

# Causes of soil acidity

# Time to *Re-Lime* Lime

Soil acidification is a natural process accelerated by agriculture. Soil acidifies because the concentration of hydrogen ions in the soil increases. In WA the two main causes of soil acidification are export of carbon in produce and inefficient use of nitrogen.

## Export of carbon

Plant roots take up nutrients as either cations, which are positively charged (eg ammonium, potassium, calcium, magnesium) or as anions, which are negatively charged (eg nitrate, phosphate, sulphate). Plants absorb more cations than anions and each time a positively charged cation is absorbed by the plant, it must excrete a positively charged hydrogen ion into the soil to maintain electrical balance. Accumulation of these hydrogen ions in the soil results in acidification.

Most plant material is slightly alkaline and removal by grazing or harvest leaves residual hydrogen ions in the soil. Over time, as this process is repeated, the soil becomes acidic.

## Nitrate leaching

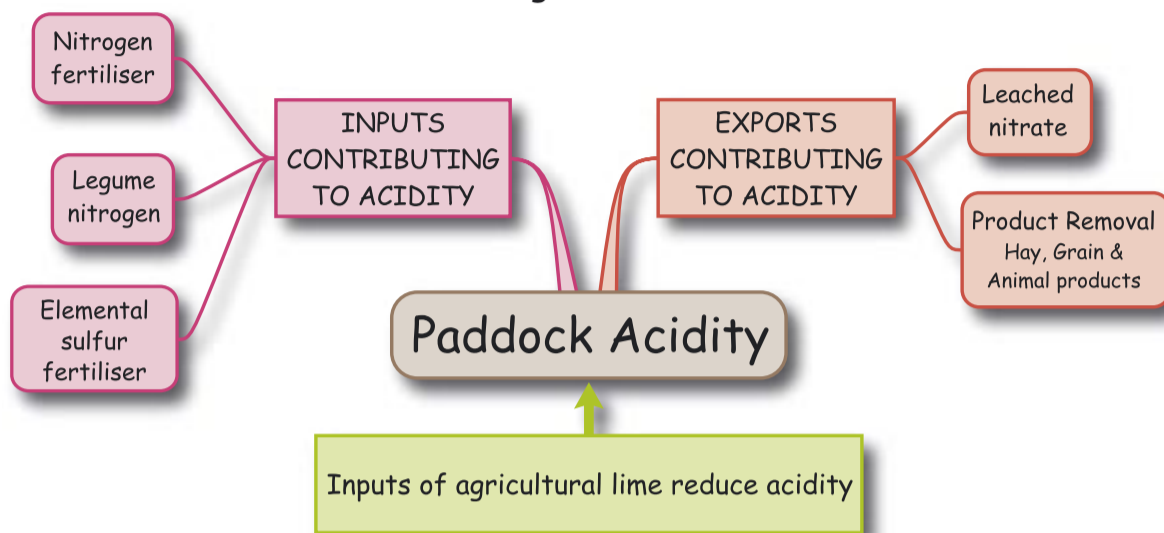
Ammonium nitrogen is readily converted to nitrate and hydrogen ions in the soil. If the negatively charged nitrate ions are taken-up by plant roots, negatively charged hydroxide ions are excreted to maintain the electrical balance and there is no soil acidification.

If nitrate (negatively charged) is not taken-up by plants, it can leach away from the root zone. If nitrate leaches, a positively charged cation is also leached to maintain electrical balance. The cations that leach are usually sodium, potassium or calcium because hydrogen ions are more strongly held by the soil.

### Measuring soil pH

- When measuring soil pH in WA, it is standard to mix one part soil to five parts (CaCl<sub>2</sub>) solution. CaCl<sub>2</sub> is used because it reduces any effect of salt concentration on the measurement.
- pH measured in water will read higher than in calcium chloride.

Agricultural practices add acid to the soil which needs to be treated with agricultural lime.



Lime (calcium carbonate) required to neutralise acidity from nitrogen fertilisers.

Fertiliser	Lime required (kg/ha) per kg nitrogen	
	No N leached	All N leached
CAN	-0.7	2.9
Ammonium sulfate	3.6	7.2
MAP	3.6	7.2
DAP	1.8	5.4
Urea	0	3.6

Lime (calcium carbonate) required to replace alkalinity exported in farm products.

Product removed	Lime required (kg/t of produce)
Cereal grain	9
Lupin grain	20
Cereal hay	15
Lucerne hay	60

Alkalinity removed in animal products is low, however, concentration of dung in stock camps adds to the total alkalinity exported in animal production.

The removal of large quantities of hay and other products will increase soil acidity and increase the need for agricultural lime.



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The Avon Catchment Council has set a target pH<sub>CaCl<sub>2</sub></sub> of 5.5 for topsoils and 4.8 for subsurface soils in the Avon River Basin by 2020.

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