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Western DAIRY

Liming of soil:
to cultivate or not to cultivate?

by Martin Staines, DAFWA, 08 9780 6288

A low soil pH is bad for soil health and for pasture production. The recommendation is to maintain soil pH above 5.0 (in calcium chloride) and preferably above 5.5. Some would even argue that soil pH needs to be at 6.0.

The DAFWA dairy team is undertaking a series of experiments to assess to what extent soil pH affects the ability of pasture to respond to nitrogen fertiliser. This was the subject of an article in the Feed Trough some months ago.

One of the experiments being conducted as part of this work is a laboratory–scale study where different amounts of lime are being applied either on to the surface of soil (as per normal commercial practice) or where the lime is being mixed into the soil. The study started in early August 2010 with a very acidic soil with a pH of just 3.9. Lime was applied at ten different rates ranging from1.3 to 13 t/ha and was applied either to the soil surface or was thoroughly mixed into the soil.

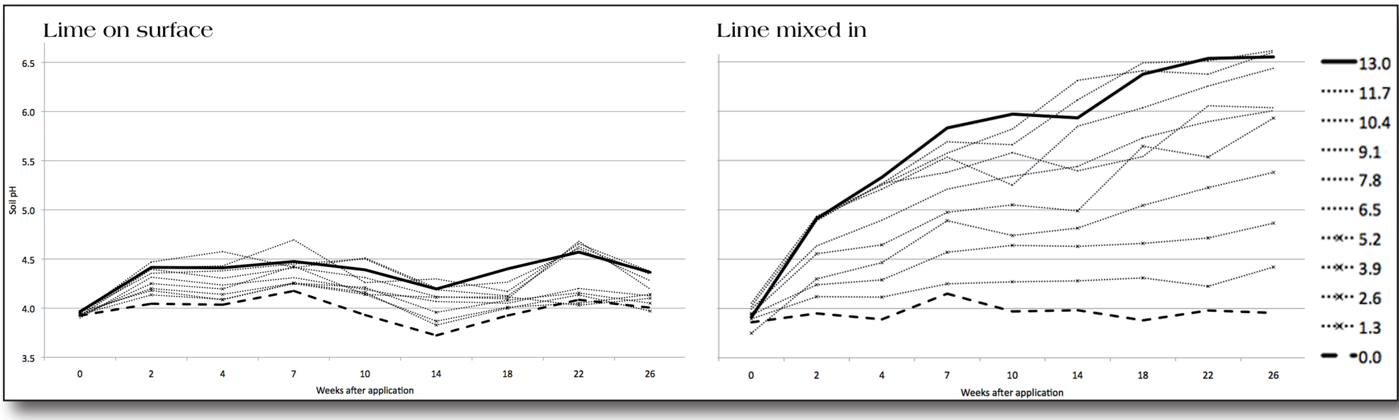
The soils are being kept outside at ambient temperatures but are always kept damp.

The results over the first 26 weeks of the study are quite dramatic. There has been very little change in soil pH with lime applied to the soil surface, whereas with lime mixed into the soil we have already reached pH 6.6 at the highest lime rates (see Figure 1).

After 26 weeks, the lowest rate of lime applied (1.3 t/ha), when mixed into soil, was as effective as the highest rate of lime (13.0 t/ ha) applied to the soil surface. In contrast, lime applied at 13 t/ha when mixed into soil increased soil pH from 3.9 to 6.6, whereas the same amount of lime applied to the soil surface increased pH from 3.9 to 4.4 only.

Obviously these results will change as the lime gets more time to work and we will keep this study going for another year or longer. We are now also in the process of setting up a plot study at Vasse Research Centre to assess the effects of these treatments under field conditions. In this new study, we will measure changes in soil pH as well as any changes in pasture production that may result from these treatments. We will keep you updated on progress. ■

Figure 1: Effect of liming rate (ranging from 0 to 13 tonnes per ha) and method of lime application (lime applied to soil surface vs lime mixed into soil) on soil pH over first 26 weeks after lime application in August 2010.



From the Editor's Desk

Following many requests from WA dairy farmers for an interstate tour to see the latest feedbase research, the WA Regional Feedbase Development Group is organising a trip to Victoria in August 2011.

