March
2002

agKnowledge

TNM™ "Total Nutrient Management"

THE Fertiliser Review

ISSUE 8

TRANSPORT AND SPREADING COSTS

The Fertiliser Review regularly provides information on the relative cost of the major fertiliser products on the market. These comparisons are based on ex-works prices. Correspondents have asked; what effect does transport and spreading costs have on these comparisons? This article looks at the relative cost of P, on the ground, for the four major P fertilisers - single super, RPR, DAP and triple super – at varying distances from the works. The focus is entirely on P because it is the most expensive nutrient and hence drives fertiliser costs.

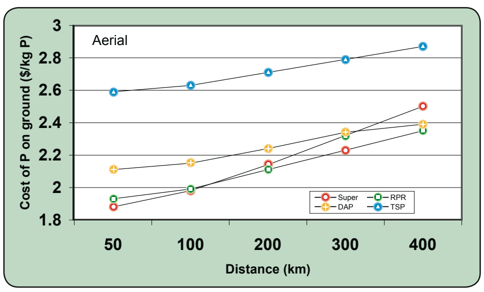
Assumptions

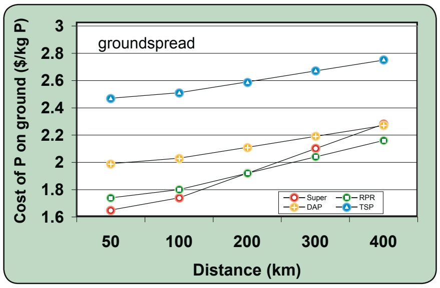
Some assumptions are necessary. These are:

1. The ex works cost of P ($/kg) based on current prices are: 1.54, 1.60, 1.99 and 2.47 for single super, RPR, DAP and triple super respectively.
2. Transport costs are assumed as $2.50/km for 30 tonnes two-way.
3. Spreading costs ($/tonne) are 25 and 45 respectively for ground and aerial spreading.
4. Fertiliser rebate is calculated as $15/tonne + 2.5% of $/tonne (viz super = $19.89/tonne).

Results

The graphs below show the effect of increasing distance from the works on the cost of P on the ground for the four major P fertiliser for aerial and ground spread application.





It is immediately obvious that triple super is never cheaper than the other products. The higher ex works cost of this product is never offset by the fact that less tonnes need to be transported and spread because of its higher P content. Similarly, DAP only becomes cheaper than super on the ground, if the distance to the nearest works is greater than 300 km, for aerial application, and greater than 400 km for groundspread.

The comparison between super and RPR is slightly more complicated. For aerial application the breakeven distance is just over 100 km – a kg of RPR P is cheaper on the ground than a kg of super P if this distance is exceeded. For groundspread the breakeven is about 200 km. However, a kg of RPR P does not have the same agronomic value as a kg of super P, because it is a slow release fertiliser. Research shows that the most effective RPR (Sechura) dissolves (ie the P becomes plant available) at about 30% per year. Thus, you would need about 3 kg RPR P to do the same job as 1 kg of super P, at least initially. If we factor this into the calculation, the on-ground costs for RPR P would need to be increased threefold. This would mean that super P is, based on current prices, cheaper on the ground than RPR P, irrespective of the distance from the nearest works.

In summary, the cost of transport and spreading has only a minor effect on the relative cost of P fertilisers on the ground. Unless distances are greater than 300-400 kms, ex works costs are a good guide to the relative costs of P fertilisers, especially when the slow release nature of RPR P is considered.

BIOPHOS – ORGANIC, BUT!

New 'organic' fertilisers are popping up in the market-place like mushrooms on a mild moist autumn day. While I am very supportive of the concept of a truly cost effective and competitive organic fertiliser, I must express caution at this stage, given the extravagant claims being made for some of the current products.

Biophos is a good example. It is made by composting an RPR with fish-waste and a selection of soil fungi and bacteria. It is manufactured by Sieber New Zealand Ltd and marketed through Ravensdown Fertiliser Cooperative Ltd. Many claims are made by the company for this product. These include:

1. "Biophos is a slow release organic fertiliser",
2. "Biophos stimulates biological activity in the soil",
3. "Biophos stimulates plant growth and health and activates the immune system," [of the plant it is assumed],
4. "Biophos makes N, P, K, Ca and S available to plants in the soil micro-organisms," [via the micro-organisms it is assumed],
5. "Biophos prevents leaching of minerals [one assumes P]into the environment because they are part of the micro-organisms and not just part of the water phase of the soil".

