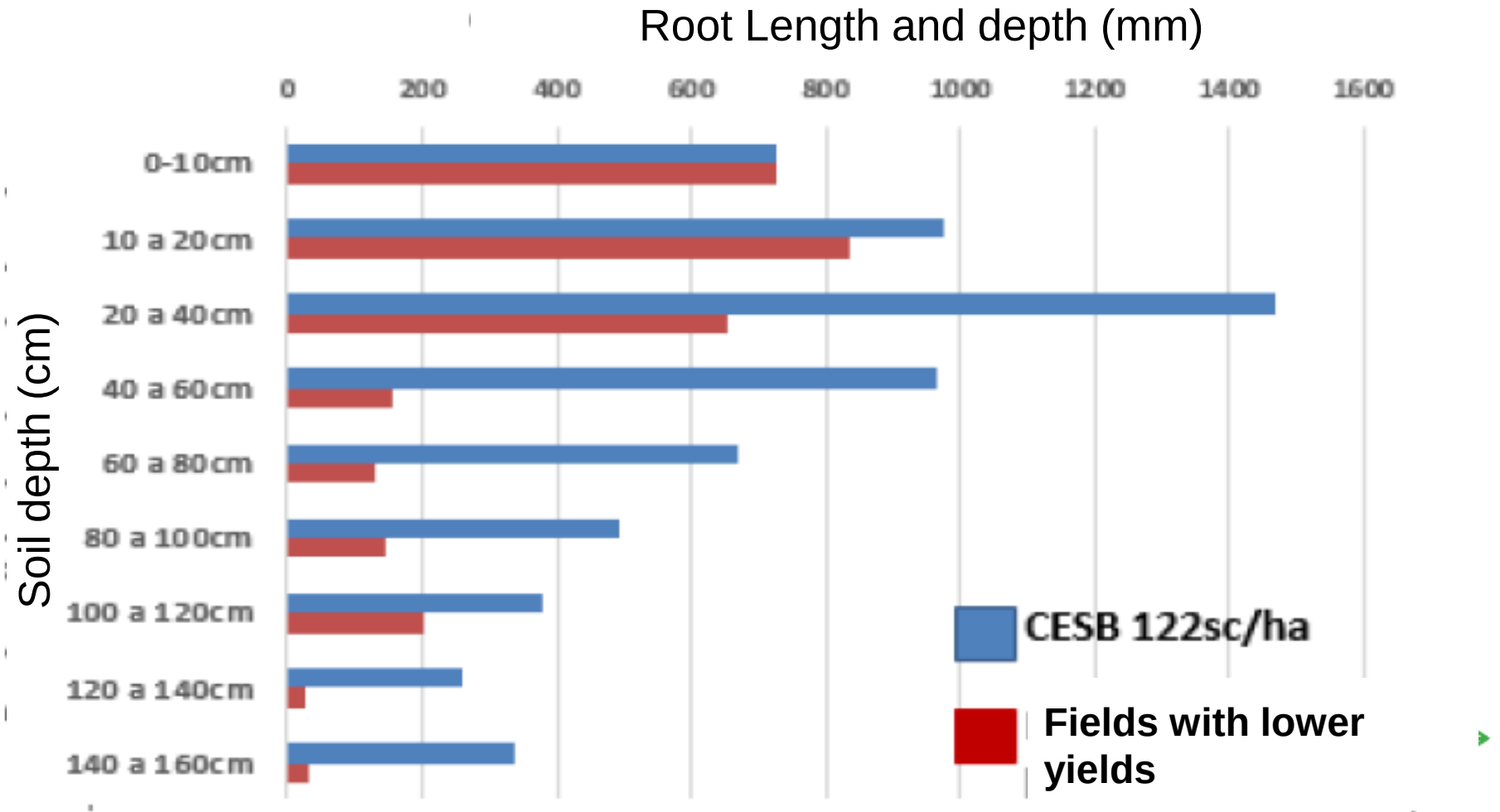
Treatments 2 to 6 :+ 25 kg/ha S

CALCIUM AND MAGNESIUM MOVEMENT IN SOIL PROFILE WITH POLYHALITE AS POTASSIUM FERTILIZER FOR SOYBEAN CROP

Fabio Vale - IPI – International Potash Institute, Piracicaba/SP, Brazil. fabio.vale@ipipotash.org

- No tillage system or minimum cultivation
- Limestone and fertilization in top soil
- Single fertilizers applied before sowing and broadcasted on top soil
- Fertility has been concentrated in top soil (0-5 cm) – P, Ca, Mg
- Root concentrated in top soil, problems in root development, high sensibility to water deficiency

