

Fertiliser Review

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THE REACTIVE PHOSPHATE ROCK (RPR) STORY

The phosphorus (P) in most phosphate rocks (PR) is not plant-available – it must be chemically treated with acid to convert the P into a plant available form. In New Zealand this is done by treating carefully chosen PRs with sulphuric acid, making water soluble P plus soluble sulphate S. However, it was realised in the early 1990s that some PRs were sparingly soluble – they did not require treatment with acid to make the P plant available. Thus, the idea of direct application Reactive Phosphate Rocks (RPR), by-passing the need for any manufacturing.

Reactive Phosphate Rocks were introduced into the New Zealand fertiliser market in the mid-1980s, coinciding with the removal of fertiliser subsidies. At this time it was claimed that they were cheaper than superphosphate, as a source of P, and that they were agronomically equivalent to super – in other words a kg of P from super was equivalent to a kg P for RPR. They were strongly promoted by new, emerging start-up companies, and enthusiastically purchased by farmers.

I was at the time the National Science Leader of the Soils and Fertiliser Group in the old Research Division of the Ministry of Agriculture & Fisheries, which morphed in 1992, into the Crown Research Institute (CRI) called AgResearch. As a measure of the interest in RPRs at this time, it is interesting to reflect that about 50% of the Group's annual R&D budget was directed towards research on RPRs. It was a big deal.

Initially we – most soil scientists - went along with the early RPR narrative. We had no research data at the

time to say otherwise. But as our research developed a different 'story' emerged.

It was true that on a total P content basis RPR P was cheaper than the P is super. But as the science emerged it became increasingly clear that RPRs were not agronomically equivalent to soluble P fertilisers, such as super. As things turned out it became a complex knot to unravel.

Some of field trials, comparing RPRs with soluble P fertiliser, were laid down on soils which had an adequate soil P status initially, in other words these sites were not initially P responsive to P fertilisers and hence it appeared that RPR was as good as soluble P! This of course masked the slow release nature of RPRs. It took many years of experimentation to discover that the P in RPR was indeed slow release and that it took about 4-6 years for annual applications before RPR “caught up” with soluble P.

There was a further complication. It was realised that the main RPR we were testing (Sechura) contained molybdenum (Mo) and that some of the field trial sites were Mo deficient. In other words some of the pasture response we attributed to RPR was indeed a Mo response!

As the research continued it also became apparent that not all RPRs were agronomically the same. Trials were undertaken comparing RPR from different sources around the world. Sechura an RPR from South America (Argentina) was consistently the best and our research,

both in the lab and in the field, showed that it dissolved at about 30% per year. This was the cause of the so-called RPR lag effect of 4-6 years – expressed differently it took about 4-6 years of annual applications before sufficient RPR residues built up in the soil, such that the pool of plant available P was sufficient to maintain pasture production. Other RPRs, some from North Africa and from USA were not as reactive.

Some RPRs had a liming effect and this was strongly promoted as another good reason for using RPR. The advertising patter was obvious – soluble fertiliser like super, were made by reacting phosphate rock with sulphuric acid, as discussed, to produce plant available P. It was not a great leap in faith to assert that super was bad because it acidified the soil whereas RPRs were good because they had a liming effect. Once again it took some time to unravel the knot.

It turned out that, while some RPRs contained liming materials, the amounts were small, insufficient to have any practical effect on soil pH when RPR was applied at normal rates.

The super-acid link also required attention.

It is true that in the early days of super manufacturing in NZ - we are back on the 1950s - the demand for super was such that the product was not properly 'cured' – the chemical reaction between the PR and the acid was not complete and hence they contained some 'free acid'. This was problematic because in those days super was sold in jute bags, which rotted over time. Thus, it was not difficult to believe that super was acid and by extension was not good for soil biology. This myth persists today even though these days, with improved manufacturing, super contains very little 'free acid'.

The introduction of RPRs also required us to do more research on the nutrient sulphur (S). Most NZ soils require S as well as P. Super contains S and hence in most circumstances if super was applied to meet the need for P, this also satisfied the need for S. RPRs contain no S and hence S had to be added and the only

way of doing this was to mix elemental S in with the RPR. Easy? No!

Elemental S is not water soluble and must be broken down (oxidised) by bugs in the soil to become plant available. This biological reaction takes time and depends, among other things, on the particle size of the elemental S and the soil temperature. Thus, further research was required to determine the optimal particle size for our NZ conditions.

Looking back, some very good research was conducted over the period 1985 to the late 1990s to unravel the RPR-elemental S knot - to understand the basic chemistry and agronomy. At its peak RPRs and RPR-derivatives made up about 30-40% of the fertiliser market. Today the market is much diminished – the bubble has burst. Some farmers discovered at their cost what the science was showing - RPRs were not as good as was initially thought, relative to super. Also, RPRs are now priced off the market especially taking into account the lag effect. Their use is largely limited to the organic farming sector and to those few who have not taken on board the science or otherwise continue to believe that RPRs have a role to play in this environmentally sensitive time.