Putting these claims into plain language, the company claims that the fungi and bacteria breakdown the RPR and incorporate the released P into their bodies, or to use the technical term, their biomass. In this biomass form the P, it is claimed, is not susceptible to leaching, runoff or P fixation.

I recently had the opportunity to review Sieber's files on the research and development of this is product with, I must add, the permission of the company. It is true that Sieber New Zealand Ltd have conducted a range of field trials with the product (6), together with laboratory tests and analyses. My conclusion based on this information was that Biophos is no better or worse than the same amount of P applied as a straight RPR. In other words composting the RPR with fish-waste and adding soil micro-organisms has no observable effect on the RPR. Biophos is no different from the original RPR!

For example, AgResearch analysed Biophos and the untreated RPR and found that they were chemically similar.

Product	Total P	Citric P	Water Soluble P
RPR (ie untreated)	12.56	3.94	< 0.2
Biophos	12.33	3.96	< 0.2

More importantly, Landcare found no evidence that Biophos contained significant amounts of biomass P – in other words no significant amount of P in the form of fungi and bacteria biomass.

Where does this leave the claims made for Biophos? It is accurate to describe Biophos as a 'slow release organic fertiliser' and it is also true that, like straight RPR, and any P fertiliser for that matter, it will, given time, release P, and if the soil is P deficient stimulate plant growth. However, the other claims (4 and 5 above) are not supported by the current evidence. If there is no biomass P in the product, as found by AgResearch and Landcare, then the mechanism by which the plant gets P cannot be via the micro-organisms and the P cannot be protected from losses because it is in a biological form.

My advice? Extreme caution required! Do not pay more for this product than you would for straight RPR.

THE RESIN P TEST: SCIENCE AND INTRIGUE

The Resin P test is causing problems. Surprise surprise! But first a little background.

When RPRs were introduced into New Zealand in the mid 1980s it was known that the Olsen P test did not measure RPR residues in soils and that therefore it would underestimate the true P fertility of a soil to which RPR had been applied for a number of years. A solution was required and to this end MAF (subsequently AgResearch) contracted Massey University to undertake some research. In 1991 I was appointed National Science Leader (Soils and Fertiliser), in AgResearch and inherited the management of this project. A final report on the work was completed and sent to me in January 1992.

The essential findings of this research was that, in the absence of RPR P (ie where only soluble P was used), the Resin test was no better or worse than the Olsen P test at predicting pasture production. Where RPR was used, the Resin test was marginally better than the Olsen test. Similar results had been reported from Australia. However the New Zealand work had an important limitation: the all important field calibrations where done on only 6 sites, and then, only where RPR was used annually for 6 years.

A decision was required - do we (AgResearch) introduce this Resin test commercially. After many meetings with my staff the unanimous decision was made not to introduce the Resin test.

Our reasons included:

1. To properly calibrate the test in all the other combinations of soil group, climatic region, and years of application of RPR, would cost hundreds of thousands of research dollars. Was this justified given that by this time the RPR market was small and dropping?

2. While the Resin test measures RPR residues, it does not provide any information on how fast the residues would breakdown and become plant available. We knew from other research that the rates of dissolution of RPR varied from 0 to about 70% (average 30%) depending on the type of RPR, its particle size and the prevailing climatic and soil conditions.

3. A better approach, we thought, to the problem, was to measure the actual amount and type of RPR residue in the soil, and then apply to this information the field tested RPR dissolution model, which took into account all of these factors.

4. Multiplying the Olsen P test by a factor of 1.7 was as good a predictor of pasture production as the Resin test where RPR had been used for 6 yrs. Lower factors could be used if RPP had only been used for a few years.

5. The Resin test was a complex and difficult test for a routine laboratory procedure.

6. We did not know anything about the field variability of the test.

The soil scientists at Massey University were disappointed with this decision and were possibly miffed that we decided not to introduce the test. The net result was that via Massey University staff and unbeknown to us, Roger Hill (RJ Hill Laboratories) ended up with a copy of the report. Furthermore, and without reference to or discussion with AgResearch, RJ Hill Laboratories Ltd decided to commercialised the test and make it available to the public.