Relationship: Root system x depth x Ca and Mg in soil x higher soybean yield

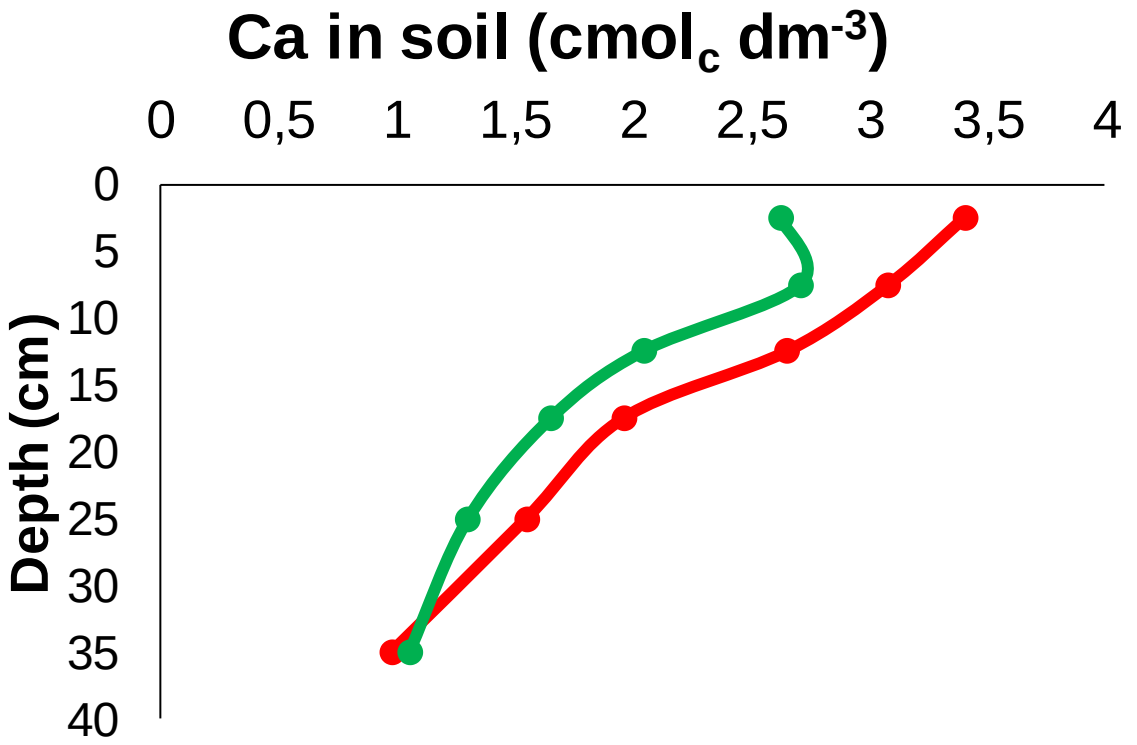


- Soybean sowed in pasture degraded area.
  - Two weeks before sowing = **2,5 t/ha of dolomite limestone**.
  - Sowing = **200 kg/ha of MAP onto furrow**.

Treatments	Timing	Aditional fertilization	
		First trifoliate (V1)	First flower (V6)
		Top soil	
KCl		KCl (70 kg K_2O ha^{-1})	KCl (70 kg K_2O ha^{-1})
Polyhalite		Polyhalite (eq. To 70 kg K_2O ha^{-1})	Polyhalite (eq. To 70 kg K_2O ha^{-1})

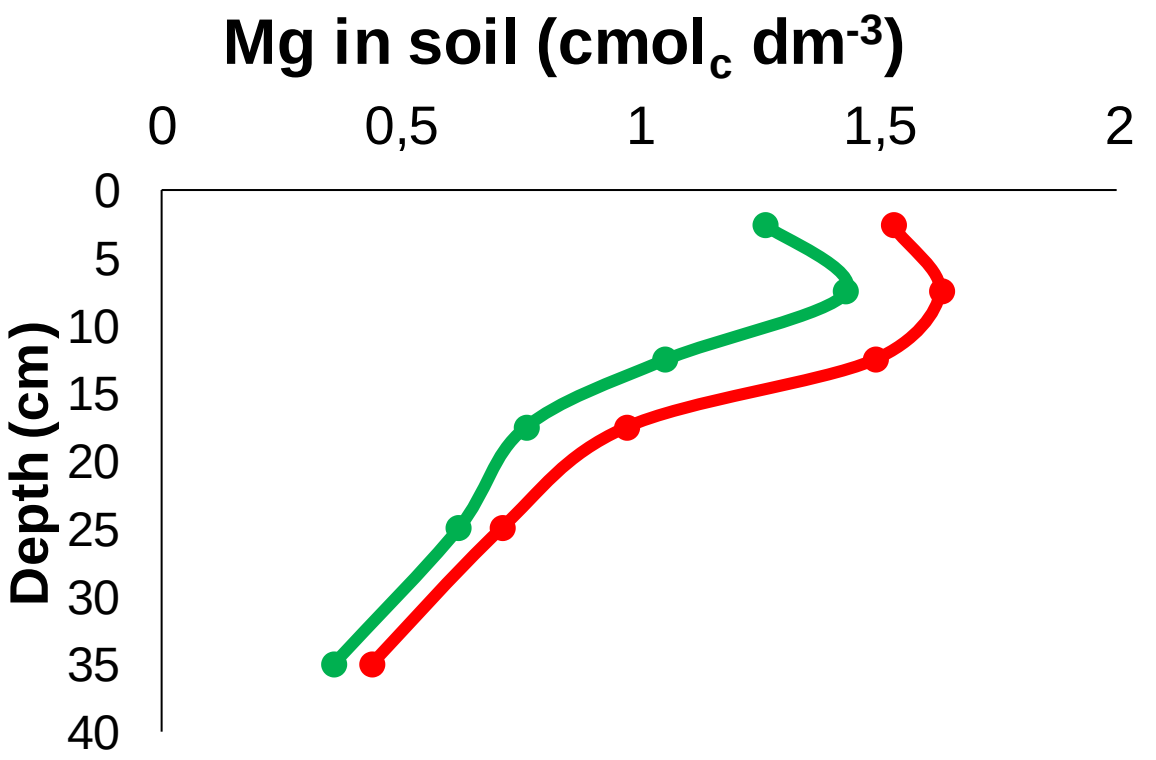
  - Sampling soil after soybean harvest (80 days after second fertilization), in the depths: 0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm, 20-30 cm and 30 -40 cm.

