

THE ECONOMICS OF FERTILISER USE

Just before Christmas 2003 I received in my mail two glossy brochures - one from Hatuma Lime Company Ltd and the other from Northland Fertilisers Ltd. The Hatuma brochure is substantial (20 pages) and tells the stories of six farmers who have used dicalcic phosphate from Hatuma. The Northland Fertiliser brochure is briefer (4 pages) and contains 34 quotes from, one assumes, farmers, all extolling the benefits of dicalcic phosphate. It also contains the statement; "Northland Fertilisers Ltd and their partners [listed in the brochure as Avoca Lime Company and Parker Lime Company] acknowledge the tremendous support received from Hatuma Lime Company." It appears we are dealing with a group of like minded companies.

Many claims are made in both brochures about the merits of dicalcic phosphate. These can be reduced to 5 categories:

- Improved soil health. More earthworms is the frequent claim.
- Improved pasture quality and palatability
- Improved clover growth
- Improved stock production
- Less animal health problems.

Compare these anecdotal farmer observations with what is known scientifically (ie measured in carefully designed and conducted trials) about the combined effects of lime and superphosphate, whether applied separately or together:

- Improved soil health. More earthworms is the frequent claim.
- Improved pasture quality and palatability
- Improved clover growth
- Improved stock production
- Less animal health problems.

Yes, they are the same. As a scientist who has specialised in this area of soil science, I have no problem accepting the anecdotal evidence from farmers who have been long-time dicalcic users. Their experiences are consistent with known scientific evidence. Correcting soil acidity, and/or soil P and S deficiencies, will result in the improvements listed above.

The point is this. There is no magic in mixing one part superphosphate with one part lime. Sure, the soluble mono calcium P in super is converted to less soluble dicalcium P. But the plant cannot use dicalcium P. It must dissolve, when applied to the soil, back to monocalcium P before it is plant available. So much for all those claims that dicalcic P does not get locked up like soluble P or dicalic P does not runoff the hills like soluble P.

Many scientific trials shown that dicalcic phosphate is no better or no worse than applying the same amounts of lime and super separately. A tonne of dicalcic phosphate (50:50) is agronomically equivalent to 500 kg ground limestone and 500 kg super.

The only real magic in dicalcic phosphate is in the pricing. Consider making a tonne of 50:50 dicalcic phosphate:

Ingredient	Cost
500 kg superphosphate	\$77.81 ¹
500 kg ground limestone	\$9.00 ²
Total cost of ingredients	\$86.81
Ex works price	\$133.10 ³

- Notes:** 1) assuming superphosphate at \$155.62 direct ex works Ravensdown
2) assuming ground limestone at \$18.00 ex works
3) ex works Hatuma Lime Company limited

In other words you are paying about \$46.00 more (\$133.10 - \$86.81) for a mixture that will do no more that the two components. Alternatively a tonne of dicalcic at \$133.10/tonne contains about \$77.81 worth of super. By difference you are paying about \$55.00/tonne for the ground limestone. Ah now, that is magic, is it not!

My advice: By all means go for all of the wonderful benefits of dicalcic phosphate. But do it at a fraction of the price - buy your super and lime separately from reputable sources.

Advice? If you are not using the products, or mixtures of the products, listed above, well what can I say - more fool you!



CORRECTION

The Fertiliser Review No 11 carried an article about soil testing. The focus of the article was on where to go to get scientifically tested and proven soil test results.

The article contained the following statement: "All three [the three major testing laboratories] provide the basic soil test, as we will discuss later, for much the same price. They do offer discount-for-volume deals to Consultants but you, the farmer, will only get this discount if your Consultant passes it on to you. Also note that if you are a Ravensdown shareholder you can get a much better deal through ARL."

This statement, and especially the last sentence, has been taken to mean or imply that The Fertiliser Review favours one fertiliser company relative to another. This unintended bias is regretted. In fact, both Ballance and Ravensdown provide free soil testing to some extent to some clients. This is unaffected by who owns the laboratory.



FERTMARK

There is currently no legislation (no Act of Parliament) covering fertilisers and consequently there is no legal definition of the word 'fertiliser'. You can sell anything and call it a fertiliser - and people do, and are! The only consumer protection for farmers at present is the voluntary FERTMARK scheme owned and operated by Federated Farmers of New Zealand.

FERTMARK is a quality assurance system that ensures that fertilisers are true to label. When a product is registered the nutrient content must be declared and an auditor inspects the works and samples the product to ensure it is at or above the declared nutrient content.

The list below shows all the companies and products currently registered under FERTMARK.