In this regard some recent research has provided encouragement. It has been found that P runoff can be reduced by using slow release RPR, compared to soluble P. However this effect of RPR lasts for only about 4 months following application, thereafter the amount of P runoff is the same. In any case, new RPR-like products have been introduced to the market to meet this need and, it is now realised that the amount of P runoff is determined, in the longer-term (> 6-12 months), by the soil P status (Olsen P) and not the type of P product applied.

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PARADIGMS

According to Google “A paradigm shift is a fundamental change in the basic concept and experimental practice of a scientific discipline.” The realisation that the earth is not at the centre of our solar system was a paradigm shift. So too the understanding that the earth was not flat. Things tick along for some time as “normal” and then something happens – a new discovery for instance – and the whole way we look at things changes. Our paradigm shifts.

I witnessed one of these moments recently listening to an American physicist, Dr Tom Sheahan, talking, in particular, about the greenhouse gas methane. His conclusion, based on recent fundamental research by Wijngaarden and Happer, was clear: When compared to the other GHGs i.e. water and carbon dioxide - methane is irrelevant!!!! Relative to the thinking behind He Waka eke Noa, which is based on IPCC models, this is a paradigm shift. The belief that methane has any practical affect on the earth's temperature is false and therefore taxing methane is irrelevant.

Step back a little. The earth absorbs and emits energy from the sun. In the absence of Green House Gases (GHGs) the emitted energy would pass through the atmosphere out into space. But some of this energy is absorbed by the GHGs (water, carbon dioxide, methane and nitrous oxide) and then re-emitted in all directions, some coming back to earth and warming it. The net effect of this coming and going of energy is that the temperature of the earth is about + 15 degrees centigrade. Without these GHGs it would be about -18 degrees C. GHGs keep the earth warm by ‘trapping’ some of the energy emitted by the earth.

This emitted energy doesn't come in ‘bulk’, but in certain defined frequencies, just like radio waves but on a grander scale. The frequency of the emitted energy depends in part on the physical-chemical properties of the individual gases. It just so happens that water “operates” across a broad spectrum of frequencies, whereas carbon dioxide and methane have very narrow

bands, which are in fact overlapped, and to some extent masked, by the water spectrum.

The concentration of the four GHG gases in the atmosphere is also an important factor. Water ‘weighs in’ at about 15,000 ppm, carbon dioxide about 400 ppm and methane less than 2 ppm - nitrous oxide is irrelevant at this scale. When the concentration of the GHGs is considered, together with the respective emission spectra, the calculations show that water dominates the scene and makes up about 85% of the GHG effect with carbon dioxide at about 15% and methane is irrelevant.

How come? How and why is this so different from the narrative that the IPCC and its followers i.e. your government and its agencies, have been promulgating?

First up, the IPCC believes, based on their models, that water enhances the GHG effect of carbon dioxide viz: an increase carbon dioxide, results in an increase temperature which in turn increases the amount of water in the atmosphere, which in turn enhances the warming. We have heard this story ad nauseum recently as an explanation for the recent high intensity flooding events in New Zealand. This cannot be true because it would result in runaway global warming, which clearly has not occurred on earth on a geological scale of time.

The IPCC models are problematic for another more telling reason. The calculations and hence conclusions regarding the effects of the various GHG gases are based on an atmosphere which does not contain water! Not only are they missing the point about the important role of water, it is also the reason why they can glibly claim that methane is 28 times, and nitrous oxide 300 times, more potent than carbon dioxide.

With Wijngaarden and Happer's proven model, we can at last do some numerical experiments. It turns out that increasing the current methane concentration will have a negligible practical effect on the earth's temperature and hence developing policies to limit methane emissions

is a waste of money. So too, increasing the atmospheric carbon dioxide concentration from its current level will have negligible effect on temperature.

Who to believe? It is now accepted that the IPCC models over-estimate the current and projected temperature of the earth by several degrees, relative to the observed temperatures coming from the satellites. It is standard scientific practice to abandon, or modify, models if they are inconsistent with the empirical data. In the case of Wijngaarden and Happer the calculated emissions from the GHGs agree with the data coming from the satellites. QED.



AGRISEA: ANOTHER INTERESTING STORY

Earlier this year I wrote to Mrs Clare Bradley the CEO of AgriSea:

Wednesday, March 22, 2023

Mrs Clare Bradley
Chief Executive Officer
AgriSea Ltd
7446 State Highway 2
RD4
Paeroa 3764

Dear Mrs Bradley

By way of introduction, I am an independent soil scientist. I provide farmers with science-based information on a one-on-one basis, and I also write the Fertiliser Review – a product and service guide for farmers and farm consultants. I am often asked to comment on some of the products your company sells. Of particular interest at the moment is AgriSea Soil Nutrition.