In my opinion RJ Hills Laboratories has, and continues, to act irresponsibly in this regard. The report and all the information it contained was the property of AgResearch. It was not theirs to commercialise and they most certainly should have obtained permission from AgResearch to use its intellectual property. But worse than this, it is irresponsible in my view to introduce into the market place a test which has not been not been adequately calibrated in the field and consequently cannot be interpreted with any confidence.

And so the wheel has gone full circle. People are reporting difficulties with this test in the field. The results are variable and cannot be reliably interpreted. Roger Hill himself has reported difficulties with this test in the laboratory, often necessitating re-running and analysing results.

All of this was predicable and avoidable from the outset. The Resin test should never have been introduced into New Zealand for this purpose and its presence in the market place simply causes farmers and consultants more confusion and unnecessary expense for zero gains. We in New Zealand should be able to do better than this.

My advice: Ignore the Resin P test.

SOIL FERTILITY TRENDS: ARE WE SUSTAINABLE?

Now for some good news. My colleague Dr Ants Roberts, before leaving the hallowed halls of institutional research (AgResearch) to join Ravensdown Fertiliser Coop Ltd, published a summary of soil test trends over the last 12 years, in the dairy and sheep & beef sectors. These data are from the Celentis Analytical database of advisory samples (250,000). The main points are:

1. Soil pH levels are ranging between 5.5 to 5.9 for both dairy and sheep & beef sectors. There are no obvious trends over time in the sheep and beef sector but there is an upward trend in the dairy sector. Dairy farmers, it appears, are using more lime to get their soils to the optimal pH level (5.8-6.0) for pasture growth.

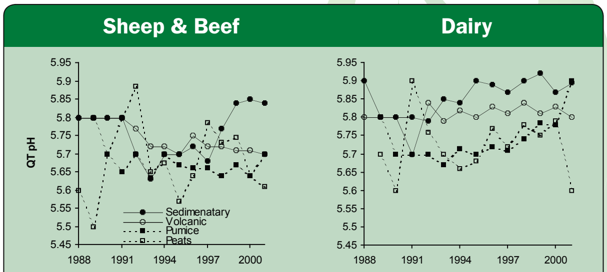


Fig 1

2. The Olsen P (referred to in the graph as QT (Quick test) P) are increasing in both sectors. Typical levels in the dairy sector are now about 30 for the sedimentary and volcanic soils and about 40 for the pumice and peat soils, consistent with the economic optimal levels of 25-30 and 40-45 respectively for these soil groups. The soil P levels in the sheep & beef sector are between 15-20 and have increased slightly over time. The economic optimal levels for this sector range from 10 up 25 depending on farm class (see article this issue). It appears that there is some scope for some sheep & beef farms – those with gross margins than \$500/ha – to profitably increase production.

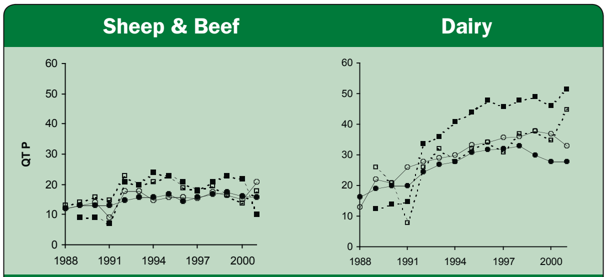


Fig 2

3. Soil Mg levels appear to be slowly declining in all situations, except the pumice soils under dairying. These trends are entirely predictable. The pumice soils have long been known to be Mg deficient and dairy farmers on these soils are in the habit of using fertiliser Mg to maintain soil Mg levels. This is not the case in most other situations where fertiliser Mg is no normally part of the fertiliser program. Losses of Mg from pastoral soils are about 15-25 kg Mg/ha/yr, mainly as leaching. Thus, if no fertiliser Mg is applied, existing soil Mg reserves will be depleted and the soil Mg level will decline accordingly. There is no immediate cause for alarm but farmers should regularly monitor soil Mg and use maintenance fertiliser Mg inputs (15-25 kg Mg/ha/yr) if the levels start to trend below 10.