From what I know of the scheme, I think it is reasonable to be confident that the products listed above are 'true-to-label'.

At this stage FERTMARK does not cover fertiliser mixtures such as potassic superphosphate. So if you purchase a fertiliser mixture you really have to rely on the QA systems within the particular company. If you want to take this further ask you local supplier for their audit reports.

Company		Products
Asura		RPR, Triple super
Ballance AgriNutrients	Awarua	Calcined magnesite, Hydro Green, Hydro CAN
	Mt Manganui	RPR, Sulphate of Ammonia, Triple Super, DAP
	PetroChem	Crop Zeal, Hydro Complex, Pasture Zeal
	Whangarei	Serpentine Super, Sulphur Super 30, Super Ten
Morrinsville		Durasul, Urea, Granmag, Muriate of Potash
BASF		Nitrophoska Foliar
Fertco		DCP 10, Granulated lime
Groganic		Poultry Fertiliser
NuFarm		Selcote ultra
Osflo Industries		Poultry Fertiliser
McDonalds Lime		Agricultural Lime
Ravensdown	Hornby	Urea, DAP, Ammonium Sulphate, Potash, RPR, MAP
	Ravensbourne	Nitrophoska Perfekt, Sulphate of Potash, Nitrophoska 12-10-10
	Awatoto	Esta Kieserite, Nitrophoska Blue, Nitrophoska Blue extra
	Greenleaf	Superphosphate, Serpentine Super, Potassium chloride (MOP)
Valley		Triple Super, CAN, Maxi Sulphur Super, Agricultural Lime
Redavale		Agricultural Lime
Summit Quinphos		Gafsa RPR, "CM" RPR, Pinhead TSP, Protect PAPR, Muriate of Potash, Sulphate of Ammonium, DAP, Urea, "CM" sulphur, Sustain
Supreme Lime		Agricultural Lime
Taueru Lime		Agricultural Lime



SOUTHERN FERTILISER LTD (now called UPTAKE Ltd)

At a recent field day I was handed a fertiliser recommendation and quotation for a sheep and beef farm in Gisborne from Southern Fertiliser Ltd. The property, or at least the area for which the recommendation was made, was 460ha. A mixture of sulphur, phosphate, limeflour, sodium and blended trace elements (including cobalt, copper, boron, zinc, selenium iodine and "soil microbe activators") was recommended, although the proportions of each were not given. The recommended application rate for this mixture was 41.5 kg/ha, a total order of 19.09 tonnes for the full 460 ha.

The costs (exclusive of GST) specified on the statement were:

1) ingredients, blending, processing, consultation, bagging, freight and pallets.	\$29731.10
2) application by plane	\$8050.00
Total Cost	\$37781.10

Sound good? I think many sheep & beef farmers would think they have done well to get their fertiliser on the ground for \$37,781.10 or \$82/ha. It appears consistent with the fact that the average sheep and beef farmer spends about \$26,000 or \$44/ha on fertiliser every year.

But think again! This farmer is being asked to pay \$37781.10 for 19.09 tonnes of fertiliser on the ground, or more revealing, \$1979 per tonne on the ground! According to survey information from Economic Service the average New Zealand sheep & beef farmer on 2000/01 spent \$280/tonne, on the ground, for fertiliser. These figure reveals that the product and service offered by Southern Fertiliser in this instance is more expensive than the industry norm by a factor of about 7. Apparently this is not unusual for Southern Fertilisers. Another farmer has provided me with 3 similar quotations.

Can this be justified? I have put this question to Southern Fertiliser Ltd but to-date they have not answered my question. Furthermore, they have declined on the basis of privacy, to unbundle their charges by itemising the various costs: ingredients, blending, processing, consultation, bagging, freight and pallets.

To get closer to the cost of the ingredients some assumptions can be made. From the on-ground (viz \$37781.10) we must deduct the application cost (\$8050 as quoted), the pallets (19 @ \$35 = \$665, as quoted), bagging (assuming \$50/tonne = \$950), freight (assuming \$20/tonne = \$380) and consultation (assume \$1000). This would bring the on-ground cost of \$1979 per tonne down to about \$1,400 per tonne which is still very much higher than the ex works costs of conventional products such as super (\$171 to \$182 per tonne) and DAP (\$486 to \$492 per tonne).

It is fair to say that the recommended mix does include trace elements (cobalt, copper, boron, zinc, selenium and iodine) but the amounts are not given. Some of these (eg B Zn and I) are unlikely to have any benefit (see The Fertiliser Review No 7). It is unlikely however that the inclusion of these could account for the price margin. Also the mixture includes "soil microbe activators". As discussed elsewhere (The Fertiliser Review No 8) the value of these is debatable.

