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Soil Acidity in Sandy Soils of the North West & Free State Provinces

Kobus van Zyl
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North West and Free State provinces



Historical findings (2002-2015) in the Free State

- The median pH(KCl) of the topsoil deteriorated by 0.17 pH units to a pH of 4.23
- The median acid saturation (%) increased by 92% in the topsoil
- The median subsoil pH(KCl) decreased from 4.25 to 4.15
- The median acid saturation (%) increased by 39% in the subsoil

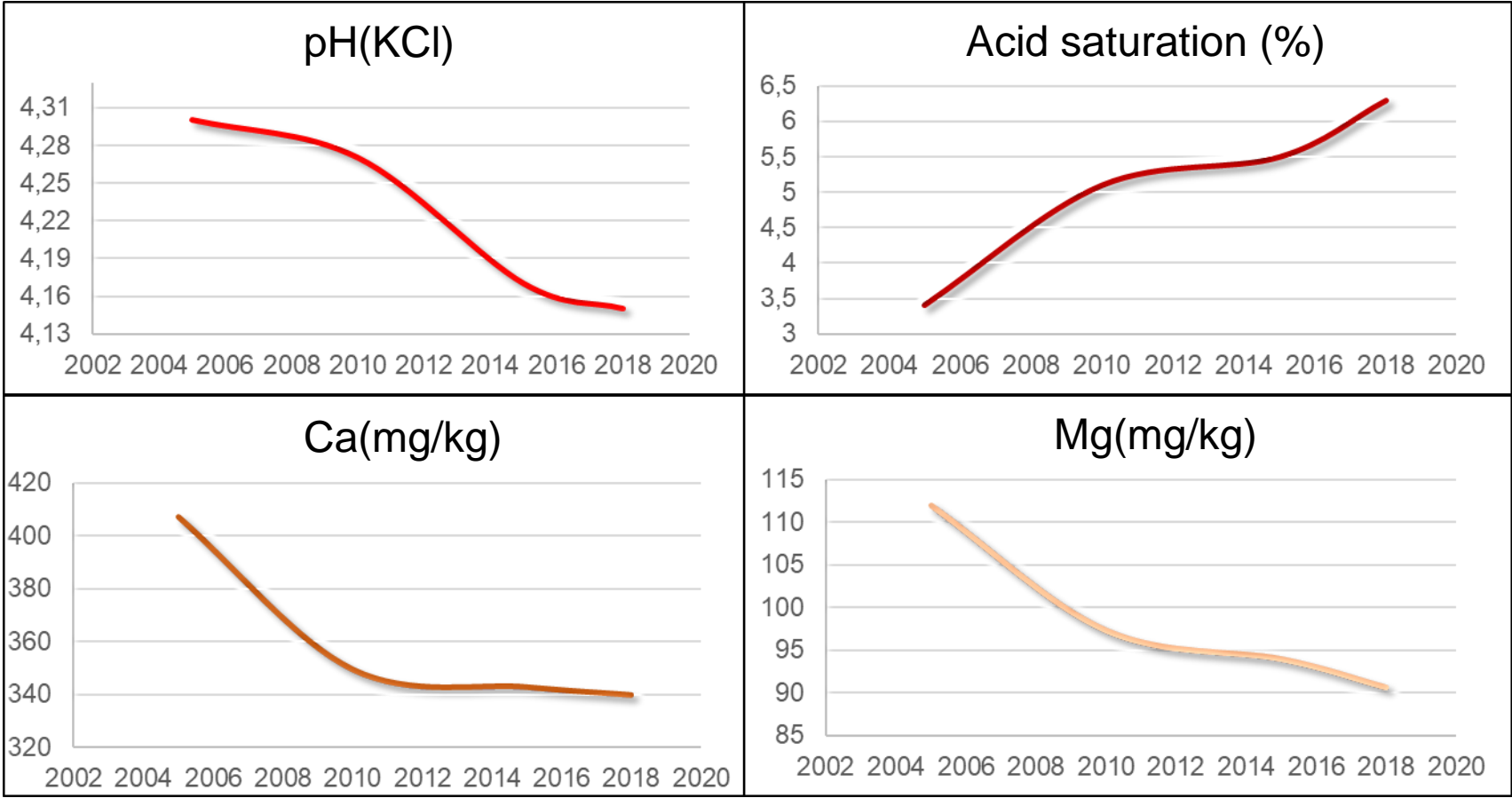
Fourie and Bornman, 2015

Historical findings (2015-2018) in the Free State

- The median pH of the subsoil remains less than 4.2
- The median acid saturation(%) increased since 2015 with a further 13%
- Basic cation loss is also evident
 - Calcium loss from the subsoil was 15% since 2002
 - Magnesium loss from the subsoil was 20% since 2002

