agKnowledge
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THE ORGANIC MOVEMENT: NEW PRODUCTS: OLD STORY, SAME NONSENSE

A new plague of questionable products is upon us, promoted by those who espouse the methods and practices of organic farming. The marketing starts with predictable alarmism – a problem is created to provide a fertile ground for their services and products.

"The Problem"

Environmental Fertilisers declare:
"Soluble acid fertilisers and the chloride in potash destroy or suppress beneficial soil microbes by being biocidal and increasing soil acidity."

Integrity Soils lists practices which destroy good soil structure:
"Use of fertilisers that can destroy humus or harm soil life such as high rates of ammonia, dry urea, DAP (diammonium phosphate), or high salt fertilisers (potassium chloride or muriate of potash)."

NutriTech Solutions Pty Ltd say:
"Our chemical experiment, [i.e. the past 80 years of farming] using high-leaching fertilisers have effectively stripped the majority of the minerals from our soils. In a short period we have managed to undo millions of years of evolution, and these serious deficiencies are arguably the most urgent problem we need to address in the coming century."

Abron Living Soil Solutions claim:
"Past agricultural practices have resulted in the de-mineralization of our farming soils and the chemical sterilization of the soil biology that would normally deliver these minerals to our plants."

Outgro Bioagriculture Ltd advise that we must:
"Stop or reduce inputs of fertiliser and other minerals known to be harmful to soil life. Some of the materials known to be the most harmful include muriate of potash, elemental sulphur and excessive use of Urea, DAP, Superphosphate, Herbicides and Insecticides."

Do these Problems Exist?

There is no basis for such alarmist statements. It is known from the scientific evidence that:

a) New Zealand soils have not been ruined, or worse, sterilized by past agricultural practices.

b) The quality of New Zealand soils including the soil biological activity is, with some exceptions related to cropping soils, generally very good (see Fertiliser Review 14).

c) Chemical fertilizers have beneficial effects on the number and activity of soil microbes (Fertiliser Review 13).

d) Organic fertilizers are no different from chemical fertilizers in terms of soil productivity (Fertiliser Review 4)

e) Organic fertilizers are no different from chemical fertilizers in terms of their environmental footprint (P runoff and N leaching) (see Fertiliser Review 4 and 18).

Some specific points arising from their advertising are worth highlighting:

1. Our New Zealand soils are teaming with microbes, unless they have been specifically sterilized as is sometimes done in glasshouses. Recent data from a typical UK soil (0-15cm) is applicable and illustrates the point:

Organism	Number (per gram dry soil)	Mass (kg/ha)
Bacterias	100 million	1600
Actinomycetes	2 million	1600
Fungi (eg mycorrhiza)	0.2 million	2000
Algae	25,000	320
Protozoa	30,000	380
Nematodes	1.5	120
Earthworms	1 per kg	800

These 'bugs' are always present in our soils although their activity will change with the seasons, or more correctly with

changes in soil moisture and temperature, being most active in the spring and autumn. Note that the rule of thumb applies – the "liveweight" under the soil is approximately equal to the liveweight above the soil. As my old Prof would say: Treat soils like babies; keep them well feed (fertilizer) and dry (good drainage) and the bugs will look after themselves!

2. Potassium chloride (muriate of potash) is frequently demonized by likening it to the 'chloride' we put in our spas and swimming pools to stop the bugs growing. This comparison is not valid. The chloride in muriate of potash is in the form of chloride anions (Cl^-) (negatively charged ions). They are benign. The chemical form of the "chloride" in the stuff we add to swimming pools and spas is chlorate (ClO_3^-), a powerful oxidizing agent, and for that reason a cleaning agent and biocide.
3. Mycorrhizal fungi are singled out for attention. These fungi extend the root system of plants and help the plant gather nutrients, particularly P. Fortunately for us they are ubiquitous (i.e. found everywhere) in our soils. More importantly, attempts in New Zealand to replace the native mycorrhizal fungi with new, more efficient strains have failed. The existing population swamps out the new intruder.
4. The myth that super acidifies the soil and kills soil microbes is perpetuated. It is true that super is made by adding an acid (sulphuric acid) to a phosphate rock. This converts the otherwise unavailable P to plant available P. When properly made and 'cured' there is very little free acid left. The long-term superphosphate trial at Winchmore, Canterbury, started in 1950 and has had annual applications of about 200 and 400 kg super/ha. There is no evidence that the soil pH levels are declining due to super applications.
5. The term "soil mineralization" occurs in their advertising as in "our soils have been de-mineralized and hence they need to be re-mineralized." I am uncertain as to what these expressions mean. The word mineralization is used in soil science to mean the breakdown of organic matter to it components including the nutrients N, P and S. I suspect what they are trying to convey is that our soils are worn out and need to be invigorated. This is of course not true, as noted earlier.

