agKnowledge
TNM™ "Total Nutrient Management"
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FERTILISER COSTS

Fertiliser costs – how do we cope? This is currently my most frequently asked question! I have written previously on this topic (see Fertiliser Review 17, 19 and 20) but my own thinking has been evolving as I try to find some practical solutions for various clients. This is were I have gotten to in my own thinking – I hope it helps.

For All Farmers

The first point should be obvious. Because fertiliser is now such a large component of discretionary expenditure, I believe, and I certainly hope, that farmers will become more objective when planning their fertiliser programs. Gone are the days of "farming by recipe" – repeating what you did last year, or what dad did before you, or what others are doing in the district. Now is the time to use the tools of science. Set up permanent soil and pasture testing transects. Measure, measure, measure! Soils, pastures and animals.

Get an economic analysis done for your farm so that you know, given your goals and the trends in costs and prices, what the economic optimal soil nutrient levels should be on your farm, i.e. at what level should you be operating at for each nutrient:

a) to ensure you are maximising the long-term farm profitability?

b) to ensure that the soil fertility is in balance - no one nutrient limiting clover growth and hence total pasture production?

It will cost you money to get the necessary professional advice. But that advice, and I know this from our records, could also make you many dollars either in savings on fertiliser costs, or by increasing the long-term farm profitability.

For Dairy Farmers

We know from recent surveys that many dairy farms are being operated at Olsen P levels well above the optimum. This is crazy from two perspectives. First, it costs more, for no additional profit, to maintain higher than required Olsen P levels. Furthermore, P losses to water-ways are related to the concentration of P in the soil. So why operate at higher than necessary soil P levels?

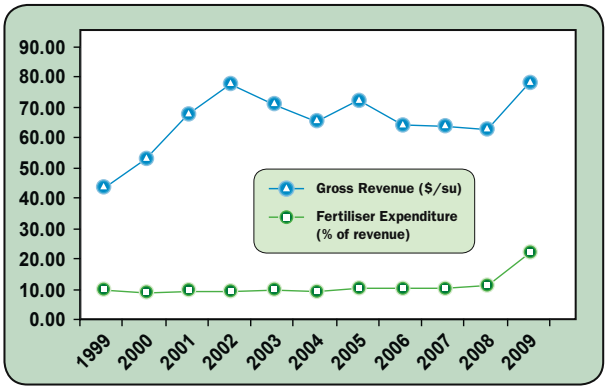
The other problem that I frequently see is soils which are not balanced – all too often the soil P levels are very high, but for some reason, the farmer has forgotten about one of the other important nutrients, especially K and S. Thus clover growth is poor, soil N levels decline (for lack of clover N) and ultimately fertiliser N is used to cover up the problem. Because fertiliser N is many times more expensive than clover N, costs go up for no net increase in production. Soil nutrient balance is therefore crucial.

Given that fertiliser costs have doubled, so too has the value of the nutrients in the dairy shed effluent. One dairy cow now produces about $25 worth of nutrients annually equating to about $12,500 for a 500 cow herd. Using this effluent properly and efficiently is a direct saving on the fertiliser bill.

And remember, generic fertilisers – super, potash, urea and lime are generally cheaper per unit of active ingredient (nutrients or in the case of lime, lime-equivalents) than branded products. The plant does not know the difference so buy the cheapest form of a nutrient.

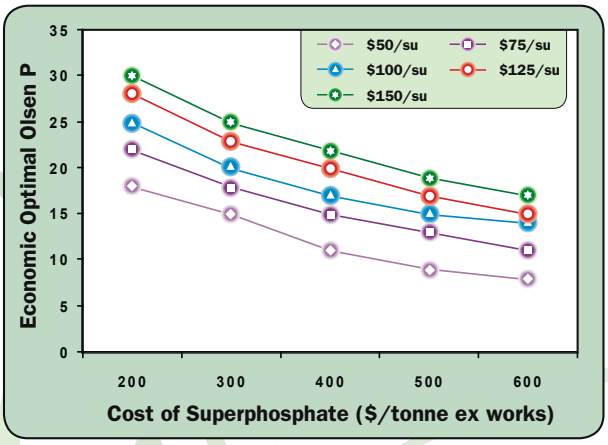
For Sheep & Beef Farmers

Unlike the dairy sector, the sheep and beef sector is not, at the moment at least, blessed with strong commodity prices. The problem is highlighted in the graph.



