

Cation availability with POLY4 compared to other nutrient sources

Timothy D Lewis, Rachel Fields, Ross Mitchell
Anglo American Crop Nutrients, Scarborough, United Kingdom

Introduction

Polyhalite (POLY4) is a multi-nutrient fertilizer containing potassium, calcium, magnesium and sulphur ($K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$). The mineral has a sustained dissolution rate which can deliver nutrients throughout the crop growing season. A number of leaching column studies were conducted with different soils at different institutions to evaluate POLY4 under different conditions. The aim was to assess the quantity and rate that nutrients are released at, compared to conventional fertilizers that also supply at least one of K, S, Ca or Mg.

Methodology

Column trials were conducted with sandy loam soil from Aberdeen, UK and from sandy loam and calcareous soils in Florida, USA.

Columns were 30 cm deep and had no plants growing in them and excess water was applied to ensure drainage. Leaching is therefore a proxy for nutrient availability.

The trials compared different potassium containing fertilizers:

- POLY4 and MOP (KCl) in both Florida and UK soils.
- SOP (K_2SO_4) and SOP-M ($K_2Mg_2(SO_4)_3$) in Florida only.

The potassium application rate supplied was balanced among treatments within each trial. In addition, a control that did not receive K was used to measure the baseline nutrient mobilisation of the soil. This baseline was subtracted to give the fertilizer treatment effect. Nutrient leachate and volume was measured from each column and converted to $kg\ ha^{-1}$. This value was then divided by the application rate to give the percentage of nutrient applied by each fertilizer treatment.

Graphs are shown as cumulative values. Vertical lines are the volume of water required to fill the pore volume of the column, based on the soil texture and column depth.

Aberdeen, UK		Application rate ($kg\ ha^{-1}$)				
	POLY4	K_2O	S	MgO	CaO	Cl
Control (NP)	0	0	0	0	0	0
MOP	0	100	0	0	0	77
POLY4	714	100	136	43	121	21