Vale (2016)



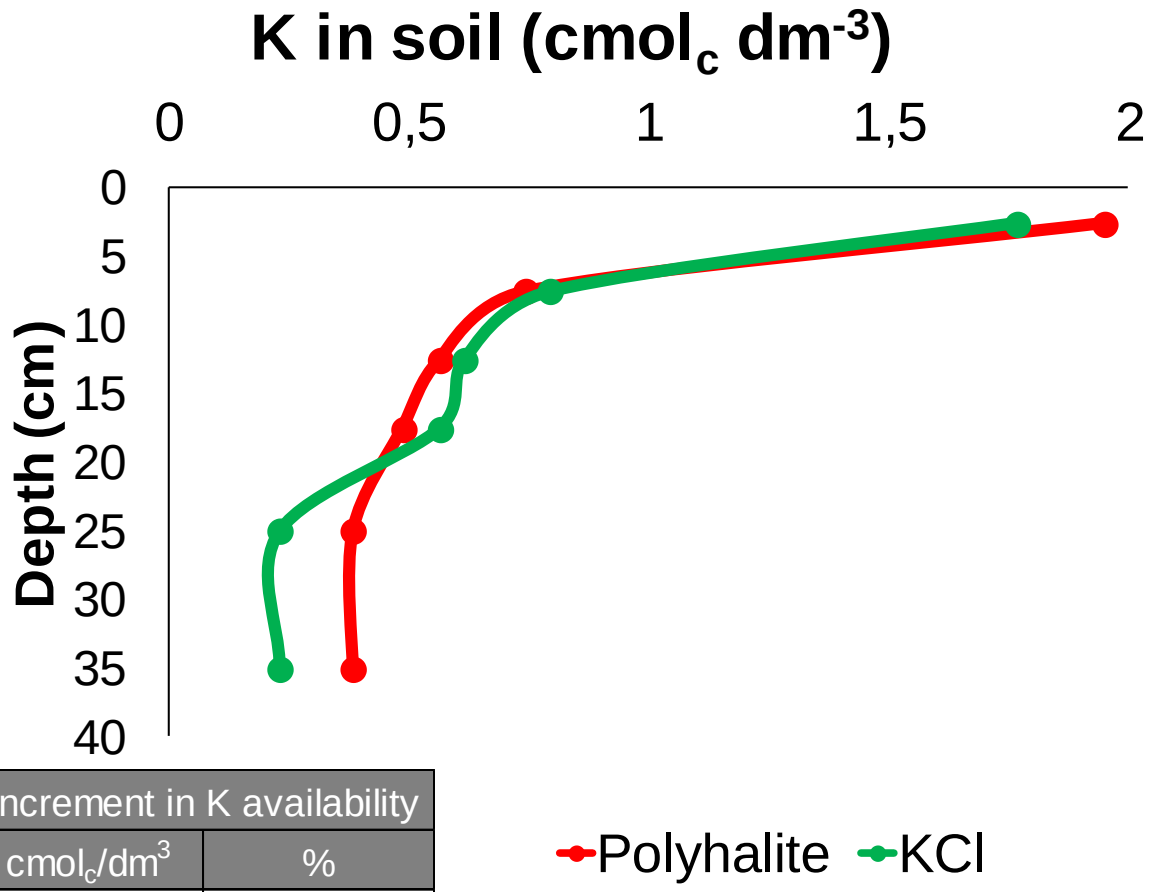
Depth	Ca average (cmol$_c$/dm^3)		Increment in Ca availability	
cm	Polysulphate	Control	cmol$_c$/dm^3	%
0-5	3,40	2,62	0,78	29,8%
5-10	3,08	2,71	0,37	13,7%
10-15	2,65	2,04	0,61	29,9%
15-20	1,96	1,65	0,31	18,8%
20-30	1,55	1,30	0,25	19,2%
30-40	0,98	1,05	-0,07	-6,7%
Average for depths				
0-20	2,77	2,26	0,52	22,9%
20-40	1,27	1,18	0,09	7,7%

Vale (2016)



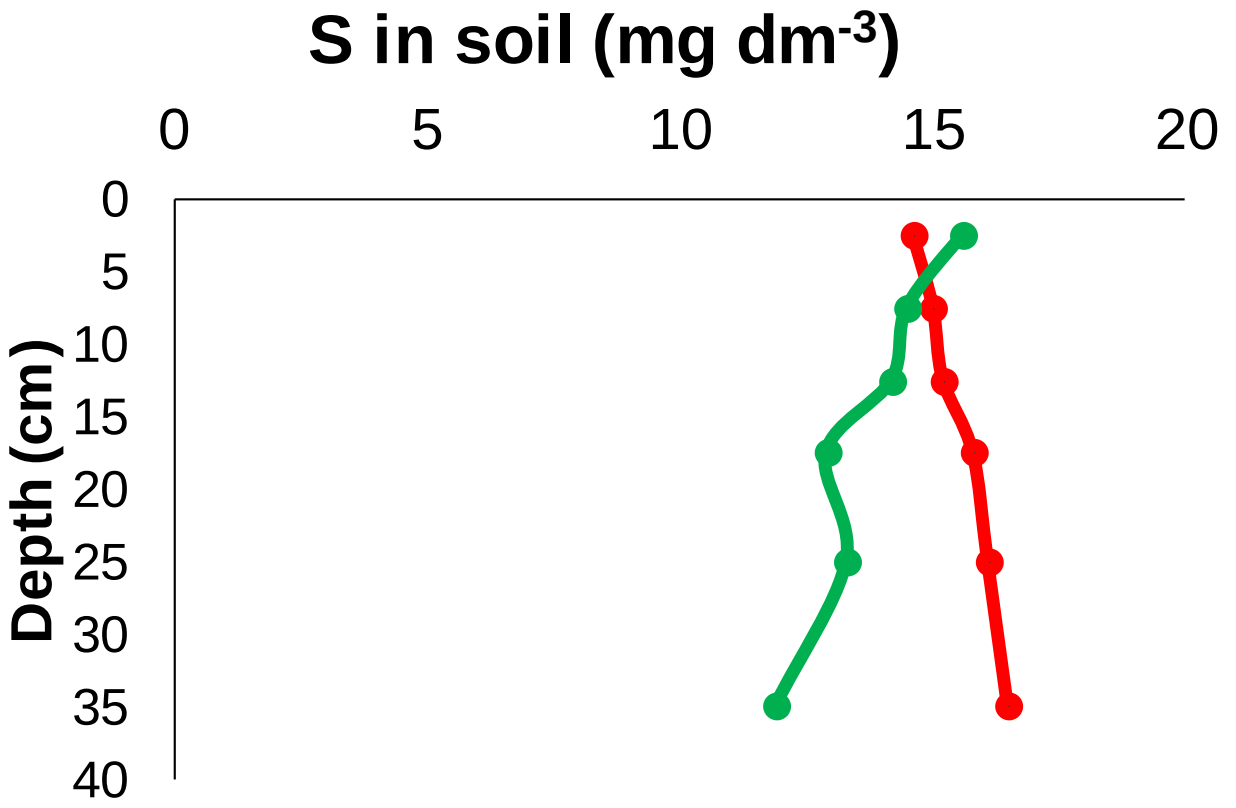
Depth	Mg average (cmol$_c$/dm^3)		Increment in Mg availability	
cm	Polysulphate	Control	cmol$_c$/dm^3	%
0-5	1,53	1,26	0,27	21,4%
5-10	1,63	1,43	0,20	14,0%
10-15	1,49	1,05	0,44	41,9%
15-20	0,97	0,76	0,21	27,6%
20-30	0,71	0,62	0,09	14,5%
30-40	0,44	0,36	0,08	22,2%
Average for depths				
0-20	1,41	1,13	0,28	24,9%
20-40	0,58	0,49	0,09	17,3%

