

Current Practices and Extension on Acid Soils in Queensland

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Description of Practices

There are predominantly four techniques that will assist in ameliorating acid soils. These are:

- application of liming material
- use of acid tolerant plants
- using management practices which reduce the rate of acidification
- applying other types of neutralising agents

Extent of Practices

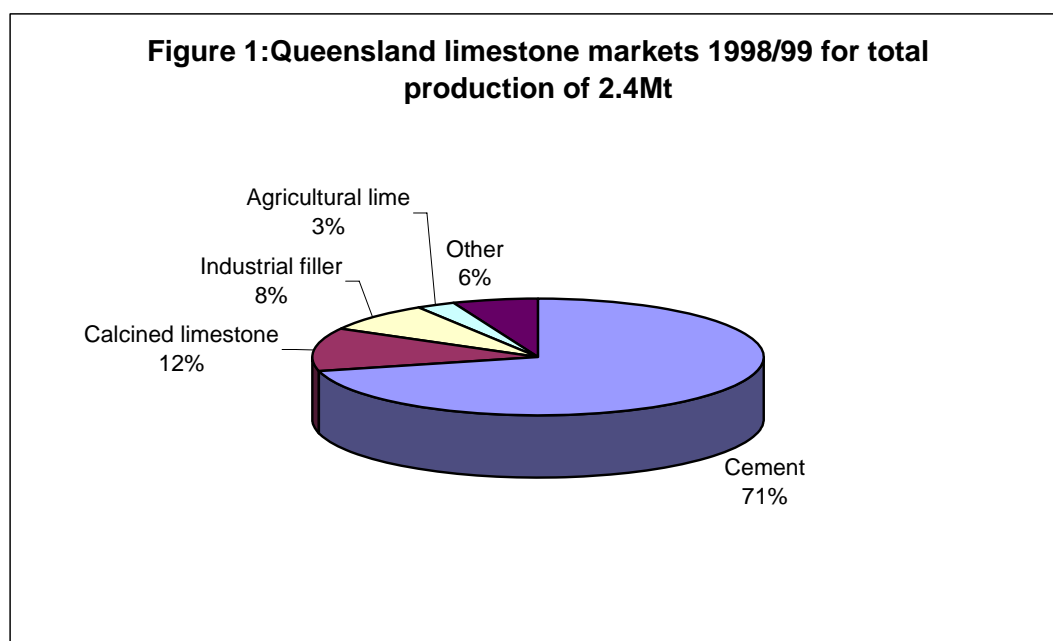
1. Application of liming material

PRODUCTION AND COST OF AGRICULTURAL LIME IN QUEENSLAND

INTRODUCTION

Limestone is used in Queensland by a variety of industries. Over the last 11 years, total production of limestone ranged from 1.99 Mt (in 1998/99) to 2.59 Mt (in 1994/95). Production in 1998/99 was 2.4 Mt. The cement industry is by far the largest consumer of limestone (Figure 1) but, in the longer term, expanded and new industrial and mining projects have the potential to at least double the current demand (F. Bruvel unpublished data). Agricultural lime forms only a small percentage of the total production.

Limestone is obtained from about 30 different mining operations (Bruvel 1999). These are located largely in coastal regions but also near Mt Isa.



AGRICULTURAL LIME

Labelling and quality

In Queensland, the sale of agricultural lime is subject to the Agricultural Standards Regulation 1997 which define 'lime' as a substance consisting mostly of calcium (Ca) or magnesium (Mg) carbonate, oxide or hydroxide, or a combination of calcium or magnesium carbonate, oxide or hydroxide, for decreasing the acidity of soil. Dolomite or dolomitic limestone is separately defined as needing to contain at least 8% Mg in the form of magnesium carbonate. The label of a lime must state the percentage content of Ca (and Mg if it is claimed to be present), the form in which the element is present, the lime's neutralising value (NV) and its fineness. There is no minimum value for NV but fineness is the percentage of the product passing through a sieve with a 0.25mm (250µm) aperture.