Their Solution?

Having unjustly put the fear-of-god into the farmer's mind, the next step in their advertising is to present their "solution." Here are some examples:

Environmental Fertilisers "manufactures solid fertiliser mixes and foliar nutrient spray mixes that are microbe friendly and soil friendly. We formulate soil fertility programs that balance soil mineral and biology and restore humus creation by soil microbes."

An Outgro Biological Program "is about working in harmony with nature to re-establish mineral balance, introduce and enhance beneficial microbiology in the soil."

Outgro advise: "Add materials that are known to be foods or stimulants to microbial life." And, "This is just one of the reasons that applications of high Carbon materials such as Molasses, Humates, Fulvics and Kelp flower are important."

Abron says: "Our strategies are based around addressing these key principles: Independence from nitrogen based fertiliser and farm chemicals; Unlocking your frozen reserves of phosphorous and other mineral in your soils; Improve profitability and Strategies to build bioactive carbon in the form of humus."

Abron adds: "There is only one way to gain access to this frozen bank account [nutrients locked up in the soil] and that involves biological activation of your soil."

Graeme Sait of Nutri-Tech Solutions says: "Humates are now recognized as the single most productive input in sustainable agriculture."

Their Products

Scanning through their advertising brochures and websites these companies are promoting a myriad of products claimed to solve these invented problems. The products fall into several groups, summarized below:

Product Group	Intended purpose or function
Humates and other carbon rich material like molasses.	To add organic matter to the soil and as a source of food for the microbes
Soil inoculants and bio-stimulants.	To restore the microbial population in the soil or to add new more vigorous microbes in particular mychorrizal fungi.
Calcium products, including fine lime and what they refer to a biologically active lime.	To correct calcium deficiency and activate the soil microbes
Products from the sea (seaweed and fish extracts and seawater).	A source of minerals
Ground rock with paramagnetic properties	To re-mineralize the soil

Humates

Humic acid and its derivatives (the humates) is a component of the organic matter in all soils. In the New Zealand context, our developed pastoral soils contain 30 to 300 tonnes (depending

on the climate and soil) of organic matter per hectare in the topsoil and about half of this organic matter is humate. Adding a few kilograms of humate powder per hectare, as some of these companies recommend, is trivial in comparison to the amounts of organic matter typically present. For this reason it is unlikely that these products have any additional effect on the soil microbial population or on the amount of organic matter in the soil (see Fertiliser Review No 20).

The same logic applies to other carbon-rich materials promoted by these companies, such as molasses or extracts of compost, seaweed and fish. The amounts of carbon that are applied, when these products are used as recommended, are trivial in relation to the amounts already present in and cycling through soils, especially pastoral soils. Consider: a pasture growing 10 tonnes of DM/ha. If the pasture utilization is say 80% then about 2 tonnes of DM is returned to the soil, half of which is carbon-rich carbohydrate (sugars). It is this recycling carbon from unused pasture which is the food for soil microbes – the more food the greater the population and activity of microbes. This is of course why the microbial biomass increases with increasing pasture production (see Fertiliser Review 13).

Soil inoculants and bio-stimulants

These products have been discussed elsewhere (see Fertiliser Review No 8). The assumption is that our soils are, as a result of years of chemical fertilizer use, now sterile and depleted of soil microbes and hence need to be re-innoculated. This is not true. Our soils are naturally teaming with microbes as discussed above. Adding a few more via a magic potion is unlikely to have any effect. In any case, any new, more active strains are likely to be rapidly wiped out or 'swamped' by the native population, as discussed in respect to mycorrhiza.

Soil Calcium

For some reason which is perplexing to me, the Organic Movement seems to have a romantic view about calcium and attach to it some magical properties. This is expressed in statements such as, "Calcium is the King. Calcium is the foundation of all biological systems. Calcium is the fundamental growth inducing nutrient and the base against which other nutrients are reacted to release energy for crop growth."

There is no evidence to support such statements. They are based on ignorance. Calcium is but 1 of 16 nutrients essential for plant growth – all are equally important and to suggest otherwise contradicts the principle of balanced nutrition (see Fertiliser Review 16).

Our New Zealand soils are awash with calcium but organic disciples seem to suggest that this calcium is not "bio-active" (whatever that may mean?) or not "plant available." Once again this indicates an appalling ignorance. So to does the statement, "Ph does not indicate the level of calcium availability." Of course it does not – it measures the amount of acidity and soil pH is not related to the amount of calcium in the soil! (For further reading go to, The Fertiliser Review No 7 or the Fertiliser Review: Special Edition: Lime and Soil Acidity).