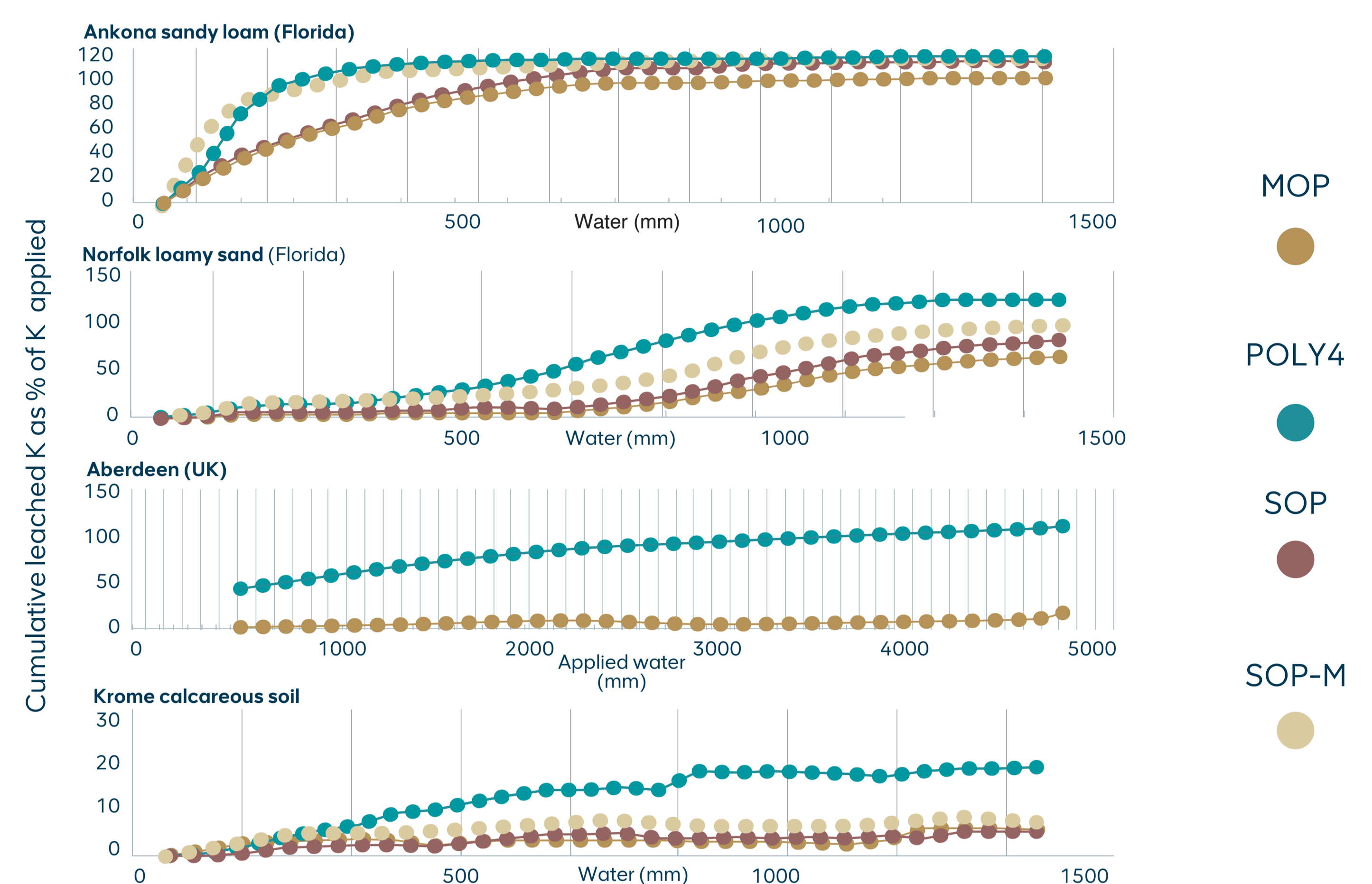
Florida, USA		Application rate ($kg\ ha^{-1}$)				
	POLY4	K_2O	S	MgO	CaO	Cl
Control (NP)	0	0	0	0	0	0
MOP	0	300	0	0	0	230
SOP	0	300	106	0	0	0
SOP-M	0	300	300	164	0	0
POLY4	714	300	385	122	345	61

Potassium mobilisation

With the Florida soils all fertilizers mobilised K. POLY4 mobilised more K (>100%) than was applied on both soils. The MOP consistently had lower K mobilisation, with only 63% of K mobilised on the loamy sand.

With UK soils, mobilisation of K supplied by POLY4 was again greater than that of MOP. Approximately 70% of K from POLY4 was mobilised. In contrast, MOP had little difference in K compared to the baseline control. By the end of the trial, 11% of the K applied from MOP was mobilised.