Bornman, 2018

Three year rolling averages of key soil analyses values indicating acidification of the subsoil of the Free State Province (from 2002 to 2018)

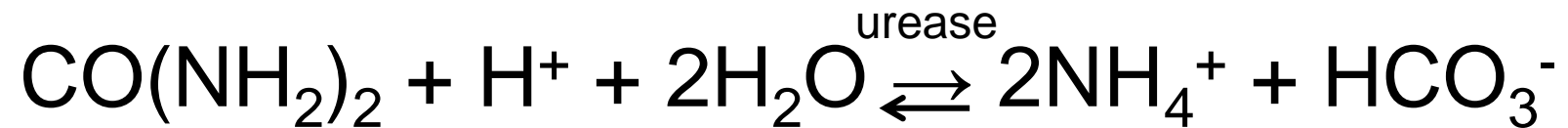


Reasons for acidification

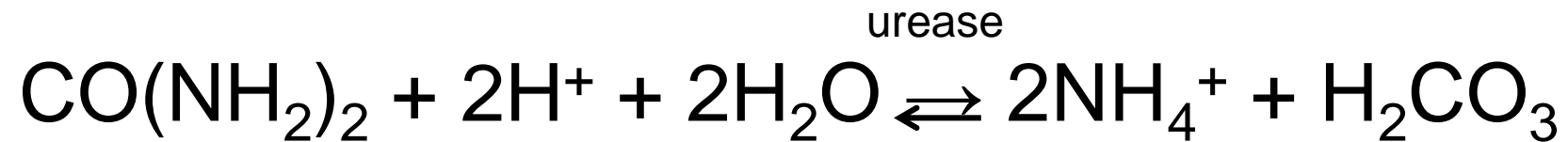
- Ineffective use and leaching of nitrogen
- Nitrogen sources (ammonium nitrate and urea)
- Tillage practices
- Contribution of different soils and soil clay content
- Irregular and insufficient liming of the topsoil
- Increased nitrogen rates
- Crop removal of Ca and Mg