The field trip will include visits to:

- Dr Joe Jacobs at Demo Dairy, Terang, for the latest 3030 research
- Dr Bill Wales at Ellinbank Research Station, Warragul, for the latest Flexible Feeding Systems research
- Dr David Nation at Dairy Futures CRC in Melbourne, for the latest on Designer Forages
- Leading dairy farmers in Western Districts and Gippsland

How you manage and make the most of your feedbase will determine your profitability. So join fellow enthusiasts as we explore and investigate the latest Feedbase Research and how you can use this to increase your profitability.

The trip would depart on a Tuesday and return at the earliest on Friday evening.

If you interested please contact Dr Dario Nandapi on 0429 201 534 or email to dario@smartcow.com.au ■

Making the most of your irrigation water P3

Pasture monitoring pays off

Participants attending the recent Dairy Innovation Forum (DIF) in WA were left in no doubt that the biggest driver of dairy profitability is pasture harvest (grazing and conservation).

The strong correlation between pasture harvest and profit holds for both low and high input dairy systems. In fact, intensive systems importing supplements that do not increase stocking rate accordingly, can result in reduced pasture harvest and hence business profit decreases.

Dr John Roche stressed that "you can't manage what you don't measure". He reported that paddocks on the same farm could vary in dry matter yield by as much as 100%. Renovating and improving lower yielding paddocks could produce an extra 1 t DM/ha across the whole farm, which if costed at $250/t DM, is worth $25,000 for a 100 ha farm.

Below: A C-Dax Rapid Pasture Meter

As well as identifying poorer performing paddocks, monitoring pasture enables farmers to predict pasture growth, make decisions on feed allocation, rotation speed and use or conservation of supplementary feeds.

Previously, monitoring pasture covers has involved walking the whole farm weekly on a set route using a Rising Plate Meter. However, as the operator can influence readings and as farms have become bigger, this can involve many hours per week for the same operator.

To make pasture monitoring easier and more accurate there are now automatic electronic pasture monitoring systems attached to or pulled by quad-bikes, where readings are independent of the operator. They are simple to use devices designed to electronically measure grass cover to enable farmers to make timely decisions from consistently accurate data for planning grazing rotations, identifying potential feed surpluses or shortages, and to fully utilise their pasture resource to enable their farming operation to realise its full potential.

Ivor Awty, Vic DPI, has developed a quad-bike mounted Automatic Pasture Reader (APR), www.pasturereader.com.au. Vasse Research Centre has used this system for a couple of seasons.

Another system developed by C-Dax Ltd, New Zealand, www.cdax.co.nz is the Rapid Pasture Meter (RPM), which is trailed behind a quad-bike. The RPM can travel at 20km/hr and take up to 200 measurements per second or 18,500 readings over a single 500m pass, compared to perhaps 250 readings over the same distance with a rising plate meter.

Bevan Ravenhill has been using the RPM since 2010 on his 800ha dairy farm at Narrikup. "We always measured our pasture weekly by walking the farm, but the RPM takes pressure off me as our pasture manager can now cover the whole farm in a morning", said Bevan.

"As well as monitoring pasture DM yield, we also collect leaf stage and observe any canopy closure and assess whether the pasture is early, mid or late lactation quality feed. We use the weekly data to monitor trends in growth rate and what we have grown to identify poorer performing paddocks for attention".

While these automatic electronic pasture monitoring systems are quick, they must be calibrated to local pasture conditions converting pasture height to kg DM, especially for our WA annual systems where calibration curve changes throughout the season. ■

Partial mixed rations responses

Martin Auldist, Flexible Feeding Systems, Ellinbank

Dairy farmers are facing the prospect of less available water from rainfall and irrigation to grow pasture due to climate change. To remain profitable, farmers will need to integrate increasing amounts of supplements in the diet of pasture based dairy systems.

The Flexible Feeding Systems research at Ellinbank Research Institute, Victoria, aims to investigate methods of improving pasture based systems through better feeding of supplements as partial mixed rations (PMR). In addition, PMRs offer the opportunity to optimise the rumen environment, and in turn improve the digestibility of the diet producing more energy and higher milk yields.