Vale (2016)



Depth	K average (cmol$_c$/dm^3)		Increment in K availability	
cm	Polysulphate	Control	cmol$_c$/dm^3	%
0-5	1,95	1,77	0,18	10,1%
5-10	0,74	0,79	-0,05	-6,5%
10-15	0,56	0,62	-0,05	-8,3%
15-20	0,49	0,56	-0,08	-13,6%
20-30	0,38	0,23	0,15	66,7%
30-40	0,38	0,23	0,15	66,7%
Average for depths				
0-20	0,94	0,94	0,00	0,0%
20-40	0,38	0,23	0,15	66,7%

Vale (2016)



Depth	S average (mg/dm^3)		Increment in S availability	
cm	Polysulphate	Control	mg/dm^3	%
0-5	14,60	15,60	-1,00	-6,4%
5-10	15,00	14,50	0,50	3,4%
10-15	15,20	14,20	1,00	7,0%
15-20	15,80	12,90	2,90	22,5%
20-30	16,10	13,30	2,80	21,1%
30-40	16,50	11,90	4,60	38,7%
Average for depths				
0-20	15,15	14,30	0,85	5,9%
20-40	16,30	12,60	3,70	29,4%

Vale (2016)

Evaluation of polyhalite in soybean, maize and wheat soils of Argentina

Instituto Nacional de Tecnología Agropecuaria

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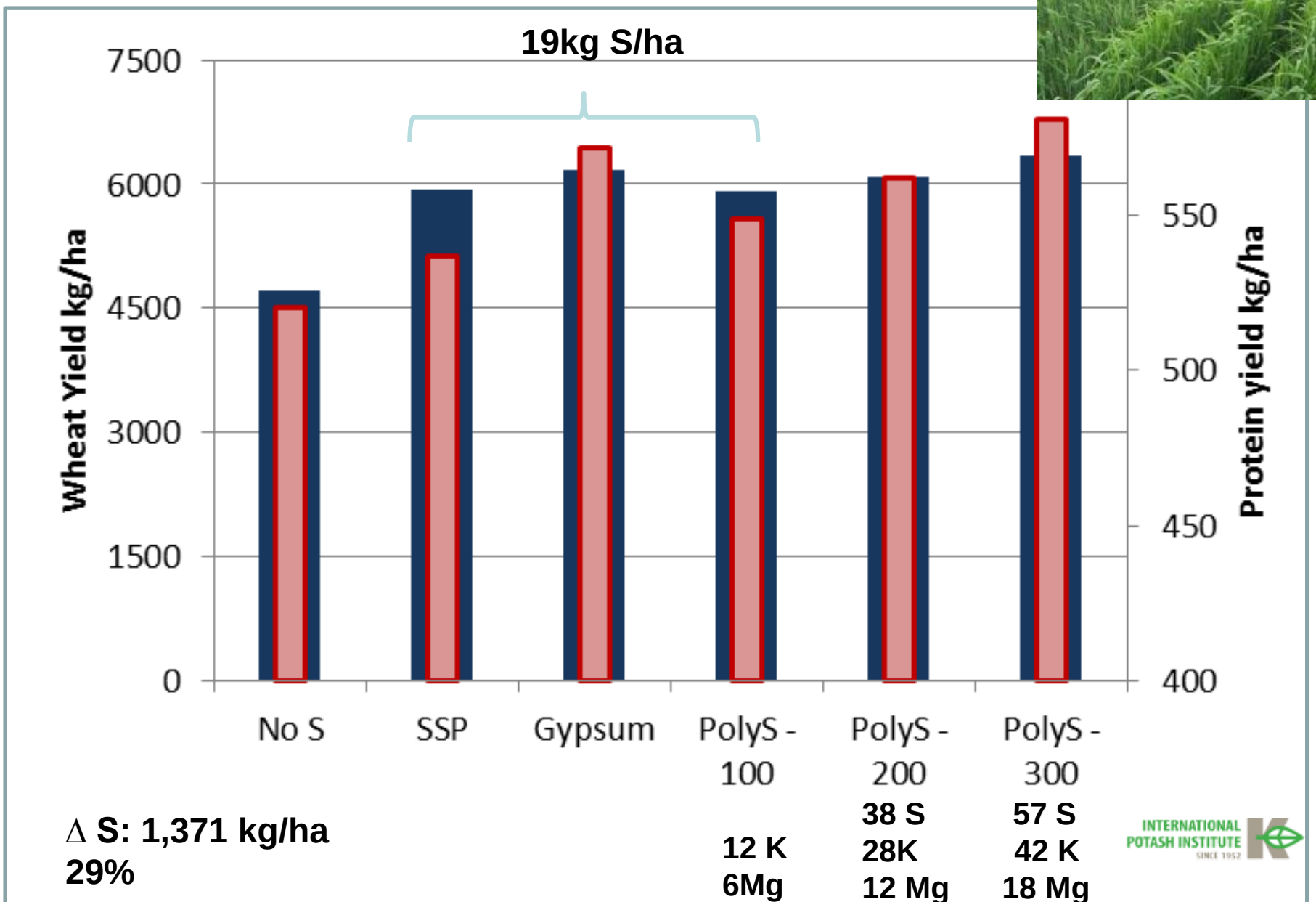
Wheat in Central Pampas, Argentina