Nitrogen management

Urea hydrolysis at pH 6.5 – 8.0

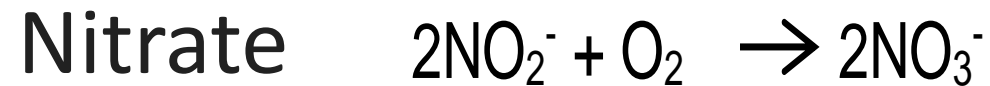


Urea hydrolysis at pH < 6.5

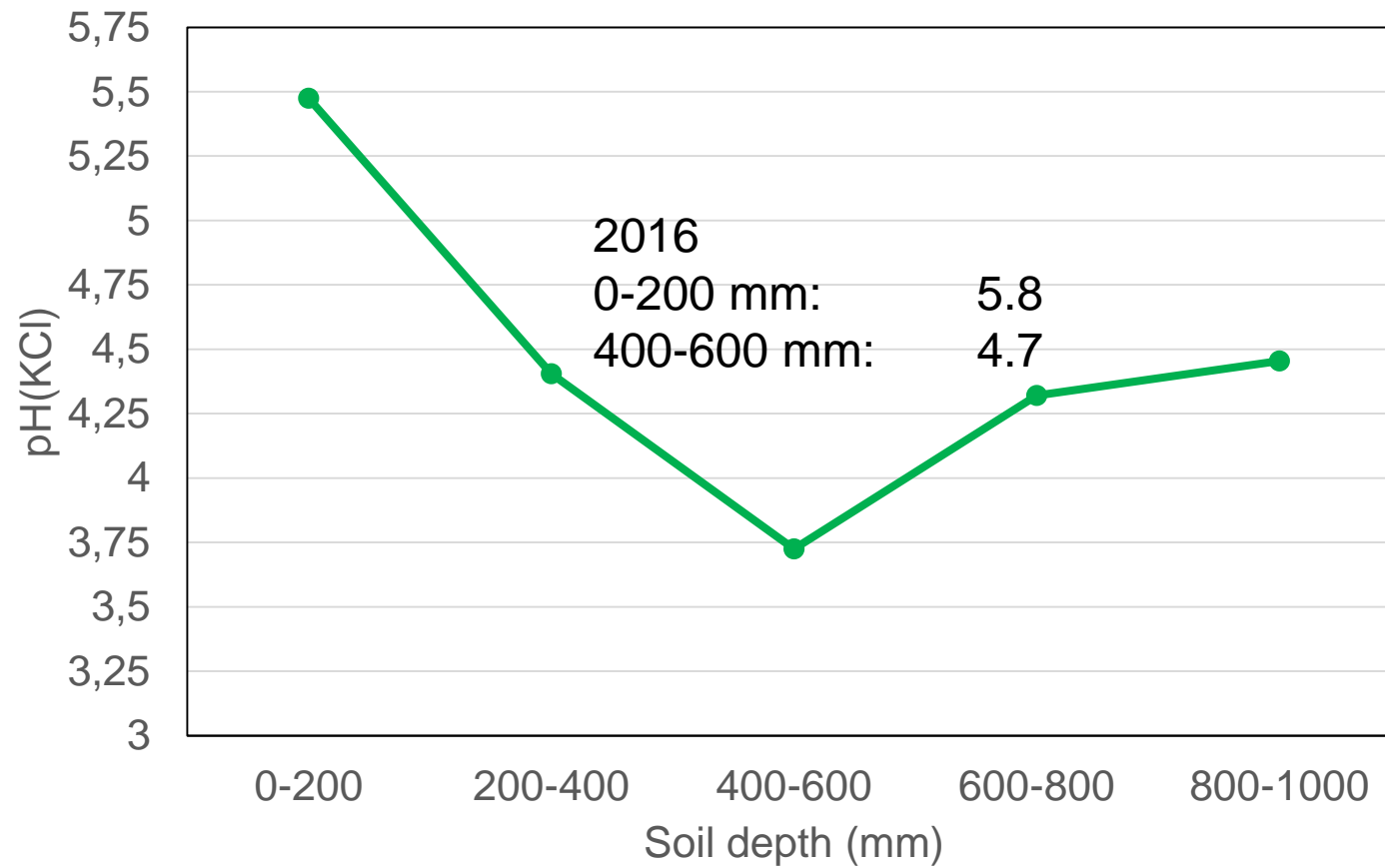


Nitrogen management

Nitrification



Soil acidity on water table soils



Soil acidity on water table soils





What happens in field?