Milk production responses was measured for grazing dairy cows in late lactation to supplements offered either as a PMR, or as grain in the dairy and forage in the paddock. Three groups of 72 spring-calving Holstein-Friesian cows grazed at a pasture allowance to achieve a pasture intake of 8 kg DM/cow/d. Each group was randomly assigned to 1 of 3 rations to receive the balance of their nutrient intake. These rations were:

(i) Control: barley grain in the dairy twice daily at milking times and pasture silage in the paddock.
(ii) PMR1: a simple PMR of barley grain and pasture silage.
(iii) PMR2: a PMR comprising maize silage, maize grain, barley grain and alfalfa hay.

All rations were isoenergetic with grain:forage ratios of 75:25 (DM basis). Both PMRs were fed on a feed pad twice per day following milking.

The 3 groups were further divided into 8 groups of 9 cows, and 2 groups were offered their supplements at each of 4 rates (6, 8, 10 or 12 kg DM supplement/cow/d). The experiment comprised a 14-d adjustment period followed by an 11-d measurement period. Milk yield measured daily and concentrations of fat and protein measured weekly were used to calculate yields of energy corrected milk (ECM).

Table 1. Yields of energy corrected milk (kg/cow/d) for cows offered different levels of supplements as a Control system or as one of two different partial mixed rations. Data are means for two groups of 9 cows offered each rate of each diet.

Rate of Feeding (kg DM/cow/d)	Control	PMR1	PMR2
6	17.5	15.8	16.5
8	19.6	18.1	19.5
10	21.4	20.3	21.0
12	20.1a	19.8a	22.0b

a,b, within rates of feeding, means with different superscripts are significantly different.

The ECM response to supplements between 6 and 12 kg DM/cow/d was linear for PMR2, but not for Control or PMR1. There was no difference between ECM yield of any group except at the highest rate, when cows fed PMR2 produced 1.9 kg/cow/d more than cows fed the Control and PMR1 diets. These data suggest that feeding grazing cows high rates of supplements as a PMR containing maize grain and maize silage may offer the opportunity to alleviate the diminishing or negative marginal response commonly observed when feeding high amounts of grain in the dairy. ■

Irrigation water:
making the most of it

With at least one in four dairy farmers in Tasmania running out of irrigation water in an average season, making the most of what water you have available for irrigation is essential.

The question that many farmers face in a dry hot summer is, "how do I stretch my irrigation water as much as possible"?

The first thing to consider, if you think that you are going to run out of irrigation water, is can you be more efficient with the water that you are currently applying? Is there any opportunity for you to apply less water each round and extend the irrigation season? To determine how much water you should ideally be applying each round and how often, you first have to know how much water can be stored in the soil in the root zone where pasture can readily access it. When irrigating, it is important to remember that you are actually irrigating the soil that acts like a sponge, releasing water to the pasture. Soils can vary in the amount of water they hold in the plants' root zone.

Soil water is held in soil pores (the spaces between soil particles). A sandy soil has large pores relative to a clay soil and will hold much less water as the large pores quickly drain due to gravity. Roots remove water from the soil pores through suction. Plants use water from large soil pores first because it is more difficult for the roots to remove water held by the small soil pores. The amount of water that plants can extract from a soil is called Readily Available Water (RAW) which is measured in millimetres. The amount of RAW that the different soil types hold in the effective root zone of pastures of 30 cm is shown in Table 1 (effective pasture root zone in WA can vary between 10 cm to 30 cm). It can be seen that a sandy soil only holds 9 mm of RAW for a root zone of 30 cm, whereas a clay loam holds 24 mm. Excess watering above the holding capacity of the soil will cause leaching of soil nutrients and is not a good use of a limited resource.

While the amount of RAW and the amount of water applied throughout the season will generally not change, the frequency of irrigation will change depending on the amount of evaporation and plant water use, known as evapotranspiration (ET). The ideal irrigation round can be calculated by dividing RAW by ET. Evapotranspiration data for the Harvey and Vasse is shown in Table 2. In March, when ET is on an average around of 4mm per day in Harvey, a sandy soil with effective pasture root zone of 30 cm would have to be irrigated nearly every second day (RAW/ET = 9/4.2 = 2.1 days), while a clay loam red soil would be able to be irrigated every six days (RAW/ET = 24/4.2 = 5.7 days). However, if effective pasture root zone is less than 30 cm then irrigation would need to be more regular. ■

Table 1: Readily Available Water held by different soil types in a 30 cm effective root zone and required irrigation round

