Current Practices and Extension on Acid Soils in NSW

Brian Hughes

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
- apply other types of neutralising agents

Extent of Practices

1. Application of liming material

Within NSW liming materials are predominantly agricultural limes (naturally occurring crushed or sieved limestone, - predominantly calcium carbonate) and dolomites (crushed or sieved deposits of calcium and magnesium carbonate) and variations between.

Estimates of Production/Sales by Region in NSW

Estimated lime production is shown in Table 1. Department of Mines and Minerals have determined the northern cross border trade of lime but there are no data for the south. An estimate from a survey of farmers at the Henty Field Days showed about 25% of the lime spread south of the Murrumbidgee River was sourced from Victoria. Based on this survey it is estimated about 30 to 35,000 tonnes comes from Victoria. This could be added to the NSW total.

Lastly no account is taken of by-product lime (eg. precipitator dust from cement factories) but this is probably about the same tonnage as stock feed lime that is included in the table figures.

Table 1. Estimates of lime use in NSW

Year	Total NSW (tonnes)	Southern NSW (tonnes)	Central NSW (tonnes)	Northern NSW (tonnes)
1974	54825	36659	0	18166
1979	56395	27516	2994	25885
1985	103448	40000	30792	32656
1986	117634	55000	39128	23506
1988	119572	73369	29685	16518
1989	144447	91497	35249	17701
1990	135367	52435	48874	34059
1991	155949	56442	65775	33732
1992	143627	65098	53188	25341
1993	243904	125757	92791	25357
1994	184478	102184	73951	8344
1995	335500	231500	68200	35800
1996	491187	304000	129561	57626
1997	457432	269515	116732	71185
1998	452576	285821	101239	65517
1999	485607	298700	127907	59000

Notes: 1974 = 1974/75 etc. Southern NSW data does not include Victorian imports. Northern NSW data includes Queensland imports.

Costs of Agricultural Lime

The cost of agricultural lime in NSW is between $27/ t and $34/t depending on the mine and the time of the year.

Lime Spreading Costs

Spreading is in the range $10 to 15/ha for about 2.5 t/ha.

Lime Cartage Costs

Cartage costs vary depending on back loading and other factors (fuel price, distance). Will vary with distance from $3/t close to pit to about $30/t 300kms from the lime pit.

Rates of lime spread at 2.5 t/ha will cost around $120 to $160 /ha.

Producers of agricultural lime:

See Table 2.

Table 2. Lime suppliers for NSW

Company & Mine Site	Address	Phone/Fax Nos	Contact
New South Wales			
Aglime (Toms Creek via Long Flat)	RP & KA Latimore Toms Creek via **Long Flat 2446**		
*Molong Agricultural Lime (Quarry Road, Molong) Council)	PO Box 17 **Molong 2866**	p: 02 63668149	Trevor Wright (Cabonne Shire
Causmag International (Young)	Park Avenue **Young 2594**	p: 02 63821177	Damian Giuliano
Clarkes Dolly Dust (BHP, Pt Kembla)	13 Goulburn Street **Marulan 2579**		Richard Clarke
*Cudal Lime	"Davys Plains" **Cudal 2844**	p: 02 63642206 m: 018 650237	Ian Shannon
*David Mitchell – Melcann P/L (Attunga, NSW) (Sherwood-Yessibah via Kempsey) (Mt Knowles)	PO Box 180 **Attunga 2345** PO Box 468 **Tamworth 2340**	p: 02 67695501 f: 02 67695707	Paul Keene
*Galong Mining (Eubinal Road, Galong)	PO Box 129 **Mittagong 2575**	p: 02 48711650	Ted Ambler
*Hyrock P/L (Excelsor Quarry via Capertee)	"Astralobe" Rutherglen Lane **Lithgow 2790** PO Box 75 **Cullen Bullen 2790**	p: 02 63513906	Paul Ledger
Lower Molongo Water Control Centre	Stockdill Drive **Holt 2616**	p: 02 62483662	Asoka Wijeratne
Bio-Recycle	5 Windsor Road **Vineyard 2675**	p: 02 45776610	Neil Schembri
*Mudgee Dolomite & Lime (Mt Knowles)	Murdoch WJ & Co P/L PO Box 781 (33 Horatio Street) **Mudgee 2850**	p: 02 63733939	Bob Murdoch
*Omya Southern (Marulan & Bathurst)	PO Box 430 **Lindfield 2070**	p: 02 99100026 f: 02 94168008	
Aglime Fertilizers (South Marulan)	Goulburn Street **Marulan 2579**	p: 02 99082422 p: 02 48411528	John Bramford Joyce O'Regan, Manager
Industrial Minerals Australia P/L (Mt Knowles) (Mudgee)	172 Pacific Hwy **North Sydney 2060**		bought by Murdoch's at Mudgee *(see above)*
* Members of the NSW branch of the Limestone Association of Australia (LAA)			
Queensland			
David Mitchell – Melcann P/L (Riverton via Tenterfield)	Riverton **Warwick 4370**	m: 041 9103 193	Stephen Barrington