©

Jan du Toit

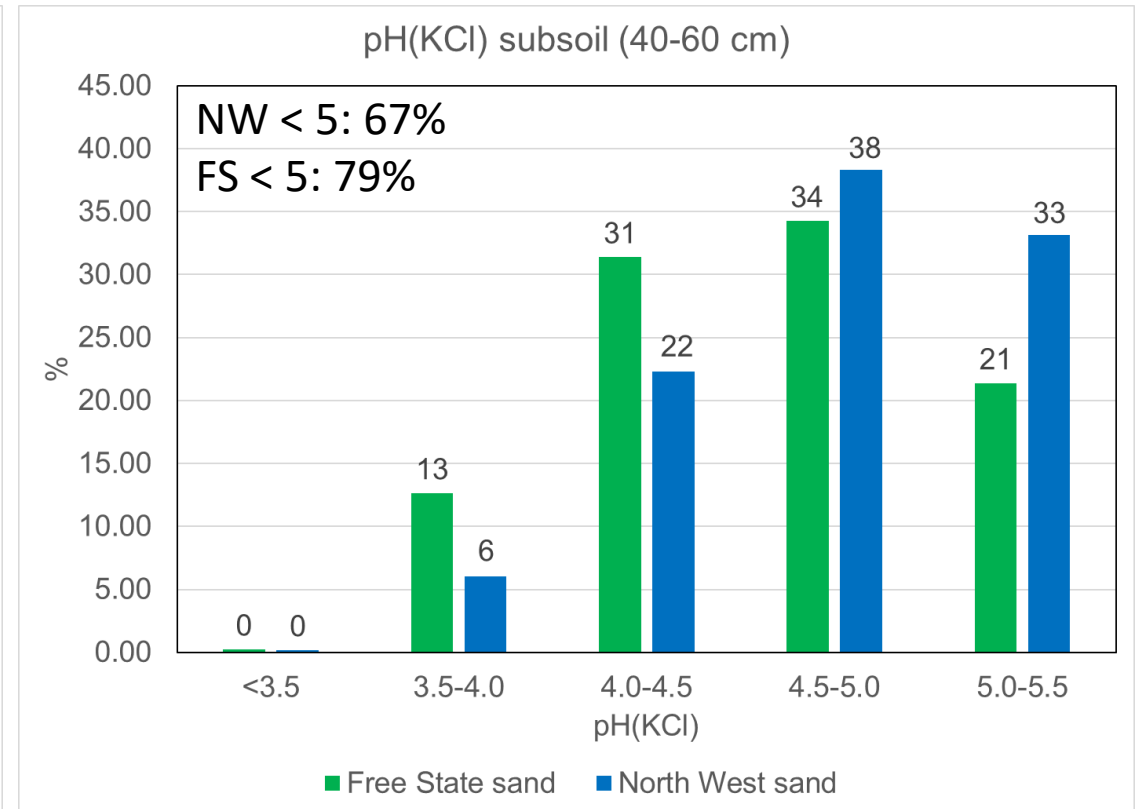
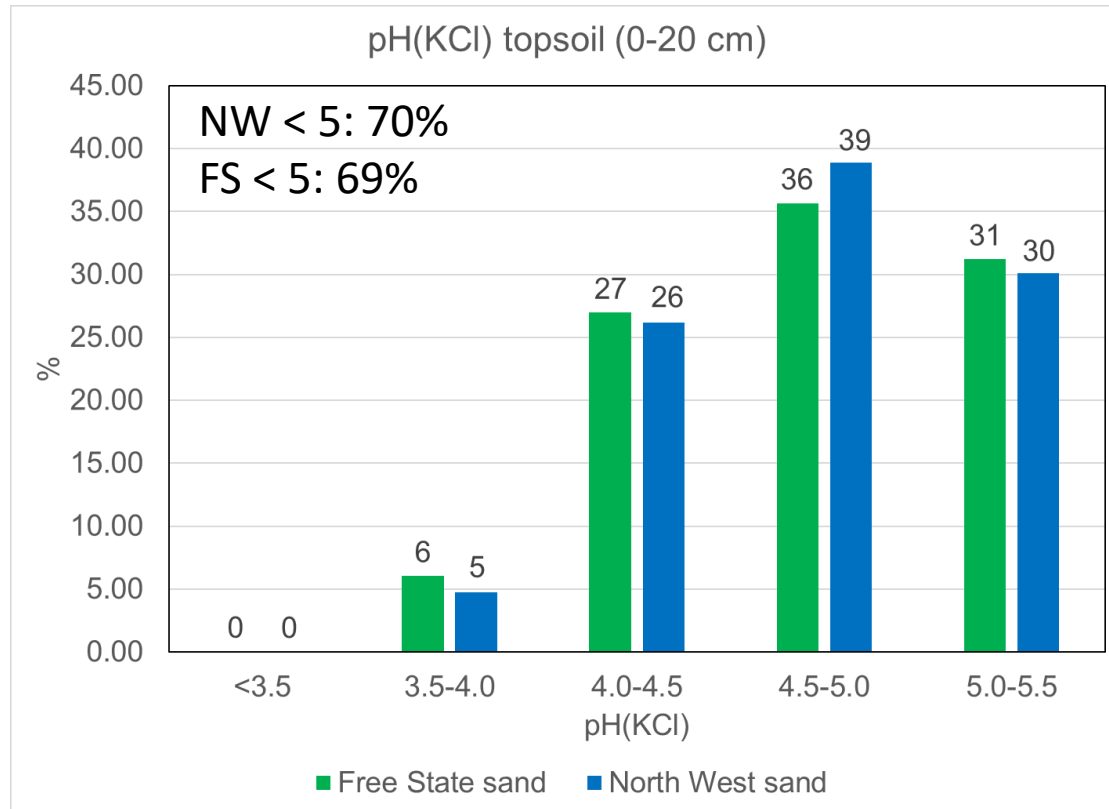
What happens in field?

Ca(mg/kg)							Mg(mg/kg)						
													
157	144	150	160	159	151	157	49	43	48	51	54	51	41
212	244	193	189	211	215	219	63	69	67	65	68	62	48
157	127	161	178	166	183	126	45	36	44	52	48	49	38
128	103	136	161	117	112	138	41	32	42	42	44	49	39
131	128	136	153	150	100	121	48	39	49	54	61	49	35
139	117	126	120	151	144	174	43	37	38	40	50	46	45
	< 100	100 - 150	150 - 200	200 - 250				< 30	30 - 50	50 - 70	70 - 90	90 - 120	120 - 150