As I understand the situation, the Southern Fertiliser product is applied as a slurry and it claimed by some such operators (see article on Lime-Flo this issue) that slurried lime and fertilisers can be applied more evenly and react more quickly than conventional granulated products. Both claims are true

but are of little practical value to the farmer. For instance, significant nutrient transfer occurs in Hill County with movement of nutrients from the mid slopes to the camp areas on the ridges and in the valleys. It can be argued that even spreading is not a benefit in such environments. Similarly, as has been discussed elsewhere (The Fertiliser Review No 3) the type of fertiliser (solubility) and form (liquid, slurry or solid) has very little effect on the agronomic performance of fertilisers.

My advice? Not recommended for the cost sensitive farmers.

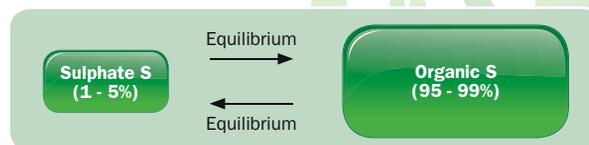


INTERPRETING SULPHUR SOIL TESTS

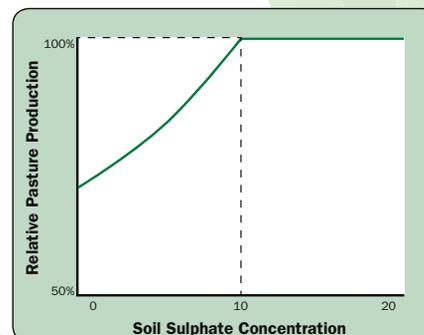
In the last Fertiliser Review (No 11) we reviewed the relevant science on the sulphur (S) requirements for pastures - how much, what time and form, and single versus split applications. This is the second leg of that double.

We now have two soil tests for S - the organic S test and the sulphate S test. What do they measure and how should they be interpreted?

Most (about 95-99%) of the S in pastoral soils is present in the organic form - it is part of the organic matter in the soil. Organic S is not plant available and must be broken down by the microbes in the soil to the inorganic form - sulphate S. At any given time the amount of this plant-available sulphate S is small (1-5%). But these two 'pools' of soil S are linked. There is an equilibrium between the large pool of organic S and the smaller pool of sulphate S.



The bigger the pool of organic S, the higher the concentration of sulphate S that can be maintained in the soil and we know from many field trials that pastures need a soil sulphate concentration (ie the number on your soil test report) of 10-12 for optimal growth.



If the soil contains sufficient organic S to maintain, via the equilibrium discussed above, a soil sulphate level of 10-12 or greater, then no additional S fertiliser is required to achieve maximum production. We would say the soil has adequate S reserves. But not all soils can accumulate sufficient organic matter to maintain the soil sulphate level above this critical level, no matter how much fertiliser S has been applied in the past.

The general rule is: the wetter the environment the more organic matter can accumulate. Thus, on ash, pumice soils and sedimentary soils under high rainfall (> 1200 mm), organic matter, and with it organic S, accumulates to a maximum level, given time (20-50 years) and fertiliser S inputs, such that the organic S level is high enough to maintain sulphate S levels well above the critical sulphate level of 10-12. Thus, fertiliser S inputs can be withheld without loss in production, until the soil organic S is 'mined' down to the critical level.

In soils formed in drier climates of New Zealand, such as the sedimentary soils of the East Coast of both Islands, it is impossible to accumulate sufficient organic S, such that the critical soil sulphate level is > 10-12. In these circumstances the soil cannot provide sufficient sulphate S from the mineralisation of organic matter, to meet the annual pasture S requirement. Fertiliser S inputs are, and will always be, required to achieve maximum pasture production.

It turns out, completely serendipitously, that the critical level for organic S is the same as that for sulphate S, 10-12. So which test is more reliable?

As noted above, there is an equilibrium between sulphate S and organic S. As the plant takes up sulphate S and the bugs in the soil get to work and mineralise organic S into sulphate S, restoring the soil sulphate concentration. And when fertiliser S is added the sulphate level in the soil increases rapidly (see fig) but then gradually declines (the bugs and other processes convert the sulphate S back into organic S) back to the equilibrium level determined by the amount of organic matter. Alternatively, when there is sufficient rainfall to cause leaching, the sulphate concentration declines rapidly depending on the rainfall intensity (see fig). (Sulphate as you know is water soluble and gets carried along with the water passing down through the soil). But once again, the bugs get to work, releasing more organic S and restore the sulphate concentration.