Production

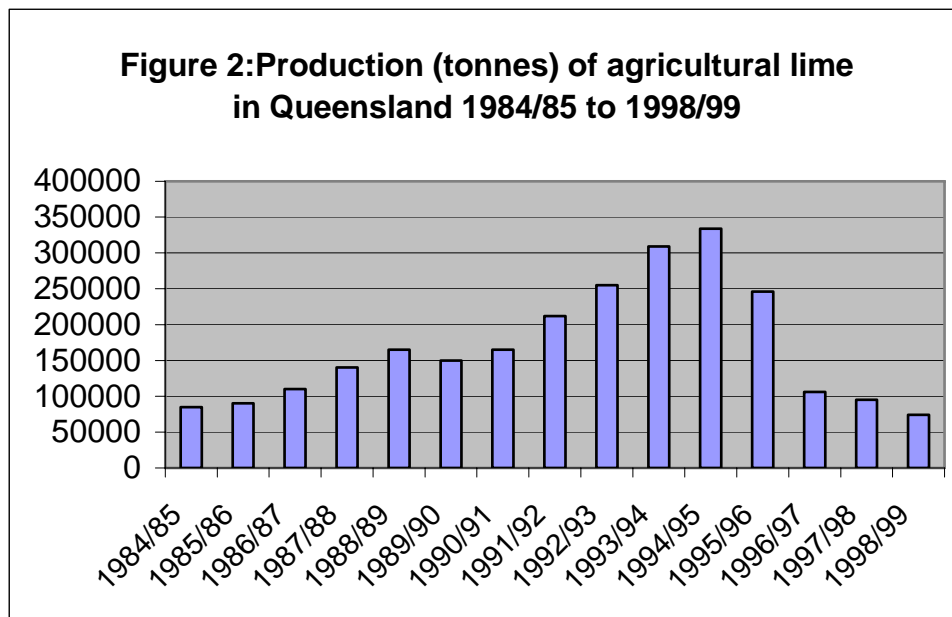
Annual production of agricultural lime in Queensland is presented in Figure 2 using data from several sources, all of which purport to be from the Department of Mines and Energy (DME), although DME themselves could only provide data for the last three years (Moody and Aitken 1993, Mican Resources 1997, Bruvel pers. comm.). The DME is the only collector of data of this nature. Because agricultural lime is produced by a large number of companies and comprises only a small proportion of the annual total limestone production, the completeness of the DME data is not known. Some lime producers have questioned the DME figures, suggesting that they are too low. Some discrepancy could arise as the amount mined in a year (DME data) may not be the same as the amount used on farms in that year. Regardless, this is the only compilation available for the State.

Lime usage increased steadily from 85 000 t in 1984/85, reaching a peak in excess of 300 000 t in 1993/94 and 1994/95 (Figure 3). Since then there has been a marked decrease, particularly in the last three years, to only 74 000 t in 1998/99. DME suggest that the demand for agricultural lime depends on current agricultural commodity prices (Bruvel 1999). Since the sugar industry is the largest user of agricultural lime, the pattern of use in sugar production determines the pattern for the total use of agricultural lime.

To obtain more information on lime use and costs a telephone survey was conducted of lime producers in Queensland using a list of names provided by DME (Table 1). While there are more than 12 producers of agricultural lime in Qld, two companies (DML and Mirriwinni Lime) appear to have the majority of the market and only one other company (Frost Enterprises) has more than 10% of the market. Competition for market share is strong and several small suppliers complained that 'competitive pricing' by larger companies had affected their sales.

Individual lime producers are reluctant to provide production figures because of market sensitivities. Some agreed to give 'ballpark' figures. Almost all producers commented on the decreased sales of lime in recent years, confirming the trend in the DME figures in Figure 2. From the telephone

survey, production estimates for recent years totalled 89 000 t, which was of the same order of magnitude as the DME figures. Lime producers suggest that the low world price for sugar in recent years, combined with the heavy wet seasons (and low ccs – a quality parameter for cane sugar) in far north Queensland, are mainly responsible for reduced applications of lime. In specific areas, cane grubs and rat plagues have been blamed as well. In one district it was suggested that lime usage was down because farmers' soil tests from one laboratory were recommending gypsum instead of lime.



Costs

The cost of lime ex-pit varies from \$15 to \$38/t with all but one in the range \$25-38. The NV of these products ranges from 67 upwards and is generally reflected in the price. Some producers, particularly those selling earthy limes of lower NV, prefer to quote prices for their product delivered on farm or spread on farm.