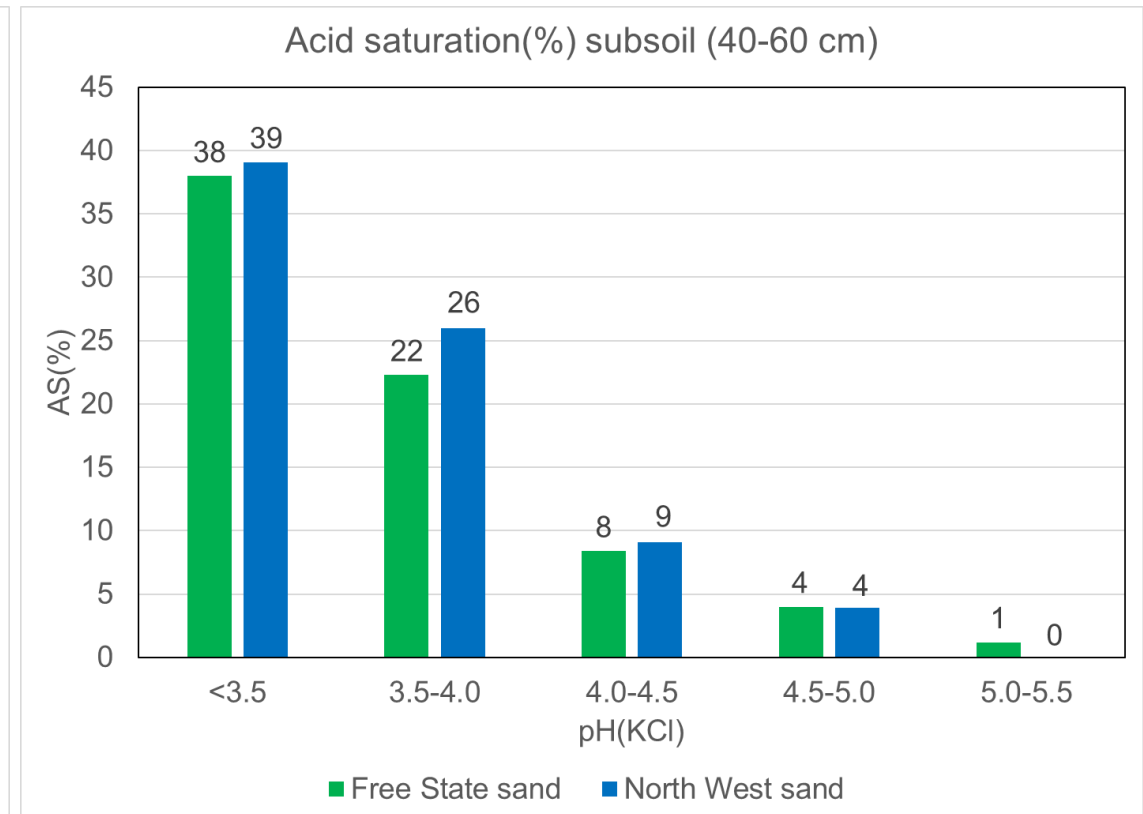
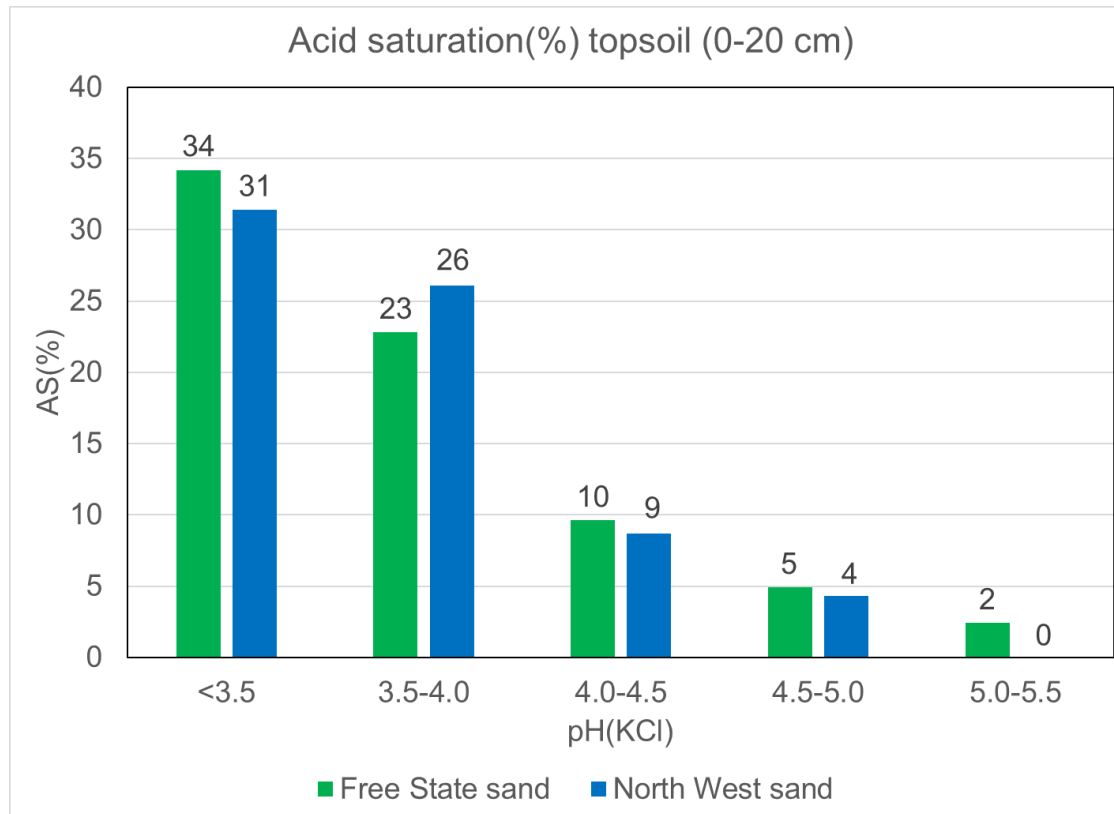
What happens in field?