For these reasons sulphate S levels in soils can be variable, depending as it does on recent fertiliser applications and rainfall events. This makes interpreting the sulphate test problematic. Is the test low because of a recent leaching event or is the soil really S deficient? Alternatively, a high reading does not necessarily mean a high soil S status. The organic

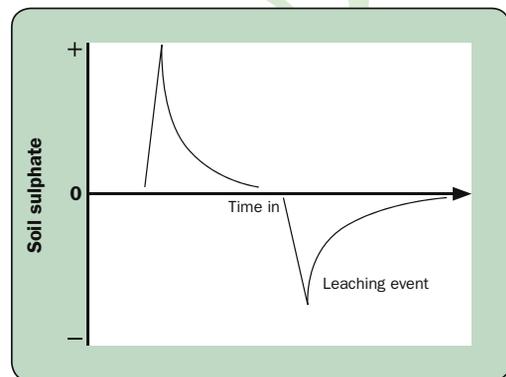
S is not affected by these processes and is consequently is more stable and reliable.

To summarise:

Sulphate S: is a measure of the amount of available S which is immediately (week to months) available for plant uptake. It can be variable because it reflects past fertiliser inputs and leaching event.

Organic S: is a measure of the soil S which is available in the longer-term (months to years). It is more stable and therefore a more reliable measure of the long-term soil S supply.

Warning: There are some fertiliser salesmen who want you to believe that sulphate S is less efficient than elemental S. The patter goes like this: sulphate S is water soluble and is therefore readily leached. The implication is that fertilisers, like superphosphate which contain sulphate S, are inefficient - the sulphate is readily washed out of the soil - and it would be more cost effective to use elemental S. Well, as discussed above, at any one time, the amount of soluble sulphate of the topsoil is very small (1-5%). So even if all of this soluble S was leached out during a rainfall event, you still have the larger organic S pool (95-99%) intact (it does not leach) to replenish the sulphate S.



DAP

A farmer from the North has requested more information about DAP. He writes, "Local farmers are using more of it, splitting it into two dressings, spring and autumn. I can find nothing much in my fertiliser books. It is new, [you] use half as much, and the cost is a factor and that is about all I know."

DAP is relatively new to us in New Zealand, or at least to many pastoral farmers. It has in fact been around a long time. It was first manufactured on a commercial scale after WW II, but has never been manufactured in New Zealand. All the DAP used in New Zealand, even today, is imported.

It is made by adding ammonium (which contains N) to phosphoric acid (which contains P) to form a chemical called di-ammonium phosphate (DAP for short). It has excellent physical properties (all the granules are of uniform size and hardness) and typically contains 18% N and 20% P. It is very soluble in water.

As a farmer, there are several important things you need to know about the chemistry of DAP.

- The chemical form of the P in DAP is the same as in superphosphate - it is water soluble mono phosphate. Thus a kg of P in DAP is agronomically the same as a kg of super P. But a tonne of DAP contains 200 kg P and hence you will need 2.2 tonnes of super to provide the equivalent amount of P.
- DAP also contains N (18%), in a form similar to urea. Thus, a tonne of DAP which contains 180 kg N, is equivalent to 390 kg urea.

So, if the chemical form of N and P in the respective products are similar, is DAP a more cost-effective form of N and P? The table below compares the ex-works cost of P in some common P fertilisers using current prices. The P in DAP is more expensive than that in super but is cheaper than triple super.

Product	Current average cost (\$/kg P ex works)
Superphosphate	1.34
RPR	1.53
DAP	1.53
Triple super	2.21

- Notes:**
- 1) average cost from Ballance & Ravensdown price lists
 - 2) the S in super is valued at \$0.33/kg and the N in DAP at \$0.84/kg

These are, it is emphasised, the ex-works costs and ignore the transport and spreading costs, rebates, discounts and agent margins, and as we know from the above, less tonnes of DAP than super are required to get the same amount of P. However, even taking this into account (see The Fertiliser Review No 8) DAP is only cheaper than super on the ground if you are more than 300 km (aerial application) or 400 km (groundspread) from the nearest works. Thus, for most farmers, the super-plus-urea option will be cheaper on the ground relative to DAP.

One final word of caution. Superphosphate contains about 20% Ca. DAP contains no Ca. This should not normally be a problem in the short-term (5 to 10 years) because most NZ soils contain more than sufficient Ca to meet pasture and animal requirements (see The Fertiliser Review No 7). However, consistent use of DAP in the longer term, especially if there is

no lime input (lime contains about 35% Ca), will deplete soil Ca reserves.