Sandy Loam
pH: 5.9
Organic matter: 2.9 %
K: 480 ppm
Mg: 270 ppm
S-SO_4: 7 ppm

Product	Fertilizer	N	P_2O_5	S	K_2O	MgO
	kg/ha					
Check - MAP	58	6	30	-	-	-
Single Superphosphate (SSP)	158	0	30	19	-	-
MAP + Gypsum (34/66)	167	6	30	19	-	-
MAP+ Polyhalite (37/63)	158	6	30	19	14	6
MAP+ Polyhalite (22/78)	258	6	30	38	28	12
MAP+ Polyhalite (16/84)	358	6	30	57	42	18

Strong response to sulfur



∆ S: 1,371 kg/ha
29%

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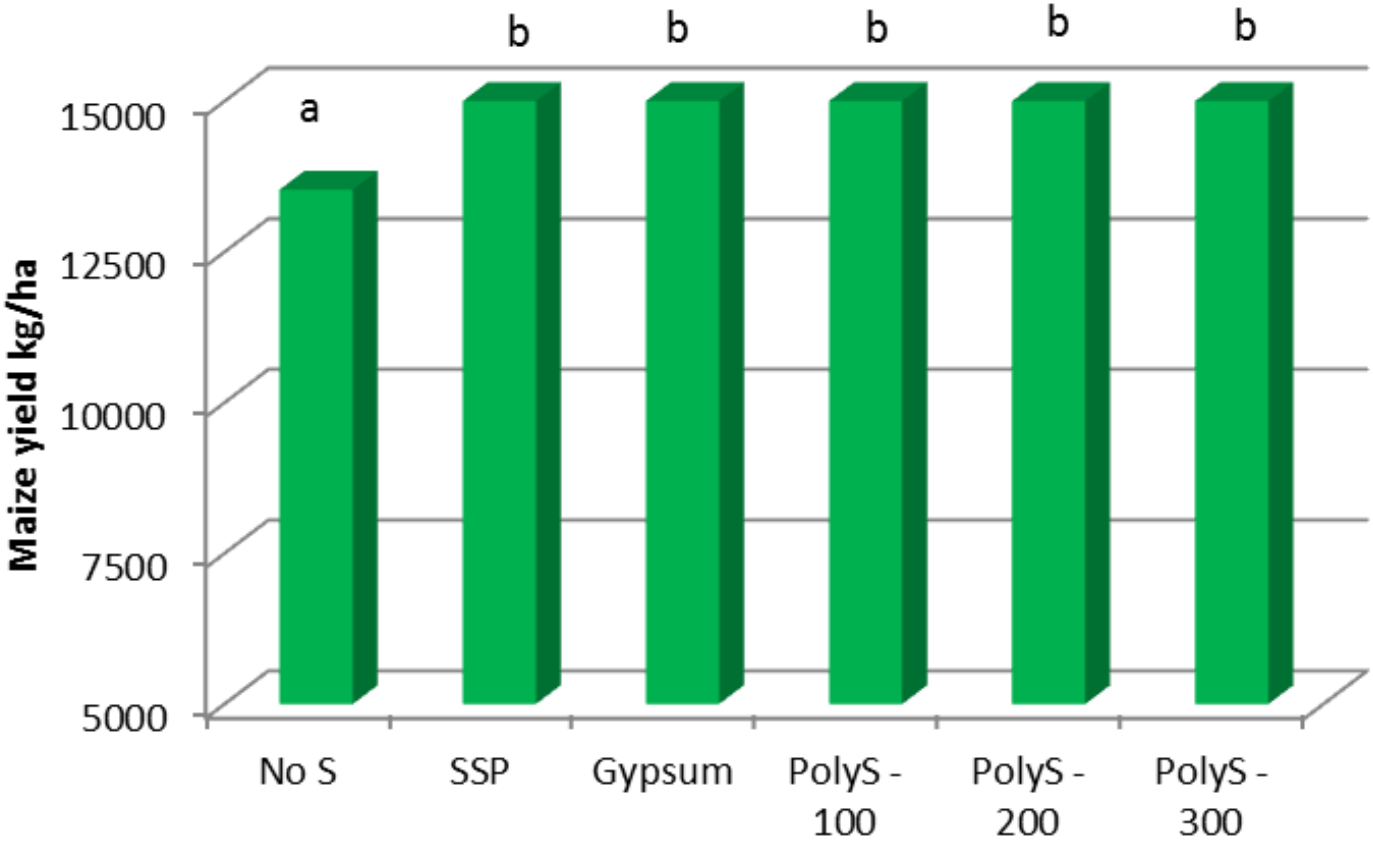
Maize Central Pampas, Argentina