Analysis	Original soil sample	3-4 years after liming
pH(KCl) topsoil	5.5	5.3
pH(KCl) subsoil	4.52	5.2
Ca(mg/kg) topsoil	187	412
Ca(mg/kg) subsoil	167	428
Mg(mg/kg) topsoil	52	96
Mg(mg/kg) subsoil	54	96

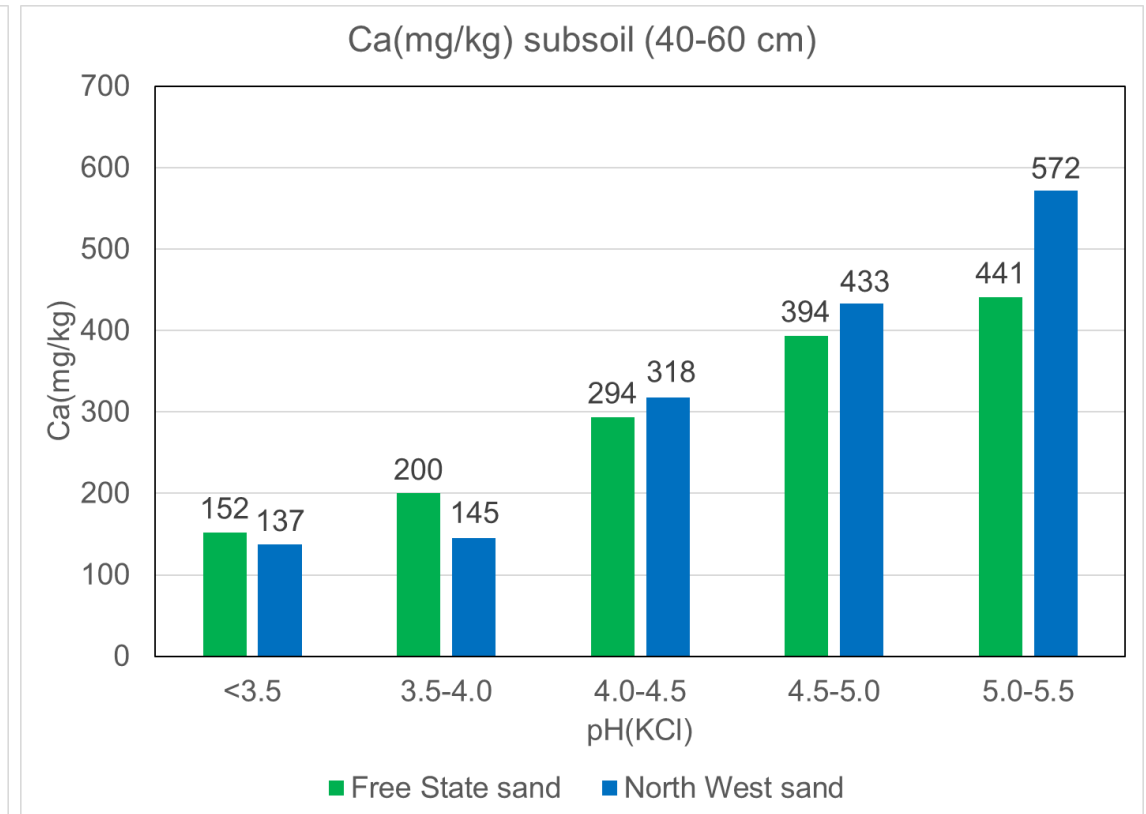
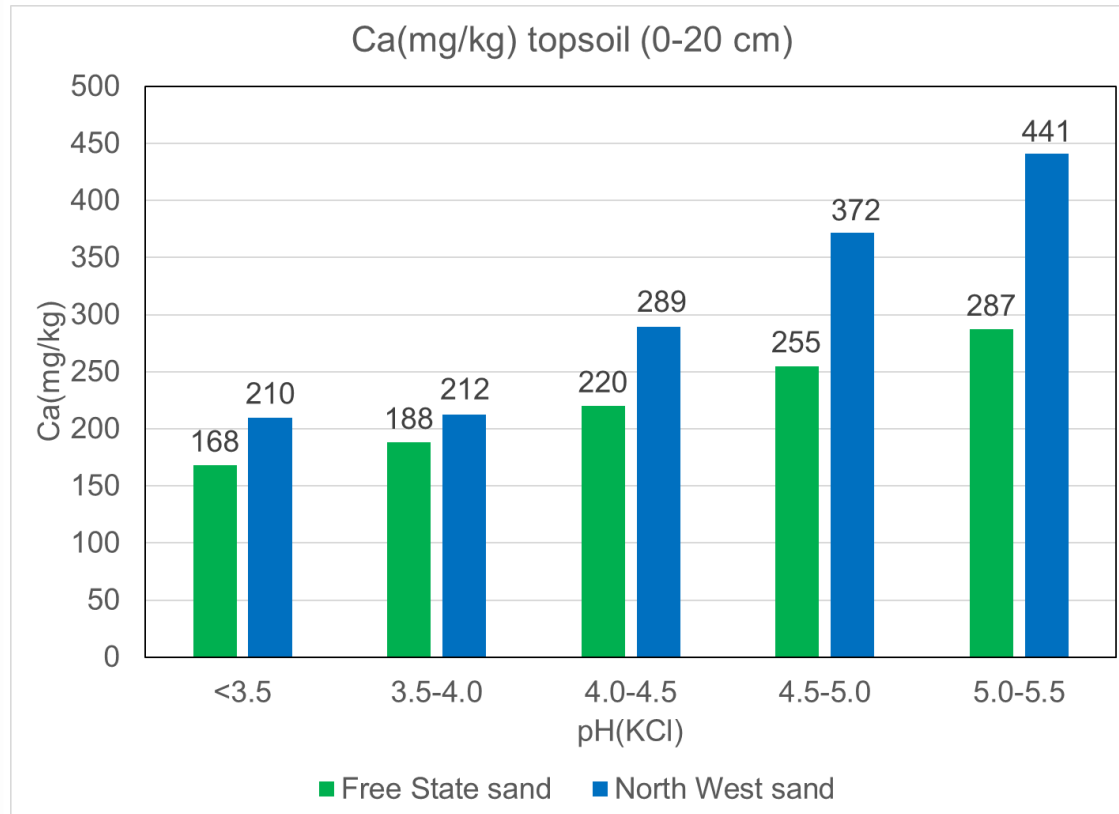
pH(KCl) of North West and Free State sandy soils