Victoria

David Mitchell – Melcann Ltd (Buchan, Vic) (Lara) (Lilydale)

PO Box 486
Lillydale 3140

Darryman Agricultural Lime Michael Pollock

2. Use of Acid Tolerant Plants

Reference: Agfact AC 19 Soil Acidity and liming. Pub. NSW Agriculture

3. Use management practices that reduce the rate of acidification

Reference: Agfact AC 19 Soil Acidity and liming. Pub. NSW Agriculture

4. Apply other types of neutralising agents

Clay spreading – not used in NSW
Alkaline irrigation water – not used in NSW

WHAT ARE THE CAUSES OF SOIL ACIDITY?

Soil acidity is a natural process

Soils acidify naturally as they weather over millions of years. The acidity of any soil varies according to the type of rock it comes from, the length of time it has weathered and the local climate. As a result some soils can be naturally very acidic (low pH) while others are much more alkaline (high pH).

The rate of soil acidification increases with agricultural activities

While many NSW soils are naturally acid most agricultural production systems increase the rate of soil acidification. The reasons for this increased rate can be explained by examining the main causes of soil acidity.

Four main causes of soil acidification

The four main causes of soil acidity are;

- removal of product from the farm or paddock
- leaching of nitrogen below the plant root zone
- inappropriate use of nitrogenous fertilisers
- build up in organic matter

Removal of product - obviously the main aim of any agricultural production system is to produce saleable products. However most agricultural products are slightly alkaline so their removal from a paddock or farm leaves the soil slightly more acidic. The degree of acidification will depend on how alkaline the product is and how many kilograms of product are removed. Where little actual product is removed from the farm, such as in wool production, the system remains largely in balance. The most acidifying forms of agricultural production are operations such as lucerne hay cutting. For instance the removal of one tonne of lucerne hay requires 70 kilograms of lime to neutralise the resulting acidity.

Leaching of nitrogen - leaching of nitrogen in the nitrate form is a very important factor in soil acidity. Nitrate is a major nutrient for plant growth. It is supplied either from nitrogenous fertilisers or atmospheric nitrogen fixed by legumes. When there is more nitrate than the plant can use, the nitrate is at risk of draining (leaching) below the plants roots and into the ground water system. This leaves the soil more acidic. Leaching of nitrate can happen through inappropriate use of nitrogen fertilisers (more common in intensive production like horticulture), or because the plants are not at a suitable stage of growth to use the available nitrogen. Pastures based on annual species, the use of long fallow in crop rotations and heavy applications of nitrogen fertilisers are examples of practices that may increase the risk of nitrate leaching.

Use of nitrogenous fertilisers - the amount of acid added to the soil by nitrogenous fertilisers varies according to the type of fertiliser. The most

acidifying are ammonium sulfate and monoammonium sulfate (MAP), followed by diammonium phosphate (DAP). Less acidifying are urea, ammonium nitrate and anhydrous ammonia. Fertilisers such as sodium and calcium nitrate are not acidifying.

Superphosphate has no direct effect on soil pH. However, its application stimulates growth of legumes and clovers that fix nitrogen. This increases the amount of nitrate nitrogen in the soil increasing the potential for leaching and consequent soil acidification.