Strong response to S



S: 1,822 kg/ha
3%

No trend or difference due to K & Mg

Soil:
Sandy Loam
pH: 5.8
Organic matter: 3.6 %
K: 440 ppm
Mg: 260 ppm
S-SO_4: 6,5

All treatments had the same P_2O_5

Soil K levels well above sufficiency

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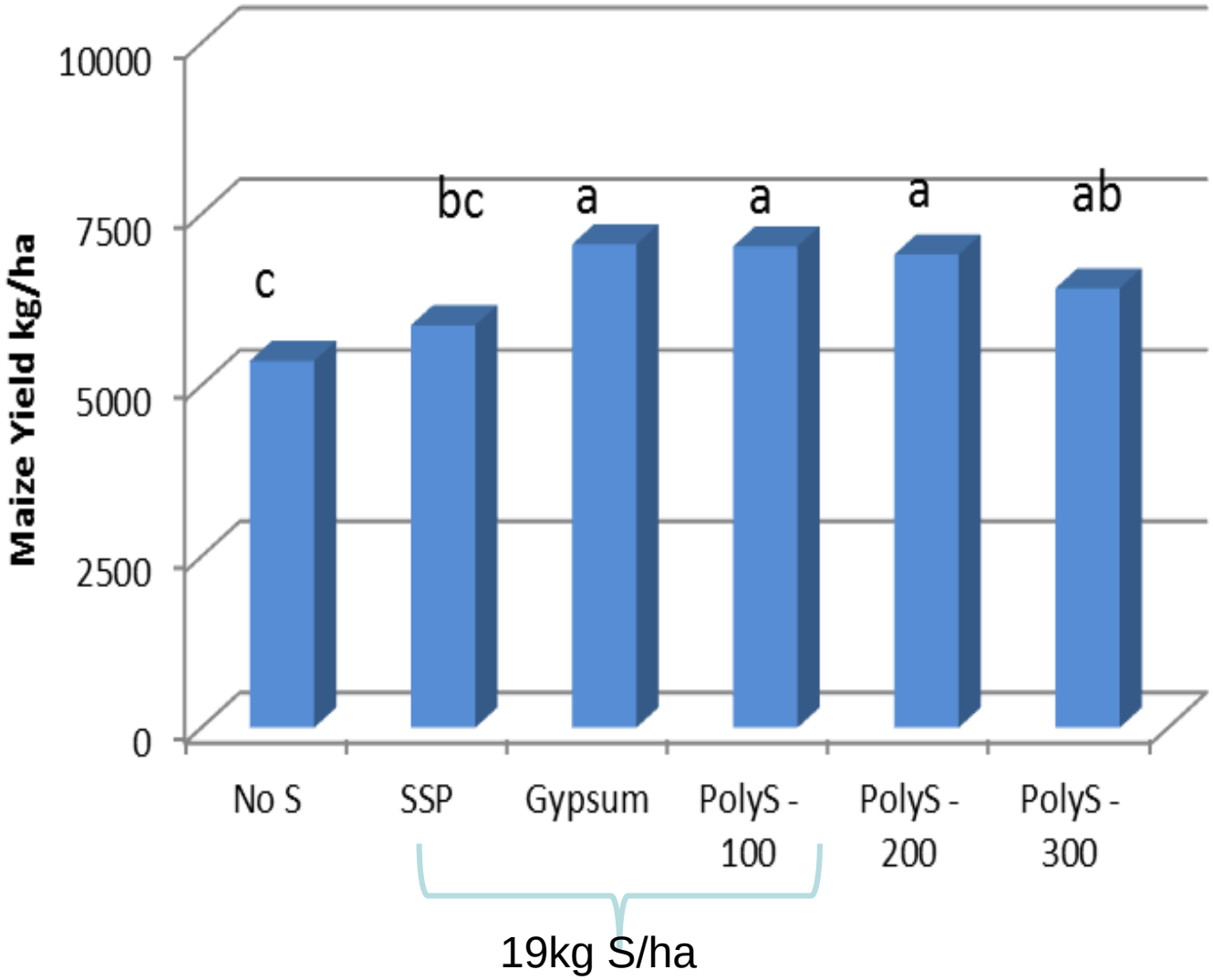
Maize in Northeast Argentina
Strong response to S



∆ S: 1,303 kg/ha
24%

Soil:
Sandy Loam
pH: 5.4
Organic matter: 3.2 %
K: 195 ppm
Mg: 130 ppm
S-SO_4: 3 ppm