PHOSPHATE POISONING

Providing fertilisers are used appropriately they do not cause animal health problems. But the general concern is frequently raised. In this issue of The Fertiliser Review we deal with phosphate poisoning. In the next issue we will look at nitrate poisoning and depending on your feedback we may well delve into other concerns.

Phosphate poisoning of stock is fortunately a rare event but is a possibility whenever fertiliser is applied to paddocks with stock on them, or when stock are moved onto paddocks too soon after topdressing. Although the name 'phosphate poisoning' implies that phosphate is the culprit, it is now thought that fluoride (which is present in all phosphate fertilisers) causes most of the damage, with phosphate playing more of a contributory role. Hence phosphate poisoning is more correctly described as fluorosis.

Often the first sign a farmer has that something is wrong is when he finds some of his animals dead. Others may be seen with vague metabolic signs suggestive of sleepy sickness or milk fever but are unresponsive to treatment. Poisoning episodes typically result in 3-5% mortality but can go as high as 10%. Obviously it is in farmers' own interests to be aware of the potential risks when planning fertiliser applications.

In the period 1965-75 a total of 37 poisoning outbreaks were recorded by the Ruakura Animal Health Laboratory and these were subsequently investigated by

P. J. O'Hara and D. O. Cordes. In all but two cases, the affected stock were pregnant or lactating ewes. Only one episode involved lambs and one involved hoggets. Poisoning of cattle is uncommon but not unknown - in recent years most instances of cattle poisoning have followed basic slag application to dairy farms.

All of the poisoning episodes investigated by O'Hara and Cordes occurred in the July-to-October period with most (80%) occurring in September or October. At that time of year, especially in difficult springs, the gap between the feed demand of the ewe flock on the one hand, and the supply of feed on the other, is stretched to the maximum.

Common features of poisoning episodes were high stocking rates, short pastures, and no alternative fodder available to stock. Frequently fertiliser had been applied to pasture carrying frost or dew which, in the absence of rain, then dried on to the foliage. Fine weather, which is obviously favourable for the application of fertiliser, increases the risk of poisoning.

agKnowledge and **The Science of Farming**

Although stock will usually avoid eating contaminated pasture if an alternative is available, poisoning inevitably occurs because they have no choice. In one case it was observed that strips of pasture which had been missed with fertiliser were grazed to ground level.

Most recorded instances of phosphate poisoning seem to have involved superphosphate. Of the outbreaks investigated by O'Hara and Cordes, the type of fertiliser had been recorded in about half the cases and all but one involved superphosphate or super-based blends. However, this is probably because almost all fertiliser applied in New Zealand at that time was super-based. More recently, phosphate poisoning following DAP application has been reported.

It would be expected that the risk of poisoning would be greater at higher rates of application and for products with a higher proportion of 'fines' which will more readily adhere to damp foliage. For these reasons, superphosphate is perhaps more likely to cause poisoning than high analysis fertilisers like DAP.

Obviously the best policy to minimise the risk of poisoning is to keep stock off topdressed pasture until at least 25 mm of rain has fallen. Since this is not always possible, it is as well to be aware of, and if at all possible avoid, the main risk factors. These include the application of fertiliser (especially superphosphate) in late winter or spring to short pastures being or about to be grazed by pregnant or lactating ewes under nutritional stress.



INTRODUCTION: Mr Dave Routley

Our 1-on-1 farm service Total Nutrient Management (TNM) (see The Fertiliser Review No 10) has been very well received by farmers in both islands. It is clear that farmers are crying out for independent science-based information and assistance.

To meet the demand Mr Dave Routley has joined the agKnowledge team, based in Northland. He will be well known to those in the north because this was his old patch where he worked for many years as a Technical Representative for Farmers Fertiliser. It used to be said of Dave that he knew every blade of grass in Northland. That is stretching it of course! What is true is that he is committed to the agKnowledge motto: independent, objective, science-based information.



SUBSCRIBE TO THE Fertiliser REVIEW

Do you want to subscribe to **The Fertiliser Review?**
Be informed. Order now
(\$15.00 per issue (2 issues per year, October and March))

Contact:

Freephone : **0800 FERT INFO** (0800 33 73 46)
Email: **info@agknowledge.co.nz**
PO Box 9147, Hamilton 3240, New Zealand

 **Optimise farm profitability**

 **Make your fertiliser dollar go further**

 **Decrease your farm's environmental footprint**

Technology Transfer
Optimise Productivity
Science Based Knowledge
Independent
Effic
Practical Experience
Sustainability



Dr Doug Edmeades

THE **Fertiliser Review**

ISSUE
12