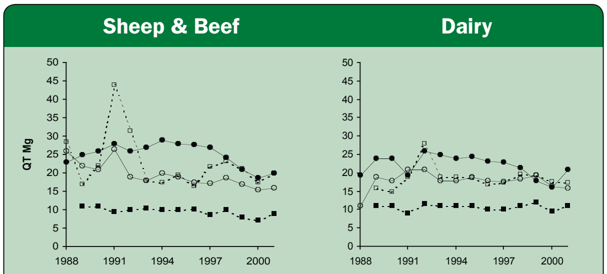


Fig 3

4. Soil K levels under dairying have been relatively constant over time for all soil groups and are typically in the range 5-7, consistent with the optimal level of 6-8. The levels in the sheep & beef sector are also steady but are lower on the pumice and peat soils (range 4-5) (the optimal level 6-8) than on the volcanic and sedimentary soils (range 6-8). It appears that sheep & beef farmers on peat and pumice soil need to review their potash inputs to ensure current inputs are sustainable.

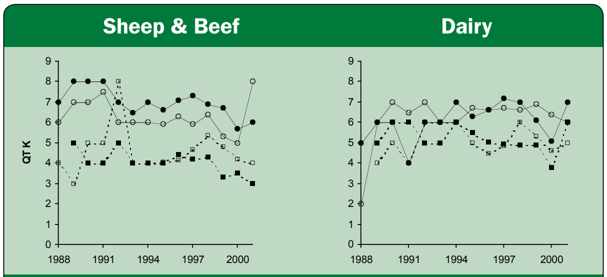


Fig 4

Overall these data indicate that current fertiliser practices are sustainable in the sense that losses of nutrients via product removal, transfer to unproductive areas and leaching, are being replaced so that soil nutrient levels are not declining. The exception is Mg. Soil Mg levels on most farms appear to be declining slowly and should be closely monitored in future. There is also evidence suggesting that some sheep & beef farmers could profitably increase production by improving soil P and K levels.

My advice: Monitor, monitor monitor. Set up a soil sampling protocol for your farm and regularly measure soil nutrients levels. Trends over-time will then become obvious and therefore manageable.

SOIL INNOCULANTS, BIO-STIMULANTS AND ACTIVATORS

If advertisements and articles in the farming press are a guide, then I think I see a new type of soil 'health' product in the market place. These are liquid products variously called soil bio-stimulants, soil activators or soil inoculants. Examples include 'PastureAid Plus' (Jenkins Biolabs), 'Pasture Clover Plus' (BioStart Ltd), Tri-D25 (JH Biotech Inc) and SC 27 (Environcorp NZ Ltd) Even my old favourite, Maxicrop – the product the High Court said did not and could not work – and its derivative, Combo (Mark Bell-Booth Ltd), have been re-branded as soil bio-stimulants.

These products are claimed to either contain more vigorous soil microbes and/or organic substrates to feed the existing microbes. The net result, it is claimed, is enhanced soil biological activity, faster turnover of nutrients and hence improved plant growth and health. Some also claim beneficial effects on soil structure and the suppression of soil pathogens.

What does science say about such products?

There are five main groups of soil micro organisms; bacteria, fungi, algae, actinomycetes, and protozoa. Collectively these organisms make up a large proportion of the total soil biomass (the living soil organisms), which, in health fertile soils can amount to a staggering 10-20 tonnes of biomass/ha, reinforcing the old rule of thumb that there is as much 'animal' liveweight below the soil as there is on top. The point is this, healthy fertile soils, as is the case for most New Zealand soils (see article this issue "Soil nutrients: are we sustainable"), are literally teeming with bugs. It has been estimated that a teaspoon of soil contains about a billion bacteria!

All these micro-organisms have specific roles in the soil and the net effect of their combined activities is the breakdown of plant and animal litter (plant roots, plant residues, dung) into increasingly smaller fragments, ultimately forming soil organic matter. Not only is organic matter good for maintaining soil structure, but these processes result in the release of nutrients from the litter in a plant available form for future plant growth. This is natures nutrient recycling system.

To do their job most micro-organisms need water and oxygen, plus a source of energy which they get from the litter they process. The more litter being returned to the soil the more active the soil micro-organisms. Fertilisers for example, stimulate plant growth and hence the amount of litter going back to the soils. Animals add to this recycling. There are many scientific studies that show that fertilisers and the grazing animal generally have beneficial effects on soil microbiological activity.