It is difficult to get a simple cost of cartage. Suppliers differ in the way they apply and calculate cartage charges. Some quote \$/t/km but the rate may change for distances over 40 km, others quote \$/km (regardless of tonnage). The majority of producers quote cartage costs to their main sales areas. This method allows some subsidisation of longer distances by the shorter distances. The high cost of cartage restricts the distances over which lime can be carried and still remain an economic proposition for farmers. Fortunately, limestone sources in Queensland occur along the coastal and near-coastal strip, so lime producers tend to regard certain districts as their sales territories where they can sell at competitive prices. Regardless of the basis for costing, most good quality lime delivered on farm seems to cost in the range \$50-60/t.

Spreading costs range from \$8/t to \$20/t with one quote of \$25/t in banana plantations. Many are in the \$12-14 range. One producer's price for an earthy

lime (\$32/t) included cartage and spreading on farm while, in another district, a producer provided free use of a spreader.

Table 1: Producers of agricultural lime:

NAME	PIT
Wells Limeworks, Marmor, 07 4934 6144	Wells Limeworks
Didcot Lime, Gayndah, 07 4161 6183 (Rose also Richard Walters)	Didcot
Marule Ag Lime, Childers, 07 4126 7167 (Kevin Scarlett)	Scarlett
Spring Creek Lime, Calcium (near Woodstock), 07 4770 6162 (Peter Schubert)	Spring Creek (Springvale)
David Mitchell Ltd, Corinda, 07 3278 6322 (Steve Barrington) 0418 349 061 (Peter White)	Riverton
	Elbow Valley (Warwick)
	Murgon
	Christmas Creek
	Ootann
Frost Enterprises, Calliope, 07 4975 7144	Taragoola
Peter Partridge, Mackay, 07 4959 8154, Pioneer Lime	Partridge (Nebo)
Neville Jones, Bowen, 4785 2259	Isavale
Chillagoe Limeworks	Chillagoe
Herbert Granshaw, Ayr, 07 4783 5822	Kirknie
Mirriwinni Lime, Mirriwinni, Robert Wilkins, 07 4067 6133	Mt Molloy
	Mt Garnet
	Laroon Station (west of T'ville)
Bob Andreasson, Bosseeva Mine, Harveys Range, Townsville, 4778 0146	Bosseeva
Burdekin Lime Co., Ayr, Phil Corrigan, 041 7649746	

2. Use of Acid Tolerant Plants

It is recognised that different crops and pastures growing in Queensland have different tolerances to soil acidity. For example, sugarcane (Aitken *et al.* 1996), macadamia (Aitken *et al.* 1990) and banana (PW Moody pers. comm.) have all been shown to be tolerant of low soil pH, and the primary constraint to the productivity of these crops in acidic soils appears to be Ca deficiency or, in certain soils, Mn toxicity. There has been little attempt to define the acidity tolerances of other crops grown in the State, and advice is based on published information from other States (eg. Fenton and Helyar 2000). For example, it is known that barley is more sensitive to soil acidity than other grain crops such as triticale, and if soil acidity is likely to be a constraint to the productivity of an acid sensitive grain crop, then a tolerant species is grown.

Correction of a Ca deficiency in an acid tolerant crop such as sugarcane can be achieved by gypsum application. However, gypsum does not increase soil pH. Therefore, while its application may overcome productivity constraints to acid tolerant crops, soil pH may continue to decline, leading to resource degradation. Low soil pH also reduces the opportunities for growing alternative, less acid tolerant, crops. Fortunately, the cost of lime is often cheaper than the cost of gypsum in Queensland, so lime is applied as the Ca source. The decline in soil pH may therefore be arrested, depending on rate of lime applied and the pH buffer capacity of the soil.

3. Use management practices that reduce the rate of acidification

Every agricultural system is inherently acidifying because of the removal of harvested product (which is alkaline). Acidification due to this source is unavoidable, and must be managed either by lime addition or fertiliser form. In general, lime application is used for broadacre field crops (eg. maize), small crops (eg. vegetables) and sugarcane. However, where fertigation is practiced (eg. horticultural tree crops and short term perennial crops such as banana), the use of soluble alkalisng fertilisers or nitrate forms of N fertiliser is practiced. Moody and Aitken (1997) calculated that the rate of acidification under banana could be reduced by 85% if the usual industry practice of applying 500 kg N/ha.yr as urea were changed to applying 250 kg N/ha.yr as ammonium nitrate. It is likely that both the horticultural and sugarcane industries could substantially reduce their current acidification rates by changing the rate and form of N fertiliser.

