

# Planning on Liming

## CAN I EXPECT A RESPONSE TO LIME?

**T**o be confident your paddock will give a response to lime you need to know the pH and exchangeable aluminium ( $Al_{ex}$ )\* of your soil - and if your crops and pastures are sensitive to soil acidity (Table 1 and Table 2 below).

**Sub-soil acidity.** If your paddock has an acid sub-soil - pH is <4.7 and  $Al_{ex}$  is >5 per cent - then the response of highly sensitive and sensitive plants to lime will be reduced. The more acid the sub-soil, the more that plants are affected. The acid in the sub-soil restricts development of a deep root system, so that the effect of an acid sub-soil is more pronounced in a dry year.

\*For information on testing your soil see ASA publication No.3 *Are my soils acid?*

TABLE 1. The sensitivity of some commonly grown crops<sup>1</sup> and pastures<sup>2</sup> to soil acidity.

<b>Highly sensitive</b>	Durum wheat, Schooner and Yerong barley, faba beans, chickpeas, lucerne, medics, strawberry, Balansa, Berseem and Persian clovers, Buffel grass, tall wheatgrass
<b>Sensitive</b>	Canola, Rosella and Janz wheat, O'Conner and Skiff barley, albus lupins, red grass (Wagga), wallaby grass (A.Linkii), phalaris, red clover, Caucasian and Kenya white clovers
<b>Tolerant</b>	Brindabella barley, Swift and Sunstar wheat, Diamondbird is the most tolerant wheat, annual and perennial ryegrass, tall fescue, Haifa white and subterranean clovers
<b>Highly tolerant</b>	Narrow leaf lupins, oats, Tahara triticale, cereal rye, cocksfoot, kikuyu, paspalum, yellow and slender serradella, Maku lotus, common couch, Consul love grass.

1. See the Winter Crop Variety Sowing Guide published annually by NSW Agriculture for the current list of crop tolerance to acid soils.  
2. See ASA Leaflet No 6 Pastures and Acid Soils for more information.

TABLE 2. Predicting lime response using a soil test

If the pH (CaCl <sub>2</sub> ) for your soil is:	and $Al_{ex}$ is:	then:
Greater than 5.4	0—5%	There are no problems from soil acidity and there is net movement of the lime effect down in to the soil.
Less than 5.3	0—5%	There is a chance of molybdenum deficiency but check for local advice.
Less than 5.1	0—5%	The effectiveness of rhizobia that inoculate acid sensitive legumes, such as lucerne and faba beans is reduced. Liming will increase the effectiveness of these rhizobia and production of their crops and pastures.
Less than 4.8	greater than 5%	Pastures and crops that are highly sensitive to soil acidity (see table 1) will give an economic response to lime. If pH is less than 4.6 the speed of the nitrification processes will increase with liming regardless of $Al_{ex}$ .
—	greater than 10%	Crops that are sensitive to soil acidity will show an economic response to lime. Sensitive and tolerant pastures will show a response but the economics of this response are marginal.
—	Greater than 15%	Crops that are tolerant will give an economic response to lime. The response of sensitive and tolerant pasture will increase with higher aluminium, but the economic benefits of this response will require close examination.
—	Greater than 20%	Highly tolerant crops and pastures will give a small response.



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## HOW MUCH LIME DO I NEED?

Applying sufficient lime to lift the pH of a soil to 5.2 will cure most problems associated with soil acidity. Where the soil below the depth of incorporation of the lime is acid, then a pH of at least 5.5 must be obtained - and maintained - to ensure a movement of the lime effect down into the soil. (Please see Table 3.)

An application of lime may also improve your soil structure. If you have a hard setting clay soil then seek advice on how lime, or a combination of lime and gypsum, may improve your soil structure.

## LIME QUALITY AFFECTS YOUR LIMING RATE

The quality or effectiveness of agricultural liming products varies. All liming materials produced in NSW are required to be correctly labelled under the Fertilisers Act, 1985. This means the calcium and magnesium content, fineness and neutralising values must all be stated on the label or invoice.

**Fineness.** The finer the particles the more quickly they react in the soil. Finer particles have a greater surface area to react with acids. The larger number of particles in a fine lime means that the lime can be better distributed through the soil. The label will indicate the proportion of the sample that passes through six different sieve sizes. Most lime crushers in NSW strive to produce a lime where 90% passes through a 150 $\mu$ m sieve. Lime where 99% is less than 75 $\mu$ m is highly reactive, but difficult to spread. Particles larger than 0.5 mm react only very slowly with the soil.

**Neutralising value.** The neutralising value (NV) of a liming material is its capacity to neutralise acidity. The higher the NV the more effective is the product. Pure calcium carbonate (pure lime) is taken as the standard with an NV of 100. The neutralising value of commercial lime is usually between 95 and 98. Neutralising value is measured across three particle sizes to indicate to the buyer if there are impurities concentrated in either the coarse or fine fractions.

TABLE 3.

**Lime required (superfine and NV>95) to lift the pH of the top 10cm of soil to 5.2 for a range of Cation Exchange Capacities and pH normally encountered when making liming recommendations. The additional lime required to lift the pH from 5.2 to 5.5 is given in the right hand column.**

ECEC (meq/100gm)	Lime required (t/ha) to lift the pH of the top 10 cm:			
	from 4.0 to 5.2	from 4.3 to 5.2	from 4.7 to 5.2	from 5.2 to 5.5
1	1.6	0.8*	0.3*	0.2
2	2.4	1.2	0.5*	0.4
3	3.5	1.7	0.7*	0.5
4	3.9	2.1	0.9*	0.6
5	4.7	2.5	1.1*	0.7
6	5.5	3.0	1.2	0.8
7	6.3	3.3	1.4	1.0
8	7.1	3.8	1.6	1.1
9	7.9	4.2	1.8	1.2
10	8.7	4.6	1.9	1.3
15	12.5	6.7	2.8	1.9

Assumptions: bulk density of soil is 1.4 and 70 per cent lime dissolves in one year. Note: For cracking clays this table will give an over estimate of lime required. \*It is recognised that low rates of lime are difficult to apply but over-liming can cause nutrient deficiencies, particularly in these light soils.

**Calcium and magnesium contents.** The choice of lime, dolomite or magnesite for crops or pastures depends principally on price and the need for magnesium. Magnesium requirement can be identified from the results of plant and soil testing and crop type.

**Comparing liming materials.** Information on the label will allow a comparison of the particle sizes and the neutralising value of liming products. A spreadsheet has been developed to help in comparing liming products using this data. If the information specified under the Act is not available on a product, for example on lime from interstate, several laboratories are equipped to analyse lime.

For further information contact your local District Agronomist or agricultural adviser.

**DISCLAIMER:** The information contained in this publication is based on knowledge and understanding at the time of writing (December 2003). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Agriculture or the user's independent adviser.