Products from the Sea

Once again a romantic notion about the sea and its products emerges from the promotion of these products. The thread of thought seems to be: over time all the goodness from the soil is washed into the sea and hence the sea, and its products, must be the repository of all this "mineral goodness". Therefore, the soil will benefit from and be revitalized (re mineralized) by applying seawater and its products (fish and seaweed extracts).

The first part is true: soils are constantly weathering and some of the nutrients from the soil are leached out and ultimately end up in the sea. That is how the sea becomes salty. But it does not follow that seawater is a good medium for plants or that adding seawater and its products is a good thing. Most plants and especially pasture plants are very sensitive to salt – it kills them!

The other argument often used is that seawater and it products contain many nutrients – some say up to 77! This is entirely possible – there are about 117 elements known to man and we should not be surprised that many are present in seawater. But this is of course completely irrelevant to soil fertility and pasture nutrition because plants only need 16 nutrients and sodium, the most abundant element in seawater, is not one of them!

Ground rocks

Yes that is right. Some companies are selling ground rock, either on their own, or as components in their magical brews. This "logic" links back to the notion that were are de-mineralizing our soils and this must be reversed by re-mineralizing them, by adding naturally occurring minerals such as basalt and serpentine (not to be confused with serpentine super). Some see these rocks as a source of silicon.

Most reasonable people know that these materials are biologically inert – not only do they contain very little in the way of nutrients but what nutrients they contain are not plant available. Furthermore silicon is not one of those 16 essential nutrients. These truths are obfuscated (covered up and clouded) in jargon. The fancy, impressive word 'paramagnetic' is introduced to give the impression that this is what really makes them work – this is their magical property. Paramagnetic materials are materials which are not naturally magnetic but when exposed to a magnetic field become magnetic. Iron

fillings are a good example. This of course has nothing to do with plant growth but everything to do with pulling the wool!

ORGANIC FOODS: ARE THEY BETTER?

The major myth perpetuated by the Organic Movement is that food produced by their methods is better than conventional food. To use their terminology, they claim that organic food has higher "nutrient density." The parenthesis is required because the real meaning of the term is not clear to me.

Well, another major review of the scientific literature, (Dangour et al 2009, American Journal of Clinical Nutrition, 90, No 3, 680-685), including results from 162 studies has concluded that, "…there is no evidence of a difference in nutrient quality between organic and conventional foodstuffs." This is hardly surprising. Two earlier reviews of the international literature, one from Germany (1977) and the other from New Zealand (2002), reached the same conclusion (see Fertiliser Review 18).

This is potent stuff. We are not talking about the results from one experiment – we are talking about hundreds of studies. And, it is not the conclusion of one person or team - different groups of researchers working independently have reached the same general conclusion. This is of course how science works, building step-by-step, piece-by-piece-by-piece, painstakingly, towards "a truth."

Significance?

The significance of these conclusions should be far reaching, given that the whole purpose of Organic Farming appears to be food quality.

From Nicole Masters of Integrity Soils, we have:
"Biological farming is a discipline that enhances produce nutrient quality by promoting beneficial soil microbe activity through full spectrum mineral and microbial applications to crops"

And Graeme Tait of Nutri-Tech Solutions Pty Ltd states:
"Pragmatic 'fusion' farming will ensure health in livestock and restore appropriate 'nutrient density' to food crops"

Abron, Living Soil Solutions state:
"Biological agriculture combines the best of conventional and organic agriculture and results in the production of nutrient dense produce …."

And finally, from Outgro Bioagricultural Ltd
"Biological solutions for healthy soils, healthy pasture, healthy stock…"

If the goal of organic farming is higher quality food, and if the science says that organic produce is no better than conventional produce, why then does the Organic Movement persist? Why don't they accept that the 'experiment' is over, the evidence is in, they got it wrong, its time to shut-up shop? It would be such a relief to most of us to see the end of their pseudo-science, their silly ideas, and the silly products they promote (see earlier article).

Such hope is false for it assumes that those who espouse the organic cause are imbued in the tradition of science, and hence are driven by evidence. Herein lies the heart of the matter. Organic farming is, at its essence, not about science. It is in fact anti-science - the Organic Movement sees science and technology as the cause of the problem which now only organic farming can cure! (See Fertiliser Review 19)

The Organic Movement is a matter of faith. Evidence contrary to the faith must be crushed, undermined, or at least ignored, in the sure knowledge that faith will only be rewarded when faithfulness has been proven. Thus, it is entirely predictable that the evidence from these three major reviews will be vigorously attacked and dismissed. The Movement will trot out the old marketing dictum – perception is everything – if the masses perceive organic food is better then it is! Science they will argue is irrelevant. To which the voice of science must say: if the market knew the truth that organic food is not better than conventional food then the masses would desist from paying a premium for products which do not add value.