For the last decade the average sheep & beef farmer has been spending about 10% of total revenue on fertiliser. In the last 6 months this has gone to about 20%, and this assumes that the gross revenue is going to be about $85/su for the season 2008/09, as projected by Meat & Wool. Most commentators are predicting a significant improvement in commodity prices but they need to be equivalent to a gross revenue of about $140/su to restore the ratio to 10%.

The figure below shows the effect of fertiliser costs and gross margin per su on the economic optimal Olsen P – the level required to maximize long-term profitability. (Note that it is assumed in these calculations that transport and spreading are $80 per tonne).



As fertiliser prices increase the optimal Olsen P declines BUT this is offset by increases in the GM/su. Indeed the economic optimal Olsen P is the same (about 15-20) if the cost of super is about $200 per tonne and the gross margin about $50/su compared with the situation where the cost of super is heading toward $600/tonne and the GM/su is about $125.

So in the long term the status quo will be retained if commodity prices improve as predicted but that is not money in the bank yet, and thus the question arises - what to do in the meantime? Here is my list of points to consider:

1) Do not panic – The problem highlighted above is likely to be temporary. If I am wrong then New Zealand sheep and beef farming as we know it will collapse.
2) Remember the past (a) – In the mid-80's the subsidy on fertiliser was stopped. The farmers who best survived the next 5 years were those who continued with their fertiliser program (see Fertiliser Review 16, 2006).
3) Remember the past (b) – research in the 80's showed that pasture production and with it animal production declines at about 5% per year. You may not notice the impact in year 1 but it starts to become harder and harder to get those animals though winter.
4) Remember the science (a) – P stays were it is put largely – the sky will not fall in if you do not apply fertiliser P in one year, assuming that the current Olsen P levels are adequate.
5) Remember the science (b) – some nutrients are more mobile so continue to apply K, S and Mo if they are required.
6) Feed the clover not the grass – clover N is much cheaper than bag N and it is a better animal feed than grass. Optimise the clover growth.
7) Science is your friend - use only tried and tested products
8) Choose the least cost fertiliser – stick with the generic products and avoid the branded ones.
9) Avoid snake oil merchants – "if it sounds too good to be true it probably is."

THE SOIL FOODWEB INSTITUTE: A CASE STUDY

Hands up all those who have heard of the Soil-Food-Web or Abron or Compost tea or feeding the pasture with sugar! In case you are confused here is a case study to ponder.

I was called to a dairy farm not too far from Hamilton during spring 2007. The owners had purchased the farm some 3 years previous and, being of an organic-bent, decided that they were going to do everything by-the-book on their new farm. They called in the experts on organic farming from the Soil Foodweb Institute. [It appears they also trade under the name Abron: Living Soil Solutions]. They took some soil samples and had them analysed, but not in the normal way – they measured the biomass in the various components that make up the biological life in the soil: bacterial biomass, fungal biomass, the number of protozoa and nematodes and the percentage mycorrhizal colonization. Sound good?

Based on this they recommended, among other things, a brew containing fine lime, ground RPR, compost tea, molasses, sugar and fulvic and humic acid. The owners thought they were on their way to organic paradise – healthy, well feed soil bugs, healthy soil, healthy pastures and healthy animals.

I walked around the farm and was appalled by what I saw. The pastures were very sick. The excreta patches, and in particular the urine patches, were very prominent with vigorous ryegrass and clover. Between these little islands of growth the pasture was yellowish-brown, lacked vigour, clover was virtually absent and the ryegrass stunted. Flat weeds were abundant. The farmer was obviously concerned.

