Agriculture WESTERN AUSTRALIA

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Farmnote

Looking at liming : consider the rate

Farmnote 70/2000

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Soil acidity series

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Summary

- Don't guess soil pH, do a soil pH test.
- Know the pH ranges for the crops and pastures you grow
- Adopt a lime strategy to increase and/or maintain soil pH

Table 1. A general guide to liming

Lime source	Limesand, Limestone, Cement or Lime Kiln Dust or Dolomite
Lime rate	1 tonne per hectare of a 100%NV product i.e. an 80% product would require an application of 1.2 t/ha.
Neutralising value	High - 95% or better
Particle fineness	90% passing through a 0.6mm sieve.
Soil type	Sandy
pH range	4.2 - 5.0 ($CaCl_2$)
Rainfall	Meddium (325 - 450 mm)
Years for pH change at 0 - 10 cm soil depth	1 - 2 years

pH increase expected at 0 - 10 cm soil depth	0.5 - 0.7

Soil acidification is a part of the nature of any cropping system. Lime increases soil pH and therefore plays a key role in our farming systems.

Lime has the added benefits of:

- Increasing rhizobium survival and nodulation of legumes, which generally survive poorly in low pH soils;
- Increasing plant availability of nitrogen, phosphorus, and molybdenum;
- Decreasing available aluminium levels.

Lime can also have the adverse affect of increasing the incidence of take-all in susceptible areas, and decreasing plant availability of copper, manganese, and zinc.

How to start liming

Soil monitoring

Soil monitoring is an essential part of a lime management program and allows you to consider a lime rate and how often you should apply it.

The soil should be tested for pH in the topsoil (0-10cm) and in the subsurface (10-20cm). If you have a deep sandy soil you should also test for pH at the 20-30cm depth.

Soils should be monitored every 2-3 years to track soil pH and lime movement.

Initial soil pH

As soil acidity increases (the lower the pH), more lime is needed to ameliorate acidity.

If soil pH is lower in the subsurface soil compared to the topsoil, a liming program must commence immediately. It can take five years or more before you see any pH increases in the subsurface after a topsoil application.

Crops

Different crop species have different tolerances to acidity. Plant growth is affected at a certain soil pH, which is known as the critical pH. Below the critical pH plant growth is severely retarded. When to commence liming will depend on the critical pH level of the most acid sensitive species you have in your rotation (Figure 1).