Most of the microbes in our soils are unbiquitous – they are naturally present in most soils. Of course if the soil is sterilised they are wiped out and soils can be made effectively sterile if the conditions for prolonged periods of time are too cold (< 5o C), too dry (< wilting point) or if no new litter is added. For example, continuous cropping with the removal of the litter for many years (> 10 yrs) reduces soil organic matter and with it, soil microbial activity. Leaving aside these extremes most fertile New Zealand soils and especially those under pasture a 'full' of active microbes.

Successful Products?

There are several examples of the successfully manipulation of soil micro-organisms. The most profound in New Zealand is the use of rhizobia. These bacteria live on clover roots and work in association with the clover to fix nitrogen from the atmosphere. They were not originally present in most New Zealand soils and had to be introduced via inoculated seed. Now they are here, they are here to stay and the use of rhizobia inoculated seed is now only required on undeveloped soils. Indeed, their introduction has been so successful that attempts to introduce new improved strains of rhizobia have failed because of the virulence of the established populations -they are now well adapted and simply 'wipe' out newcomers. Another example is the product Kodiak. This is a culture of a specific bacteria which suppresses the activity of a specific soil pathogen (ie a bad micro-organism) which damages wheat roots and hence limits production.

Failures

There have been notable failures. For example, attempts were made in New Zealand in the 1970s, to introduce a special, more active, type of soil fungi - mycorrihizal fungi - into New Zealand pastoral soil. These fungi grow on plant roots, and in sterile soils, their introduction greatly increases the plants ability to take up soil phosphorus. These fungi are already present in large numbers in New Zealand soils and are well adapted to our conditions. For this reason new, possibly more effective strains, could not be successfully introduced.

New Products

So where does this science leave these new products. How good are they and where are they likely to be useful? First, it is possibly that these products could have beneficial effects on sterile soils – soils without any resident microorganisms. Except for fumigated glasshouse soils, such soils do not exist in New Zealand. It is also possible that they could be beneficial on runout soils – soils cropped continuously for many many years. Once again this would be unusual in New Zealand where most cropping farmers and market gardeners practice crop rotations including a pasture phase. In other words they probably do not have a major role or use in the New Zealand context. And this indeed is reinforced by the field trial results.

Field Trials

I have recently reviewed the international literature on these products. Results from 153 field trials, examining the efficacy of 15 of these products on a wide range of crops, showed that the average 'response' was about 1%. At the practical farming level these products appear to be ineffective. These results were obtained on cropping soil, which as noted earlier are likely to have lower organic matter levels and hence biological activity than pastoral soils. It is less likely that they would be effective in the pastoral situation.

There are two plausible reasons for this. First, as alluded to earlier, these products, when applied as recommended do not add sufficient numbers of microbes to affect a change to the existing soil microbial population. For example, one product investigated was Agrispon, a soil bacterial inoculant. It was found that the ratio of the number of bacteria added, when the product was applied as recommended, to the number present in the soil initially, was about 1 to 15 million!

Similarly, given their rate of application (typically 10-20 litre/ha) it is unlikely that they will provide sufficient additional organic matter – food - to affect the activity of the existing microbes. For example a standard application of Maxicrop adds about 500 grams of organic matter/ha.

agKnowledge and The Science of Farming

The amounts of organic matter currently being recycled in fertile pastoral soils in New Zealand is of the order of 50-100 tonnes/ha!

My advice? Leave well alone and the cheque book in the pocket. Two quotations are appropriate. Norman Taylor, the father of soil pedology in New Zealand, once said "the soil is a living entity". I hope you now agree. To this, Professor Walker, the father of soil fertility in New Zealand, added, "Soils are like a babies. Keep them well fed [with nutrients, trace elements and lime], well watered [irrigation or natural rainfall] and keep their bottom's dry [well drained]." If you manage your soils following this wisdom and advice, the soil microbes will look after themselves. You will never need a soil inoculant, activator or bio- stimulant.

Help! Help! Help!

Many thanks to those who filled out the recent questionaire. Much appreciated.

For your information, 94% said that The Fertiliser Review added value to thier business. An overwhelming 96% said it helped them make better fertiliser decisions and 78% said it saved them money.

Why such success?

Well, 76% of you said that The Fertiliser Review was valued because it was relevant, objective, science-based and independent.

Remember to check out our website for more info and success stories!

YOUR QUERIES...

Do you have a topic, a product or issue relating to fertilisers that you would like discussed in **'The Fertiliser Review'**?

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