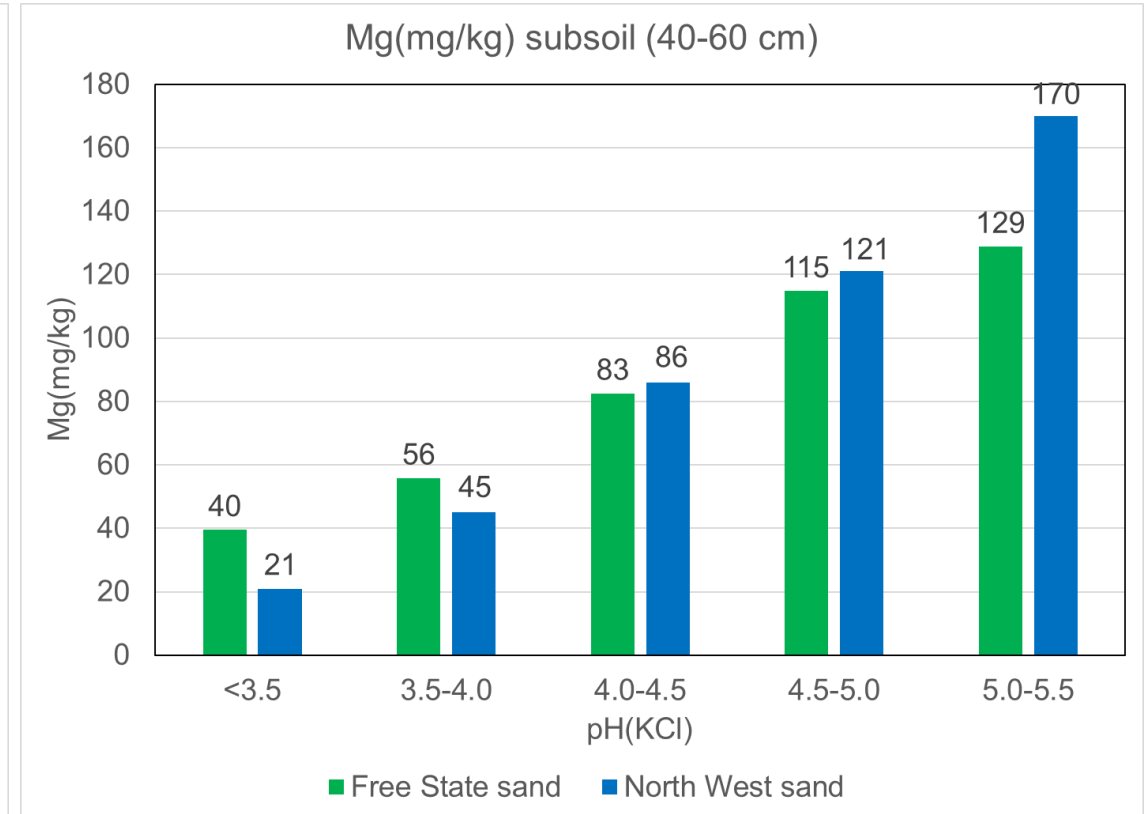
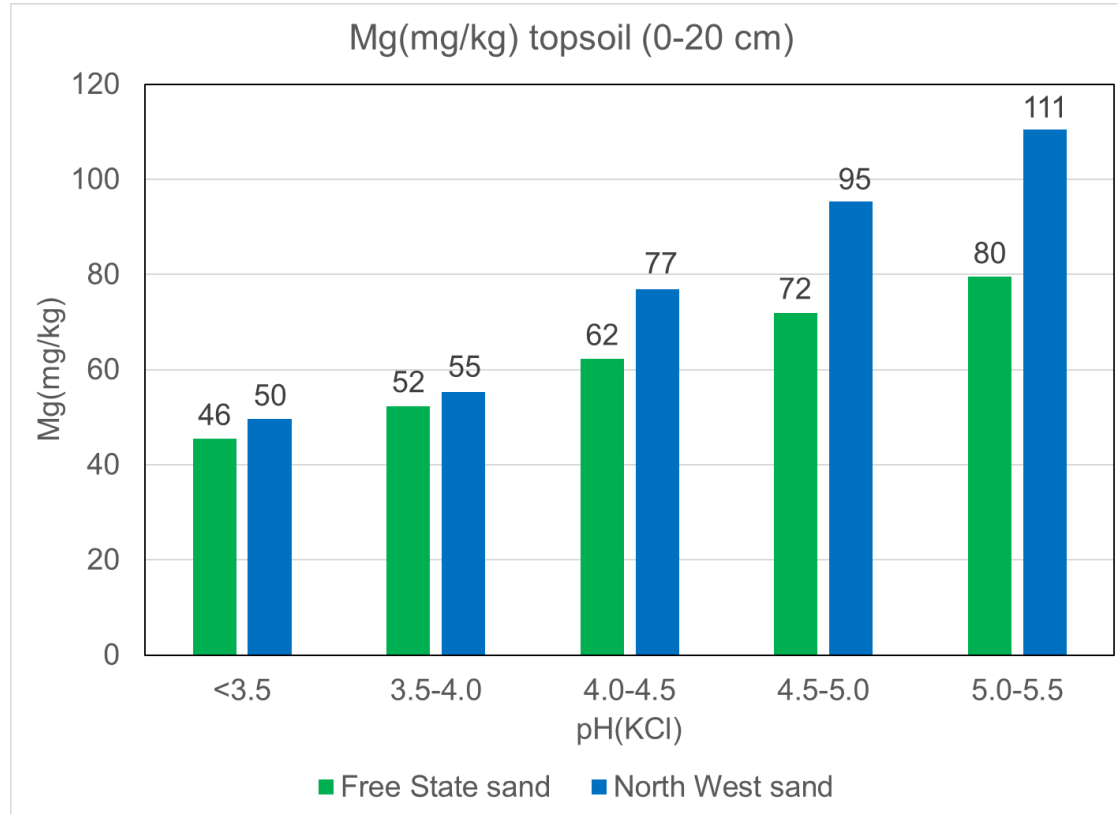
Acid Saturation (%) of North West and Free State sandy soils



Ca(mg/kg) of North West and Free State sandy soils



Mg(mg/kg) of North West and Free State sandy soils



Summary

- Lime the soil and fertilize the plant
- Subsoil acidity is not easy to rectify and will take time
- Monitor regularly – at least once ever 3 years or more frequent
- Effective liming= effective utilization of nutrients, soil moisture and a healthy soil biological system
- We need effective and healthy plant roots
- Strive for consistent and sustainable results
- How do we manage nitrogen to avoid subsoil acidity?



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