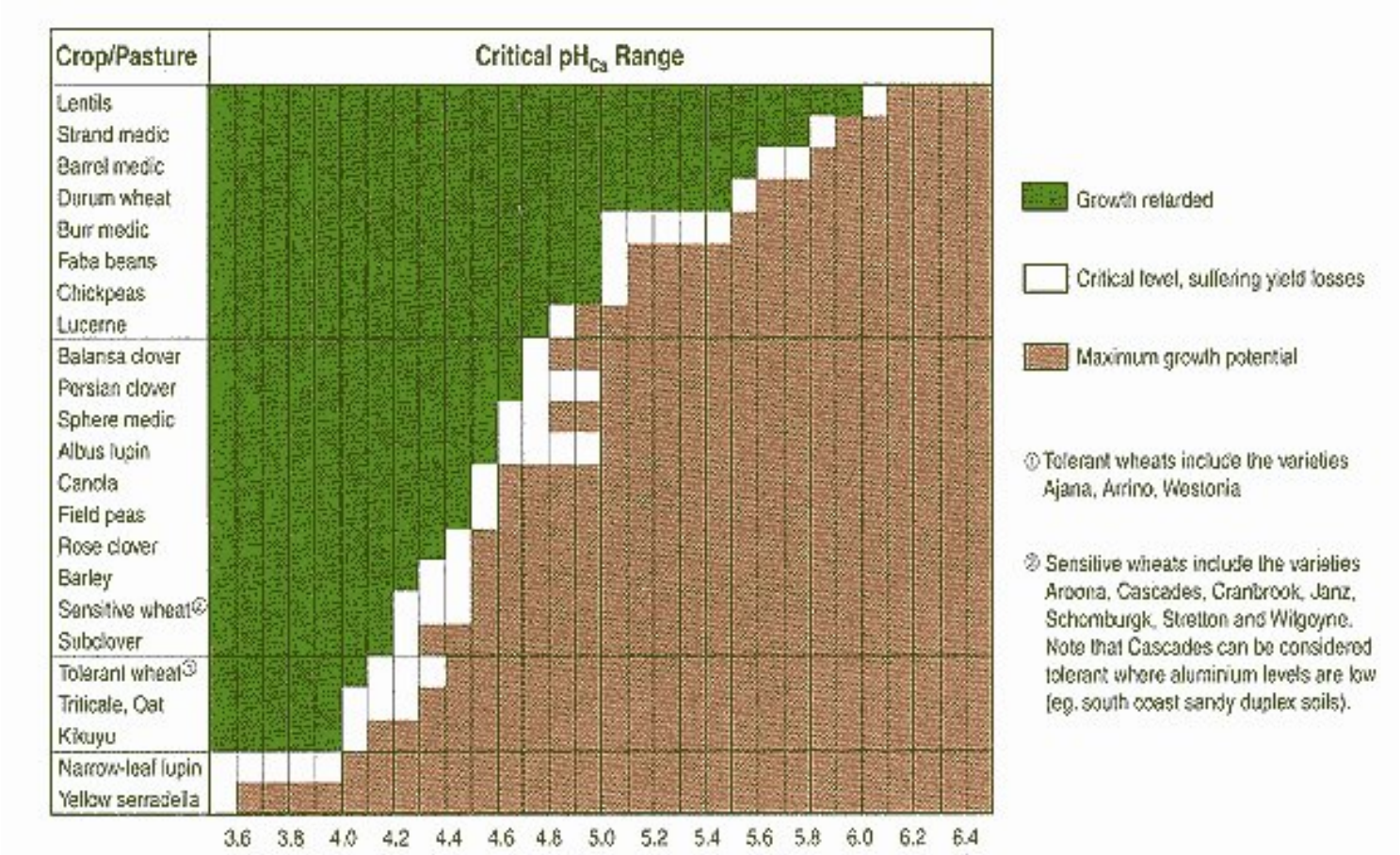

Figure 1. Critical pH ranges (topsoil pH in $CaCl_2$) of some WA crops and pastures

For example, in a narrow-leafed lupin/wheat rotation, acidity will start affecting crop production at approximately a pH of 4.8. This is when acidity has the potential to affect wheat growth, while lupins will generally tolerate this level of acidity. To avoid acidity affecting your crops, lime should be applied when the soil reaches a pH near but above the critical pH for that crop. The cost of liming early far outweighs the cost of applying lime too late and suffering poor plant vigor and yield loss.

Buffering capacity

The pH buffering capacity of a soil is its ability to resist pH changes. The higher the organic carbon and/or clay in the soil, the greater its buffering capacity and its ability to resist pH change.

More lime is needed to increase soil pH in a soil with a high buffering capacity.

The higher the buffering capacity of the soil the harder it is to change pH. Typical pH changes for high, moderate and low leaching soils are shown in Table 2.

Table 2. Estimated pH increases with the addition of 1t/ha of 100%NV product to soil types with a high, medium and low leaching intensity.

Leaching	Increase in pH
High (sand)	0.5 - 0.7
Medium (loam)	0.3 - 0.5
Low (clay)	0.2 - 0.3

Incorporation

Lime has to be physically in contact with moist acid soil in order to neutralise acidity.

Lime dissolves slowly in the soil, therefore, incorporation in the top 10cm of soil (or deeper if possible) is best to increase the rate of reaction and leaching of lime to a greater depth.

Incorporating lime will increase soil pH in the 0-10cm soil depth within 1-3 years.

If lime is not incorporated it will take longer to increase soil pH in the 0-10cm soil depth.

Rainfall

Newly applied lime starts to react with the hydrogen ions only after the soil becomes moist. Higher rainfall means greater leaching and faster lime reaction.

Acknowledgements

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Further Reading

- Farmnote No. 78/2000 'The Importance of Soil pH'
- Farmnote No. 68/2000 'Looking at Liming : test strips'
- Farmnote No. 67/2000 'Looking at Liming : quality'
- Farmnote No. 69/2000 'Looking at Liming : comparing lime sources'
- Farmnote No. 80/2000 'Managing Soil Acidity in Agricultural Land'
- Farmnote No. 79/2000 'Soil Acidity and Barley Production'
- Farmnote No. 2/96 'Tolerance of Wheat Varieties to Soil Acidity'
- Bulletin No. 4343 'Soil Guide - A Handbook for Understanding and Managing Agricultural Soils'.

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