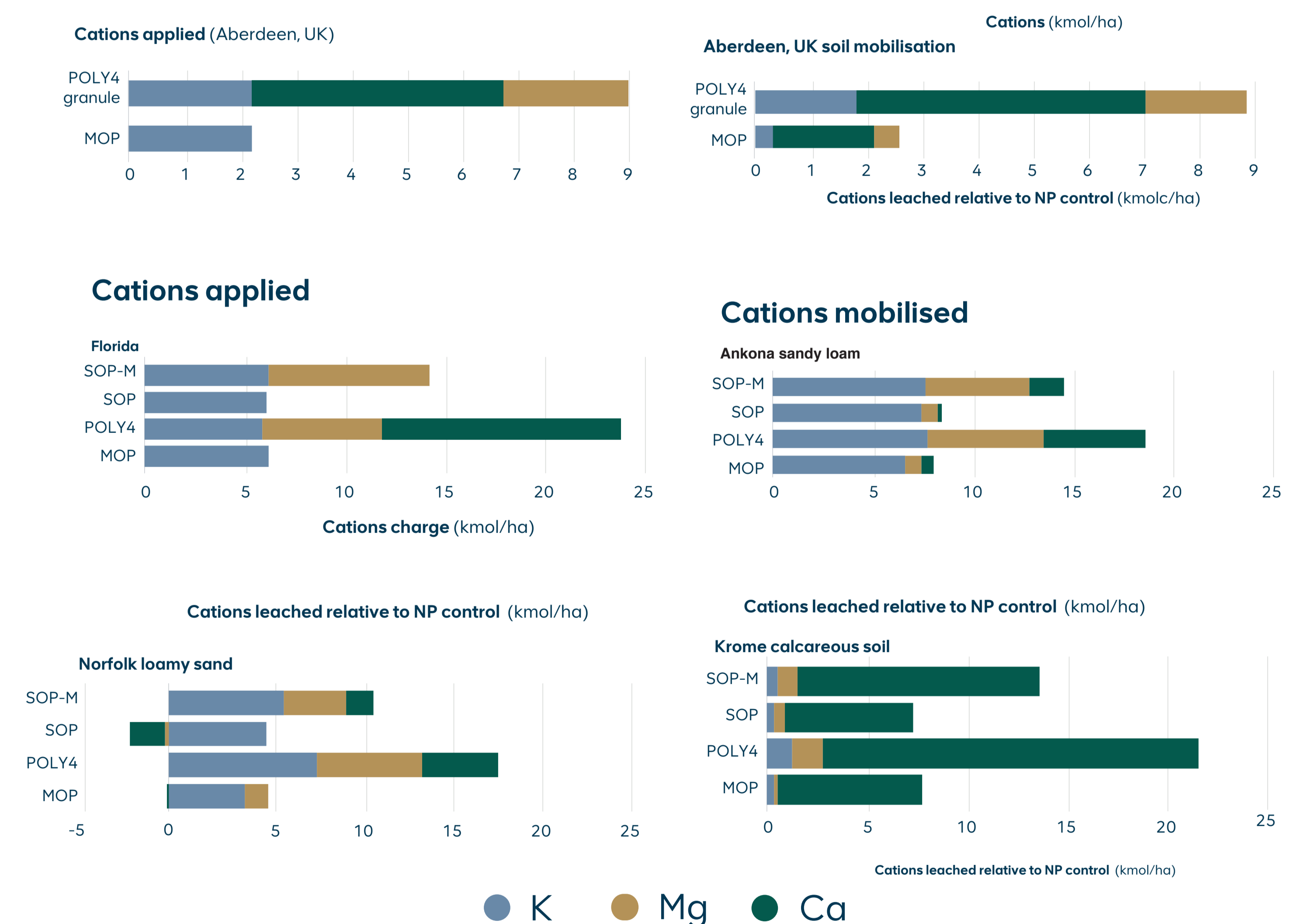
With the calcareous soil from Florida the scale of the results was quite different and more complex, but the ranking of nutrient availability remained consistent with other soils above. Only the POLY4 treatment mobilised a substantial amount of K (18% of K supplied). Again the other K fertilizers were less effective at providing K for the soil solution (<7.5% of K supplied by MOP, SOP and SOP-M).



Distribution of nutrients mobilised

When total cations applied (moles of charge) by POLY4 or MOP were compared to total cations mobilised (moles of charge), it was found that both treatments mobilised proportionally a similar total charge.

With the Ankona sandy loam and Norfolk loamy sand the distribution of cations applied was comparable to the distribution of nutrients mobilised. However with the Aberdeen soil and Krome calcareous soil a large amount of additional Ca was mobilised. However, the POLY4 treatment had a greater quantity of potassium and magnesium mobilised despite supplying the same rate of K, and less Mg than SOP-M.



Conclusion

POLY4 consistently mobilised a greater proportion of all cations applied than other fertilizer sources. NB: This was also true for K mobilised although fertilizer rates varied so the same K was applied.

POLY4 consistently mobilised a greater proportion and total quantity of potassium than other K sources.

POLY4 was the only treatment in Florida that leached more K than it put in (non-calcareous soils). POLY4 mobilised K in the calcareous soil and the Aberdeen soil. Other K fertilizers were quite ineffective at mobilising K.

POLY4 consistently leached the greatest Mg, even when the Mg rate was lower with POLY4 than the comparative treatment (i.e. SOP-M in Florida).