I took five soil samples from the farm and had them analysed. The results, shown below, told the story.

	pH	Olsen P	QTK	Sulphate S	Organic S	Mg	Na
Average	5.9	20	5	13	7	16	6
Optimal	5.8 - 6.0	35 - 40	7 - 10	10 - 12	10 - 12	8 - 10	3 - 4

The soils were very deficient in P, K and S, and this was entirely consistent with my visual assessment of the pastures. The soil was very sick. And this outcome was predictable. As far as I could work out the Soil Food Web people did not recommend significant amounts of P, K and S, and of course, in time, the soil nutrient reserves became exhausted, the clover stopped growing, except for around the urine patches, and with it the input of natural clover N back into the soil. Consequently the grass struggled with very little soil N and hence the overall pasture production declined.

And here is the irony. Because pasture production was poor the amount of residues being returned to the soil in dung, and from dead and dying plant material, declined, starving the soil bugs of their food source. Exactly the opposite effect that was required!

How does this nonsense occur?

The people from the Soil Foodweb Institute apparently believe in a theory proposed by an American soil biologist, Dr Elaine Ingham. She had found in her work that the ratio of the various components which make up the microbial biomass in the soil were different depending on the land use. Microbial populations under forests are different from those under natural pasture, which in turn are different from those under developed pastures etc. I am told by a reputable soil microbiologist that this is entirely reasonable and understandable. It is the next step which causes difficulty. From this plausible theory comes the idea that there is an ideal ratio of bacteria to fungi to protozoa to nematodes, in pastoral soil and that the soil can, and should be, managed to achieve this ideal ratio. This I am told is nonsense. Not only is it impossible to measure these microbial entities with any precision but, in any case, soil microbiology in pastoral soils does not work this way.

To make matters worse in this case, the Soil Food Web people recommended applications of things like compost tea (100 l/ha), raw sugar (3 kg/ha), molasses (5 l/ha) and Humic/Fulvic acid (4 l/ha) to presumably encourage the best bugs and achieve the ideal microbial ratios. But consider this: a typical volcanic soil in the Waikato already contains about 50-100 tonnes/ha of Humic and Fulvic acid (these are just components of soil organic matter). What is the little bit in their brew going to do? More sobering, pastures contain about 30% sugar of various types. If you are growing 10 tonnes DM/ha and utilizing 80%, that means 2 tonnes DM/ha are being returned, which equates to 600 kg sugar/ha. And they recommend a further 3 kg/ha!!!

Of course if their science was right I should have seen, after 3 years following this advice, picture-perfect pastures growing in a healthy, biologically active soil. I saw quite the opposite. Needless to say, based on the soil tests I had done, I recommended capital inputs of P, K and S. Twelve months later the pastures are starting to fill out, clover is reappearing and once again there is growth and vitality in soils and pastures. Is it not amazing what a little science can do?

So be wary: these otherwise very well meaning people who simply wanted to do what was right for the soil were taken advantage of by this pseudo-science and ended up inadvertently with the opposite outcome they desired. Dead soil not living soil!

RECIPE: HOW TO FEED THE SOIL BUGS

Take one exhausted soil. Add clover and ryegrass. Plus P, K, S, Mo and lime to measure. Graze frequently ensuring that all excreta is returned to the soil. Maintain soil nutrient levels. Do not lax graze. Let nature take its course. Keep this recipe secret! (PS the applications of sugar, molasses, compost tea or seaweed extracts are not recommended unless the sole reason is to reduce your tax exposure).

The maths is as follows: Assume 10 kg DM/ha/yr initially. Assume pasture utilisation = 80%. Therefore amount of DM returned to soil = 2000 kg/ha. Assume sugar content = 30% of DM = 600 kg sugar/ha, sufficient to feed all the soil bugs.

ECON: TWO POINTS OF CLARIFICATION

I have incurred the wrath of Ravensdown with my public comments about their product ecoN. I completed a review of all the available New Zealand field trial research on ecoN, or more correctly on the nitrification inhibitor, DCD, of which ecoN is Ravensdown's proprietary formulation.

I reported to Ravensdown that there was good evidence indicating that ecoN reduces soil nitrate concentrations and, to the extent that leaching losses of nitrate N are related to soil nitrate concentrations, this suggests that ecoN could become a useful management tool to reduce nitrate loadings to ground water. This good news needs to be tempered because much more work is required before we are in a position to advise individual farmers, in specific climate regions, and on specific soil groups, the likely cost and benefits.