Build-up of organic matter - over the last 50 years the regular use of fertiliser and improved pastures, particularly subterranean clover, has increased the amount of organic matter in the soil. While organic matter has many beneficial effects including improving soil structure, the increasing amount of organic matter may make the soil more acid. However, organic matter will not build up indefinitely, and when equilibrium is reached the acidification process stops. NB. It is important to differentiate between a natural build up in organic matter from a build up that occurs by adding organic material from another site. Where organic matter build up occurs due to transported material the increased organic matter generally increases pH (less acid).

Differences in farming systems

Soil acidification rates vary according to the agricultural production system in use.

Cropping - product removal and nitrate leaching are usually the most significant factors in a cropping system. Build up of soil organic matter and the use of nitrogenous fertilisers are mostly secondary factors. The relative importance of nitrate leaching will depend on the specific pasture / crop rotation. Use of nitrogenous fertilisers and timing of application will be more important in intensive cropping systems with higher inputs of N fertiliser.

Grazing - nitrate leaching and build up of soil organic matter are the major causes. Product removal in total is usually low and the use of nitrogen fertilisers not applicable. It should be noted that the leaching of nitrate is potentially much less under a perennial pasture than one based on annual species.

Horticulture - much of the acidity in horticulture is localised around micro irrigation outlets. This is where nitrogen is applied via the watering system. Excess use of nitrogen fertiliser, consequent nitrate leaching and product removal are all major contributors to acidity in horticultural production.

Irrespective of the production system the challenge is to manage the causes of acidity to either slow the acidification rate or neutralise the extra acid through the use of a liming material.

State Programs

Extension Programs

Acid Soil Action

In NSW, the main soil acidity extension program is run through the Acid Soil Action Program. This is an initiative of the NSW government and involves the community, industry and government agencies. The program is split into two components consisting of

1. Acid Soil Action - tackling the negative effects of soil acidity on agricultural production and
2. Acid Sulphate Soils Program - dealing with management of acid sulphate soils in coastal regions.

For the purpose of this document this report will only describe the first component. The first stage of this program was funded for a period of three years until June 00. Recently funding has been committed for a further three year program. Funding of $10.1 million has been attracted from stakeholders for the next three years.

The aim of Acid Soil Action program is to correct soil acidity, however, where significant economic constraints are encountered, the aim will be to reduce the effect of acidity on agricultural production and the environment.

The program is administered through the Acid Soil Action (ASA) (Agriculture) Management Committee, established to ensure local ownership and management of the Acid Soil Action program. This committee has representatives from the farming community, the lime crushing industry, Total Catchment Management Committees and government agencies.
(Greg Fenton is the project coordinator)

Three experienced officers are employed through the program. They are responsible for supporting research projects, initiating extension activities, producing technical bulletins, providing acid soil management training to private and public agencies and administration.

Program money is used to fund both research, extension and community programs

Expected Outcomes

Specific outcomes of the program will be:

- more sustainable management of acid soils in the permanent pasture zones of the central, southern and northern tablelands
- correction of soil acidity in the cropping, irrigation and horticultural areas
- recognition of soil acidity and how it can be managed in the northern inland.

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Progress to Date

In the first three years the ASA Management Committee funded 60 community group projects and 30 research and advisory projects that addressed the three key areas nominated in the program. These are with a summary of activities:

1. Community education and extension including
   - farmer group involvement
   - workshops for agency and private advisers
   - development and delivery of farmer education series
   - field day and demonstration displays
   - development of best practice publications, workshop notes and book chapters
   - integration of acid soil issues into farm and regional planning

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2. Development of improved management systems
   - increased area of land managed sustainably
   - acid tolerant lines of canola and barley
   - increased mapping of acid soils and distribution particularly in the Bathurst and Dubbo areas
   - updating and remodelling of Lime -It 2 for windows environment

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3. Community incentives for sustainable management of acid soils
   - involvement and development of linkages with landcare, Farming for the Future, Topcrop, GRDC, NSW Farmers Association, Agricultural Bureau and other farmer groups
   - soil testing support workshop series - 650 farmers testing 3000 paddocks
   - farm and paddock management plans
   - 60 farmer / community projects including demonstrations and effects of liming etc

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Current and Historical Research

Current

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