4. Apply other types of neutralising agents

Clay spreading

The southern Australian practice of mixing alkaline, clayey subsoil with acidic, sandy surface soil to increase surface soil pH (and cation exchange capacity) is not practiced in Queensland because of the lack of suitable soil types.

Alkaline Irrigation Water

Alkaline irrigation water does not occur in the areas where soils are excessively acidic in Queensland.

Use of alkalisng fertilisers

Proprietary fertiliser products that have a low neutralising value (such as those containing a small proportion of magnesium oxide or potassium bicarbonate) can be used in fertigation to slowly increase soil pH through repeated application. The high cost of these materials prevents their use in systems other than horticulture.

Summary of Land Use, by Agro-ecological region by Practices for Qld

See Table 2.

Table 2. Practices used to combat acidity on and agro-ecological and land use basis

AER	3. North east wet-dry tropics		4. Wet tropical coasts		6. Subtropical slopes and plains	7. Wet subtropical coast	
Land Use	Sugarcane	Horticulture	Sugarcane	Horticulture	Horticulture	Sugarcane	Horticulture
Lime Use low (1999, 99000t)	6000	2000	24000	17000	6000	31000	13000
Lime Use high (139000t)	10000	3000	54000	17000	6000	36000	13000
Rate of use (t/ha)	2 every 4 yr	2	2 every 4 yr	2-5 at planting, 1 other years	2	2 every 4 yr	2
Reliability*	3	2	3	3	2	3	2
Farming practices							
Use lime	yes	yes, some	yes	yes	yes	yes	yes
Grow tolerant plants	Sugarcane is tolerant		Sugarcane is tolerant		grow Mn tolerant crops (small)	Sugarcane is tolerant	
Use less acidifying practices				Nitrate fertiliser is an option, <10% use.			

* reliability of answers was assessed in a 1 to 5 scale with 1 unreliable and 5 very reliable

State Programs

Extension Programs

Management of Acidity on a Catchment Basis

Following the demise of the National Soil Acidity Program of the Land and Water Resources Research and Development Corporation (LWRRDC), the impetus ceased for developing a State-wide approach to soil acidity management in Queensland through catchment management strategies. Currently, only one Queensland catchment, the Mary River Catchment, has a soil acidity management plan, despite soil acidity being a constraint to productivity in several other catchments. This situation is unlikely to change unless funding for an extension initiative can be secured.

Contacts

State perspective:

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Mary River Catchment:

Mr J Buchanan, Chairman, Mary River Catchment Coordinating Committee
PO Box 1027, Gympie QLD 4570

Publications

Aitken, RL and Cowles, GA (1993). Properties of Queensland liming materials. DPI Leaflet QL92003. (Queensland Department of Primary Industries: Brisbane.)

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Web Sites

None

Research

Current and Historical Research

Current

Current research on soil acidity is industry-focused, with several research providers (Bureau of Sugar Experiment Stations, CSIRO, Queensland Departments of Natural Resources and Primary Industries) involved in collaborative projects. For the sugar industry, long term field trials are measuring the residual value of lime and other amendments applied to sugarcane soils, and the effects of liming on N mineralisation and sugar

ccs (a quality parameter for cane juice) (eg. Kingston *et al.* 1996) are being investigated under trash blanket and burnt systems. Soil acidification under *Stylosanthes* pastures in the dry tropics of northern Australia is the focus of a project aimed at developing a risk assessment model for pastoral soils of the region as well as developing management strategies for reducing the acidification rate under the pastures.

Historical research

The National Landcare Program and the LWRRDC supported National Soil Acidity Program, were the catalysts for much of the past research on acidic soils and their amelioration in Queensland. Projects under these programs measured the rates of acidification of several agricultural systems unique to the State (sugar cane, tropical bananas) (Moody and Aitken 1997) as well as developing an acidification risk assessment map of the State (Ahern *et al.* 1992). The lime industry supported the establishment of many lime rate trials in south-east Queensland, and a significant result was a calibrated lime requirement soil test (laboratory based) which allows prediction of the amount of lime required to raise soil pH to a target value (Aitken *et al.* 1995). This test is in use by both private and public sector laboratories. Useful summaries of the extent and management of soil acidity in Queensland appear in Moody *et al.* (1994) and Aitken *et al.* (1998).

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