The product ecoN unfortunately did not fare as well in terms of its effect on pasture production: I concluded that the likely pasture response was 2% (+/- 1%). This is exactly what can be predicted given the amount of N in DCD and the rate of application. It is acting as an N fertiliser.

Two technical matters have arisen subsequently to the release of these results, which require comment.

Ravensdown have said publicly that they do not agree with my "selection of the trial data." This sounds sinister. It sounds like I chose particular data to ensure I got the answer I wanted. This is not the case. For the record:

I had possession of data from many field trials, some were 'in-house' and others were in the public domain. Not all these trials were equal however. Some were unreplicated and/or the trials were conducted by unskilled (i.e. non-technical) labour. I had to decide what data to include in my review. This is how I dealt with the problem and how it is recorded in my report.

"To answer this I have posed the broader question: if a proprietor came to me with a set of unreplicated trial data or data derived from a trial operated by unskilled personnel what weight should it be given? I have applied the answer I have given previously before the Courts, in the Maxicrop and Probitas Court cases. They should in my opinion be set aside and given no weight when there is other evidence from properly conducted research to the contrary".

In other words, my decision was based on objective criteria and maintains a high scientific standard. I can be criticised by some for being too hard, too harsh, and too inflexible. But such criticism is unlikely to come from the potential purchasers of the product.

Some people have asked me why my conclusions about the effects of EcoN on pasture production are so different from those coming out of Lincoln University? It is a good question which deserves an answer.

In all the research reported by Professors Cameron and Di they tested the effects of EcoN in the worst case scenario. This is stated very clearly in their early scientific papers. They compared the effects of Econ versus a control (no treatment) in the presence of urea (normally applied at 200 kg N/ha) and urine N (1000 kg N/ha). This is a very high N loading and not surprisingly large effects from ecoN applications were measured. There is nothing wrong with this research – often when scientists want to test a product they go to the most extreme circumstances on the grounds that if it will not work under these conditions it will not work anywhere. It is a starting point to establish the 'proof of concept'.

Of course these extreme conditions (treatments) do not occur 'on-the-farm', and hence it is dangerous to assume that the same results will occur when a farmer uses the product. He will normally have a paddock with a mosaic of urine patches of different ages and different rates of urine N application. Most of the paddock will not have had a recent urine applications. Furthermore, it is unlikely that 200 kg N/ha would be applied in any one application, or even a number of applications, over the winter period. It is for these reasons that the Lincoln University research cannot, as it stands at present, and should not, be extrapolated to the 'real' farm situation.

The conclusion I came to was based on results from trials in which the effect of EcoN was measured under the 'normal' farming situation. This is the reason for the apparent differences between my conclusions and the results from Lincoln University.

EARTHWORMS: THE DANGERS OF ROMANTIC LOVE

You know when you 'fall' in love – everything is always beautiful, nothing is, or can be, wrong. Somehow the normal objective approach to life is suspended!

I was recently invited to talk to a very unique farm discussion group – it comprised 100% female farmers. We got talking about earthworms and their importance. In the process it occurred to me that we all have this terribly romantic notion of earthworms – what they do is all good - they can do no wrong!

They make holes in the soil and make the soil more friable – freer draining. Result; more leaching of nitrate N – an environmental pollutant!

They do poos on the soil surface, called romantically, vermicast. This poo is nutrient rich relative to the bulk of the soil and sitting, as it does, on the soil surface, it can easily be washed into waterways during high rainfall events. The result; enhanced runoff of P – an environmental pollutant!

Those of organic bent would have us believe that "mother nature" is all good – copy her for a happy, healthy wholesome life. I like to ask – what are the facts? It is always a good starting point.

PS: Earthworms are sexually complete – they are hermaphrodites. So I assume they do not have this human tendency to fall in love.

UNDER THE FENCE-LINE

Have you ever noticed that very little pasture grows under fencelines? I have heard many explanations including: the effect of electricity (assuming an electric fence) and or magnetism on plant life and on soil bugs, the weathering of the zinc and or iron from the wires on to the soil affecting pasture growth. It is always a good talking point when on a farm walk.

This is my explanation and I would like to know if there is disagreement.