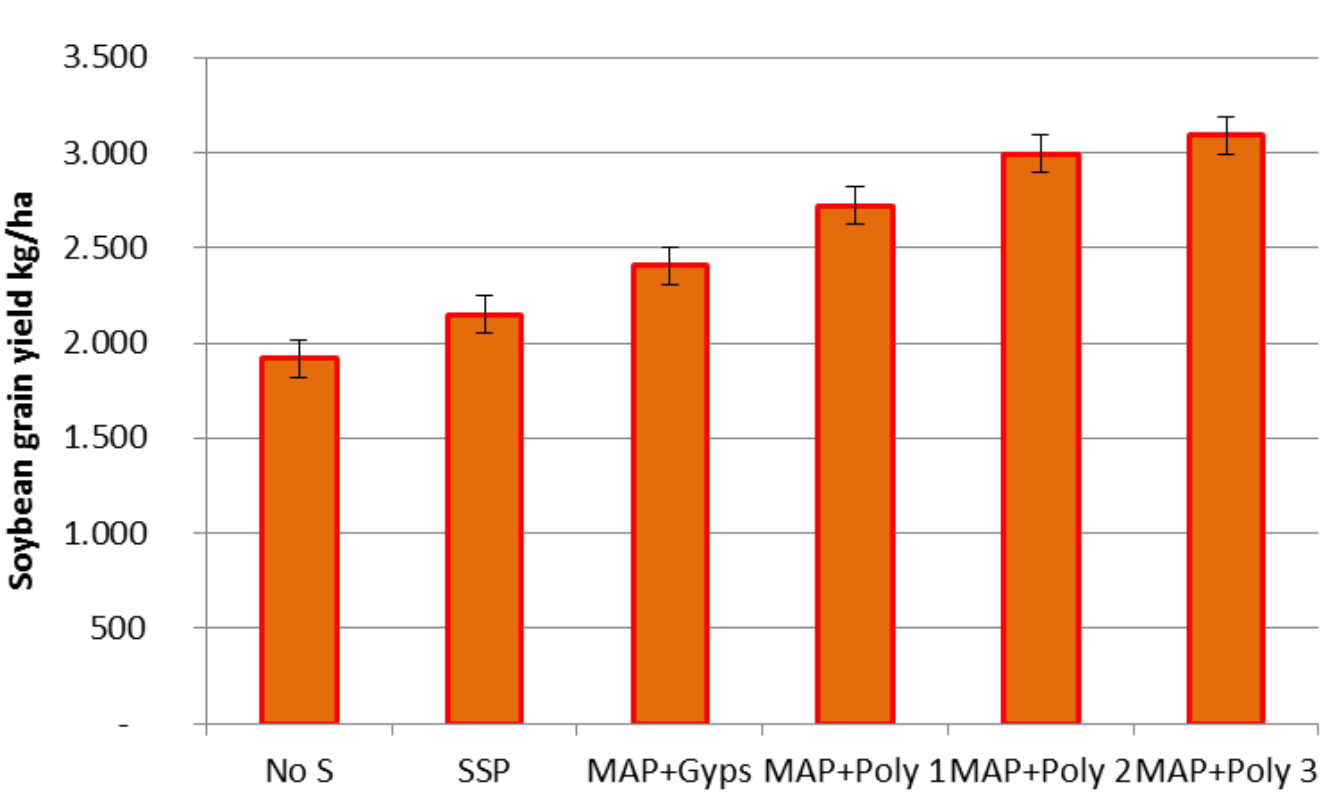
No difference due to K & Mg

In spite of low soil K, low yields made K levels sufficient

Soybean in Northeast Argentina

Soil

Sandy Loam
pH: 5.2;
Organic matter: 2.8 %
K: 90 ppm
Mg: 110 ppm
S-SO_4: 3.3 ppm



∆ S: 753 kg/ha
35%

∆ K-Mg: 665 kg/ha
27 %
1,9 kg Soy/kg Pyhte

Soil K levels not sufficient

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Alfalfa experiment–France

The whole field received 300 U of GMOP in October

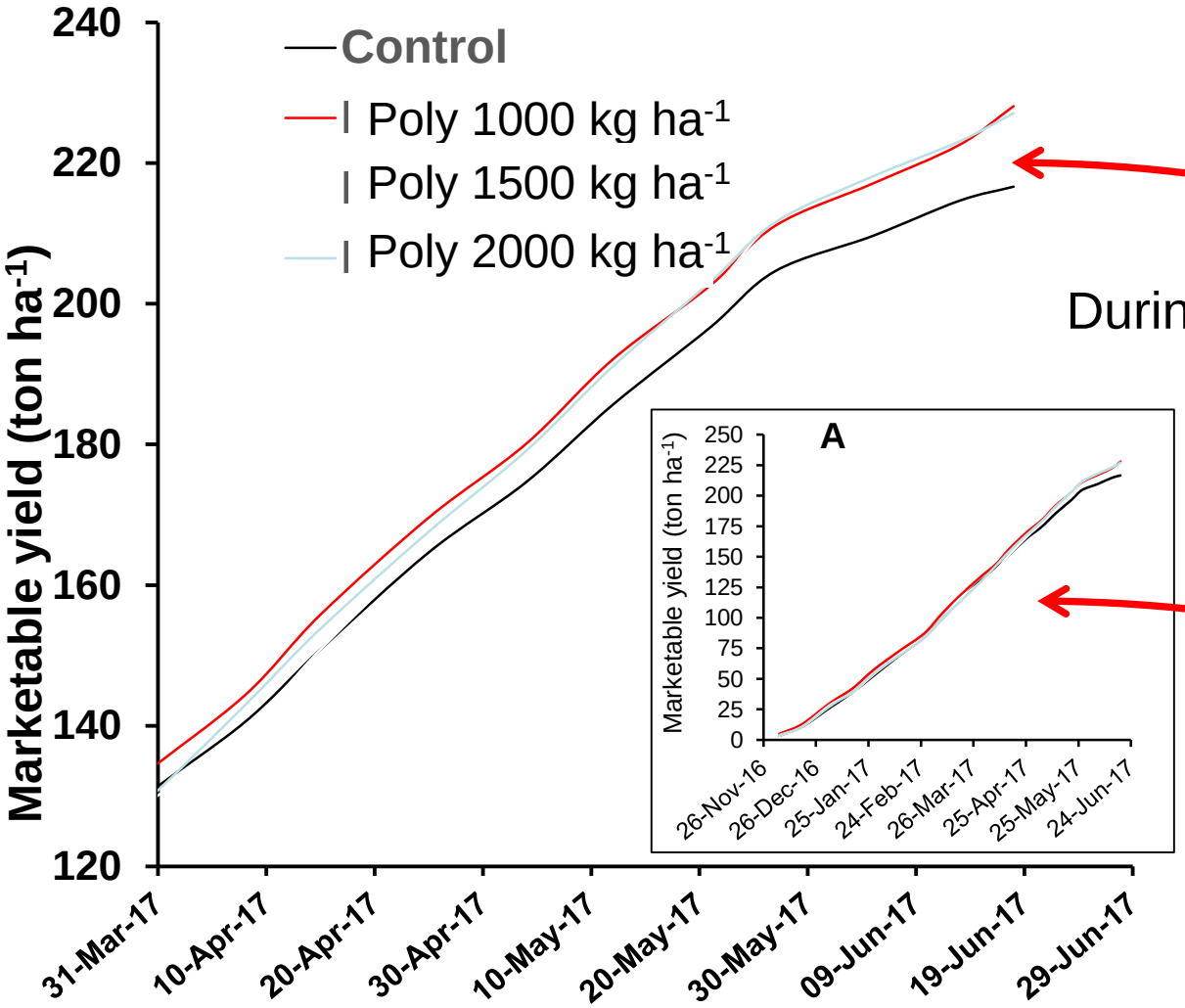
Alfalfa in 3rd year

Polyhalite in tomato greenhouse: preventing Ca & Mg deficiencies under desalinized water, Israel

- Movie