The AgriSea website lists the benefits of AgriSea Soil Nutrition including:

- 1) Increased soil biological activity
- 2) Increased root length and mass
- 3) Increased soil quality and fertility
- 4) Improved soil structure (aeration, drainage, can withstand traffic)
- 5) Deeper humus layer (nutrient storehouse of your soil)
- 6) Locked up minerals and nutrients in the soil become bio-available.
- 7) More natural nitrogen fixation (reduced need for synthetic fertilisers)

Could you please provide me with any objective, science-based information to support these stated benefits of this product.

Yours sincerely

Signed D C Edmeades

I sent a follow-up letter:

Dear Mrs Bradley

A month has elapsed since I last wrote to you regarding your product AgriSea Soil Nutrition. You will recall (see my letter of Wednesday, March 22, attached) that I was interested to know what scientific evidence you had to support the various claims made for this product. I have yet to receive a reply.

I would appreciate some response from you on this matter.

Yours sincerely

Signed D C Edmeades

In response I received this note from Mrs Bradley dated 30/5/23:

Doug,

I would like to directly address the continued harassment I have been subjected to by yourself.

On numerous occasions you have approached me in person and I have increasing concerns about the nature of your continued communications to which I have previously chosen to ignore.

Twice while heavily inebriated you have threatened me and even asked myself and another female colleague into your motel room, we felt unsafe and quite frankly shocked at your behaviour.

I would appreciate your continued contact, phone calls and harassment towards myself and our family to cease. I will not hesitate to take this issue further.

Signed: Clare Bradley.

I responded as follows:

Dear Mrs Bradley,

You sent me a note dated 30-5-23 (copy attached). I think this is a case of mistaken identity. I do not believe I have ever met you, your staff or your family!

The only communication between us that I am aware of are the two letters (also attached) dated respectively March 22 2023 and April 22 2023. I look forward to your formal reply.

Yours sincerely

Signed D C Edmeades

So there you have it! Leaving aside the personal nature of the note, I can only conclude that either AgriSea does not have any “objective, science-based information to support these stated benefits of this product [AgriSea Soil Nutrition],” or, if they do, they do not want me, or the public, to know about it. The latter option seems unlikely and the former option could lead to problems.

As I noted in Fertiliser Review 34, under the amended Fair Trading Act, “it is now illegal to make a representation about a good or service without any reasonable basis. What this means is that businesses that make claims or imply something about their goods or services must have reasonable grounds for making those claims.”

“Reasonable grounds can come from: information provided by reputable suppliers or manufacturers, information the business making the claims hold, or any other reasonable source (for example, scientific or medical journals).”

“Importantly, a business must have reasonable grounds at the time (my emphasis) they are making the claim.” It appears that gathering data to support a claim after it is made will not be sufficient.

In the absence of any objective information from AgriSea, we can only proceed on the basis of known information.

AgriSea Soil Nutrition

According to the website, “AgriSea Soil Nutrition is a soil bio-stimulant and conditioner which improves your soil structure and fertility and allows for optimum uptake of minerals and nutrients”. The specific claims made for the product are as set out in my initial letter to Mrs Clare Bradley of AgriSea (see above).

In 2001 I reviewed the then available international literature on these types of products (see Fertiliser Review 8). 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.

A more recent review (2018) reached a similar conclusion. “.....research at the University of Minnesota has shown that in most cases those products [i.e.bio-stimulants] are ineffective and do not live up to the expectation.”

My Advice? A product to avoid unless or until AgriSea can show they have evidence to support the claims being made for the product.



HYDROBOOST

In Fertiliser Review 47, I wrote about a product called Biozest. I concluded that the science presented to support the claims made for the product were unbelievable. It is a good example of what I call pseudo-science, meaning false science. It uses the words of science but it fails the evidence test. Speculation wrapped up in jargon science. Here is another example.

More recently I was sent an email promoting a product called Hydroboost. The headline proclaimed "Save \$1200 and accelerate the Nitrogen cycle without costly fertiliser application." Interesting?

The promotional material explains; "The core HydroBoost technology emulates the beneficial effects of water or snow melt. This water is also called Structured Water or 4th Dimensional water....." We are told that this ".....fourth phase water has a molecular structure of H_3O_2 that acts like a battery, releasing energy to support healthy, vibrant plants.

To reinforce the story we are told that: "Water losses its charge when it comes out of the ground and is "lifeless." Hydroboost has used the principles of a low frequency radio wave to recreate Structured Water, (H_3O_2) as it passes through the unit."

It is claimed that HydroBoost ".....simulates bacterial and fungi growth in soils which improve N uptake and other nutrients, helps reduce pathogen and plant disease and enable improved growth [by up to 19%] reducing the need for synthetic fertiliser."

This would be wonderful if only it was true – buy one of their units, attach to the waterline and hey presto. You name it, HydroBoost can do it!

This is not just pseudo-science – it falls into the category of a hoax, for the simple and sufficient reason the water has a molecular formula of H_2O . – The chemical H_3O_2 does not exist.