There are 3 components to our clover-based pastoral system: the soil, the pasture and the animal. All are vital to make the system work. The soil supports the pasture and pasture provides the animal feed and the animal completes the cycle – returning dung and urine to the soil. It is, if you are into management speak, a virtuous cycle, with each component enabling the other to do its job.

Animals apparently are happy to eat the pasture that grows under the fence but are very shy and reluctant to back up to the fence-line when defecating or urinating. The net result is that the soil-pasture-animal-soil-cycle is broken. The nutrients consumed in the feed under the fence is not returned from whence it came.

Just in case you thought I was making this up here is some data I came across recently from a paper by Mr Carran, a scientist who worked at AgResearch, Grasslands.

Soil Nutrient	In the Paddock (0-75mm)	Under the fence (0-75 mm)
Nitrogen	3.9 tonnes/ha	3.0 tonnes/ha
Carbon	46 tonnes/ha	33 tonnes/ha
Olsen P[1]	34	19
Organic S[1]	10.2	4.3
Calcium[1]	14	16
Potassium[1]	32	7
Magnesium[1]	59	59

Notes: 1) Measured in MAF Quick test units.

Quite clearly the soil under the fence-line is depleted in nutrients except Ca and Mg, relative to the bulk of the paddock. This is so despite the fact that fertiliser would have been applied to the area under the fence (these data are from an intensive beef farm on flat paddocks fertiliser by truck). This is once again a reminder of the unique nature of the clover-based pastoral system we have in New Zealand and highlights the importance of the animal in that process. This was of course the most important finding from one of the most important pieces of soil research on grazed New Zealand pastures (see Fertiliser Review No 13, 2004, More Good News for Soil Life).

NITROGEN INHIBITORS: A NEED FOR NATIONAL TRIALS

In years past when a new product arrived on the market or a subject became of national importance, the Director General of Agriculture would instruct the Director of Research, who in turn would instruct his troops in the Research Division to plan and execute a national series of field trials and report back, in effect, to the nation of farmers. I can think of many examples. The national series of trials, on fertiliser N back in the 1960s, when the idea of using fertiliser N on clover-based pasture was seen as a heresy. The national series on lime trials instigated because of the confusion about the importance of lime. More recently in the 1980s, the national series of P trials comparing RPR and soluble P fertiliser was conducted to investigate the usefulness of RPR. These trials were funded by the taxpayer for the national good and the results were free to everyone.

One of the goals of the science reforms, which commenced in 1990, was to encourage more industry funding into science, in and of itself not a bad thing. But unforeseen problems have arisen.

Certainly industry has responded and increased their R & D expenditure. But understandably they want control of their "pot" of money and they want a quick return on their investment. They also have their own priorities. So we now have this plethora of funding pots, each with its own goals, funding

short-term research. Furthermore, the government funding agency, FoRST, does not fund research that it perceives as 'close to industry', arguing that if the industry is the beneficiary of the research then they should stump up with the dollars. In addition, the fertiliser industry has also been reformed and deregulated. They are required, under modern economic theory, to compete nationally. Understandably, they have their own goals and intellectual property (IP) to develop and protect.

The net effect of all of this is that there is now no leadership or direction at a national level in matters to do with soil management. The scientists are left running around in ever decreasing circles, like Oliver, begging for more dollars at each pot, for increasingly shorter term projects.

Apply this situation to the subject of Nitrification Inhibitors. Each of the 3 big companies has developed, or is developing, it own products. The individual company R & D budgets are too small to include a national perspective and they must work in isolation of each other to protect their IP. Importantly they need 'instant' results to increase sales of their proprietary products. Science is compromised by the need for sales, profits and return on investment. The irony is that farmers become confused by the jungle of competing claims and do not know who to believe.

Surely this is crazy. The nation needs good research on these products because of their potential roll in mitigating some of the environmental impacts of farming. The research needs to be comprehensive and it needs to be 'pan industry'. And most importantly it needs to be conducted by scientists who are independent - who have no pecuniary interest in the outcome.

Science Based Knowledge Optimise Productivity Independent Efficient Technology Transfer Sustainability

Optimise farm profitability

Make your fertiliser dollar go further

Decrease your farm's environmental footprint

Dr Doug Edmeades