Polyhalite in tomato greenhouse: preventing Ca & Mg deficiencies under desalinized water, Israel

Yield



During spring, from April to June

Throughout the season

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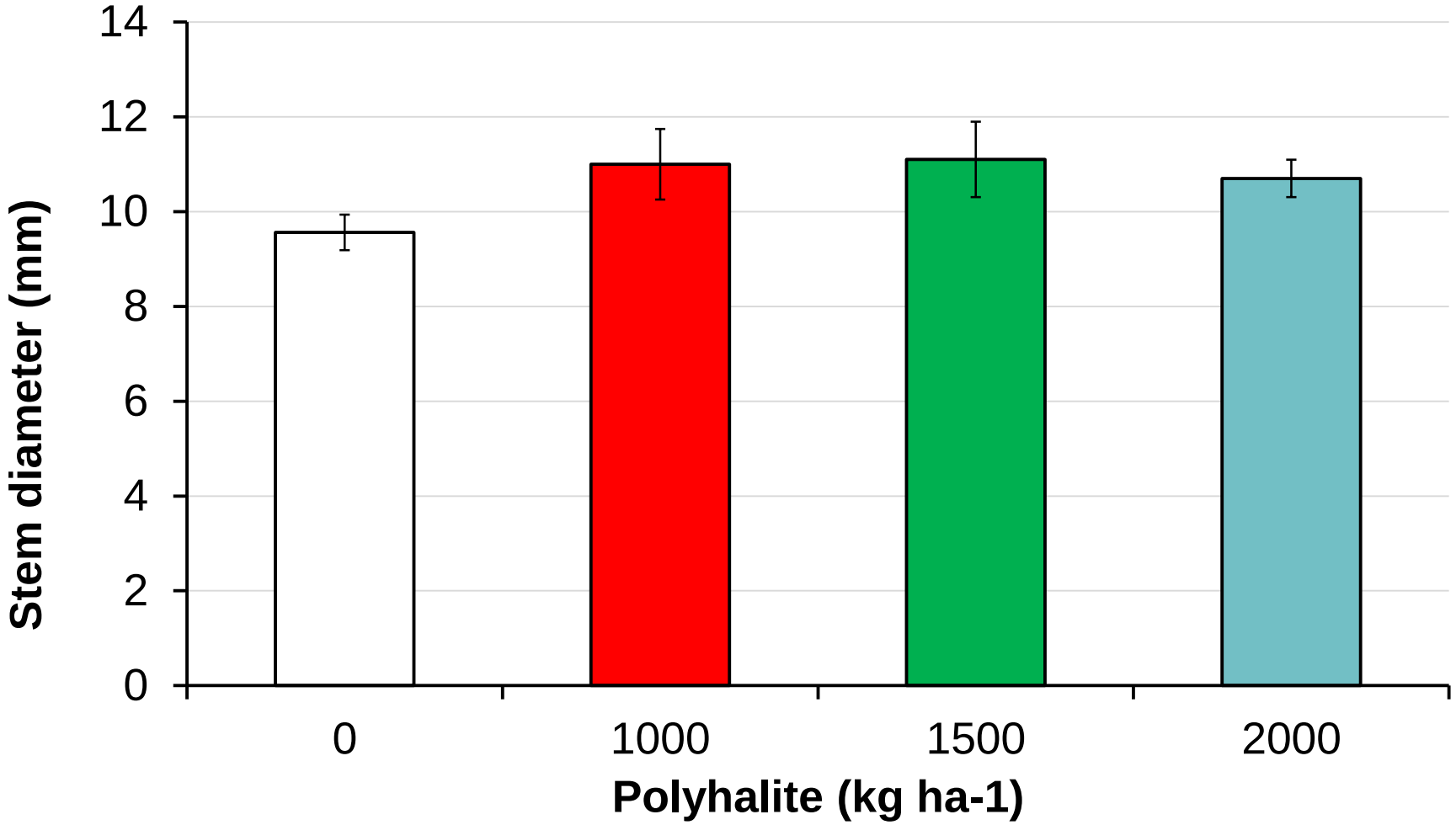
Polyhalite in tomato greenhouse: preventing Ca & Mg deficiencies under desalinized water, Israel

Tomato stem diameter below the uppermost inflorescence on 23-May, 2017



Polyhalite in tomato greenhouse: preventing Ca & Mg deficiencies under desalinized water, Israel

Magnesium deficiency in leaves

Poly 0 kg ha^{-1}

Poly 2000 kg ha^{-1}

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