Soil type	RAW (mm) in a 30cm effective root zone	Irrigation round (days) based on a 4.2mm evapotranspiration
Sand	9	2.1
Loamy sand	15	3.6
Sandy loam	21	5.0
Sandy loam rich in organic matter	27	6.4
Loam	27	6.4
Clay	15	3.6
Clay loam	24	5.7
Well-structured clay	18	4.3

Table 2: Average daily evapotranspiration (mm/day) for WA regions

	Harvey	Vasse
Jan	7.7	7.9
Feb	6.4	7.2
Mar	4.2	5.9
Apr	3.5	3.5
May	2.3	2.3
Jun	0.7	1.7
Jul	1.3	1.7
Aug	0.6	2.3
Sep	2.9	3.1
Oct	4.0	4.5
Nov	5.1	6.3
Dec	7.4	7.2

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Perennial ryegrass Staggers

Mark Freeman, TIAR Dairy Centre

[Reproduced in part from Tassie Dairy News, February 2011]

Commonly a problem of summer and autumn grazing, perennial ryegrass staggers can cause enormous management problems on dairy farms and, in worse case scenarios, can cause stock deaths.

The condition causes nervous, stiff gaited cows that can collapse when moved and often require supplementary feed and water to be supplied as the animals are incapable of grazing normally. This may mean early drying off, even if still milking well, and will almost certainly increase management pressures on the farm.

Ryegrass staggers is caused by the grazing of endophyte-affected ryegrass plants. Most ryegrass plants sown in Tasmania have the naturally occurring seed borne fungus, Neotyphodium lolii. The endophyte is transported within the seeds of the ryegrass plant and is also added by plant breeders to aid in protection from insect damage. The endophyte lives mainly in the seed head and leaf sheaths of the ryegrass plant. Ryegrass staggers occurs when some of the toxins (known as alkaloids) produced by the endophytes are consumed in high concentrations by grazing dairy cows. When a ryegrass plant is undergoing heat or moisture stress the endophyte responds by increasing production of the toxins to protect the now vulnerable plant, thus increasing the risk of staggers if hard grazing occurs.

Controlling staggers at the plant level

The endophyte normally produces three types of alkaloids; Peramine, Ergovaline and Lolitrem B. Peramine has a role in deterring some insect attacks and has no known effect upon grazing stock. Ergovaline protects the plant against some pests and is a known vasoconstrictor, that is, it constricts the blood vessels particularly those supplying blood to the extremities of the body. This can lead to the animal overheating and causing increased thirst. Lolitrem B is an alkaloid that has a serious effect upon the nervous systems of dairy cows causing the stiff gait and increased excitability (nervousness); it is this toxin that causes dairy cows to collapse. The critical levels for Lolitrem B are between 1.8–2 parts per million but if levels of Ergovaline are also elevated, the concentration of Lolitrem B may be much lower than the critical levels and still cause problems.

Plant breeders have bred ryegrass cultivars infected with new endophytes, known as Novel endophytes in an attempt to solve the problem of ryegrass staggers. One of the more common Novel endophytes is AR1 (AgResearch, NZ) which

[Continued over]

Staggers *[From p3]*

contains only Peramine and will not cause staggers in grazing animals. Other Novel endophytes in the market include AR5 and AR6 (AgResearch, NZ) containing only Peramine and Ergovaline. NEA2 (Heritage Seeds) contains Peramine, Ergovaline and low levels of Lolitrem B. It is important to remember that if you wish to remove the endophyte problem from your paddock by sowing new varieties containing Novel endophytes, the original ryegrass plants must be removed, or the seeds from the old remaining plants will re-infest the new pasture.

Controlling staggers with grazing management

Ryegrass staggers is made worse by hard grazing when the plants are under climatic stress. If cows are showing signs of ryegrass staggers then it is important to change the current management practice. Increase supplements to reduce the reliance on the affected pasture and gently move the stock off the problem paddocks and onto safer areas. With this in mind, it is a good idea to plant different cultivars with different endophytes in differing parts of the farm to dilute any potential staggers problem. ■

Making smarter use of nutrients

John Lucey, DAFWA

Making smarter use of available nutrients and more efficient use of fertilisers to increase profitability and environmental sustainability has been one of the major aims of the Greener Pastures project.

With five years of Greener Pastures results, plus six years of results from the previous Vasse Milk Farmlets project, there are some clear findings on how farmers can make smarter use of nutrients.

It is a waste of money to apply fertiliser to acid soils due to lower availability of nutrients. Apply sufficient lime to raise soil pH in top 10cm to 5.5 or greater - apply 5 t/ha lime if pH below 5, apply 3 t/ha if pH 5 -5.5, apply 1 t/ha if pH 5.5 – 6 and no lime if pH above 6.

Many dairy farmers are now confident to use Greener Pastures recommendations to reduce their phosphorous (P) fertiliser. It is not profitable to apply P fertiliser when none is required. If no fertiliser P is applied, soil tests decline slowly, they do not crash, however, if you do not apply P, do not forget sulfur requirements, especially after a wet winter.

Critical Colwell soil test P levels (related to 90% of maximum pasture yield response to applied P fertiliser) vary with the ability of the soil to sorb phosphorus, as measured by Phosphorus Buffering Index (PBI), see Table 1.

Table 1: Critical Colwell soil test P levels for soils of different P sorption capacity

PBI (no units)	Critical Colwell soil test P (mg/kg)
< 5	10
5 – 10	15
10 – 15	20
15 – 35	25
36 – 70	29
71 – 140	34
141 – 280	40
281 – 840	55

Potassium (K) soil levels are difficult to monitor by soil testing as urine patches, containing high K, greatly affect soil test K values. Tissue testing is being increasingly used as a more accurate guide for when to apply fertiliser K.

Clover is very sensitive to K deficiency, so deficiency results in clover rapidly disappearing from the pasture. By contrast, ryegrass is better at acquiring K from soil than clover and rarely shows K deficiency, regardless of the soil test K value.

For intensely grazed ryegrass pastures, tissue test selected paddocks at the three leaf stage through the growing season and apply 10 kg/ha K if the test shows less than 2% K.

Soil testing for sulfur (S) on sandy soils in the high rainfall area is not reliable as sulfur can leach below pasture roots. In wet years apply fertiliser S to pastures on sandy soils after July each year, either as part of an N:K:S blend as we do at VRC or as a spring gypsum dressing. ■

For Further Information

National Dairy Australia Feedbase Projects have a wealth of information about feedbase research & management in WA and other dairy regions available on their websites:

Greener Pastures
www.agric.wa.gov.au/greenerpastures
FutureDairy
www.futuredairy.com.au
Project 3030
www.dairyextension.com.au/project3030.asp
Western Dairy
www.westerndairy.com.au
Dairy Australia
www.dairyaustralia.com.au
www.myG2Mfeedreport.com.au
www.coolcows.com.au
Tasmanian Dairy Demonstration Farm www.tddf.com.au
Beyond 2012
www.tasdairyprojects.com.au

Greener Pastures Bulletins

The Greener Pastures project has been a partnership between the Department of Agriculture and Food Western Australia (DAFWA) and Western Dairy and Dairy Australia to assist dairy farmers make smarter use of nutrients, especially nitrogen (N) and also phosphorus (P).

Greener Pastures findings can be used by the Australian dairy industry to improve the efficiency of nutrient inputs, a major cash cost on dairy farms, and also address growing community expectations that modern dairy farm systems are environmentally sustainable.

A series of Greener Pastures Bulletins are now available, with each Bulletin focused on a specific aspect of nutrient management and/or grazing management investigated during the Greener Pastures project (Table 1). The Bulletins provide practical messages for farmers, together with the major research findings.

Greener Pastures Bulletins cover the following aspects of intensive dairy pasture systems:

- #4820 **Managing nutrients in dairy pastures**
- #4815 **Managing nitrogen in dairy pastures**
- #4811 **Managing phosphorous in dairy pastures**
- #4812 **Managing potassium in dairy pastures**
- #4814 **Managing sulfur in dairy pastures**
- #4813 **Managing soil acidity in dairy pastures**
- #4810 **A fresh look at nutrient losses from intensively managed dairy pasture**
- **Grazing management of dairy pastures** (Release due mid 2011)
- **The economics of managing nitrogen fertiliser in dairy pastures** (Release due late 2011)

Copies of the Bulletins are available by contacting John Lucey: 0429 889 083 john.lucey@agric.wa.gov.au, or from www.agric.wa.gov.au/greenerpastures