THE NEW ZEALAND SOIL CARBON CONFERENCE

The second NZ Soil Carbon Conference was held at Te Papa, Wellington in September 2010. It was organized by Nicole Masters of Integrity Soils with keynote speakers Prof. Tim Flannery and Dr Christine Jones, both from Australia. The conference blurb stated, "This conference showcases an innovative system that is rapidly growing throughout the world; which not only reduces pressure on the environment while increasing food quality, but also has the potential to mitigate greenhouse gases."

So what is this innovative system that is rapidly growing? It is of course the organic movement in a new guise. For years they have yearned for credibility and because science has not obliged them, they now indulge in the political game with their three card trick: food quality, environmentalism and now climate change.

We know from science that organic food is not better than conventional food (see earlier article in this issue) and that organic farming methods per se do not reduce nitrate leaching

and P runoff – the environmental foot-print (see Fertiliser Review No 4 and 18). But what about climate change and greenhouse gases – where do they fit in with the Organic Movement?

Dr Christine Jones has established the Australian Soil Carbon Accreditation Scheme. She believes that by changing our farming practices (i.e. going organic) will result in more carbon being sequestered in the soil (stored on the soil organic matter), thus mopping up some of the "excess" carbon dioxide in the atmosphere. In her mind, going organic will save the planet from dangerous warming. By hitching their wagon to climate change alarmism they seem to believe that their time has come – now they will be taken seriously?

A lengthy review entitled, "Soil Carbon Sequestration under Pasture in Australian Dairy Regions" has recently been published. It summarizes the 'state of play' on this issue in Australia. This is what they record in respect to Dr Jones: "There is uncertainty at the moment about the quality of Christine Jones' field measurements, data processing and interpretation of experimental results relating to soil carbon." And, "Jones apparently has not written any peer reviewed publications in soil science journals. She is not an accredited expert in soil science; her PhD was in agronomy." They graciously add, "….her views may prove valid under some circumstances."

One thing we can be certain about is that those circumstances are unlikely to be in New Zealand. Why? Because our developed pastoral soils now have plenty of carbon (in the organic matter). Typically our pastoral soils contain about 10% C – they are lucky to have 1% in Australian soils. More importantly, most of our pastoral soils have reached an equilibrium, which is determined by the climate and soil group - it is simply not possible to increase soil carbon levels any further no matter how hard we try (see Fertiliser Review 20). Thus, the opportunity for New Zealand farmers to increase soil carbon levels is limited to those few farmers who have forgotten about including a clover-based pasture in their crop rotation and have, as a consequence, mined down the soil organic matter. And to put that in perspective, it takes about 60 to 80 years of continuous cropping to reduce the carbon content from about 6% down to 2%.

There is another problem which the Australian Report highlights which the Organic Movement appears not to recognize; that is the cost of accumulating soil carbon. Soil organic matter is not just carbon. It also contains N, P and S. To sequester carbon in the soil, the other component nutrients, N, P and S must also be added. For our soils every tonne of carbon in the soil requires about 100 kg N, and 15 kg of P and S which are worth about $180. There is no free lunch at Mother Natures house!

All of this over-trumps the Organic Movement's third trick. The opportunity for NZ farmers to sequester carbon in the soil and hence reduce carbon dioxide is not a Kiwi option, and even if it were, it is an expensive option.

One final question to ponder: I can understand why Integrity Soils, Outgro Bioagriculture Ltd and Environmental Fertiliser Ltd were sponsors of this conference. They have something to gain from the propaganda. But MAF and AgMardt were also sponsors. Why are these otherwise reputable, science-driven organizations sponsoring and hence lending their credibility to a Movement which at is heart is anti-science or at least shows no respect for scientific evidence?

HILL LABORATORIES – AGAIN

In Fertiliser Review 23 I raised my concerns about the increasing use of soil and plant tests which are not calibrated, or not adequately calibrated, for use in New Zealand. In the absence of appropriate calibration the results derived from these tests are almost worthless. I used an example of a laboratory report from Hill Laboratories to illustrate the point, noting that this laboratory appeared to be at the fore-front of this dangerous trend.

Subsequently a client sent to me an advertisement for Hill Laboratories which stated, "We will provide you with accurate, high quality testing service from a range of tests developed specifically for the New Zealand farmer." I raised this, and other concerns, with Dr Hill by way of a letter dated May 28 2010, suggesting that the advertising was misleading. Dr Roger Hill replied (June 23, 2010) saying that he was "confident that there has been no misrepresentation" and going on to state, "With respect to the other issues raised in your letter, these have been discussed on several occasions in the past, and I think there is little point in re-stating our respective views on this."

The last point is of concern for it suggests that Dr Hill is not interested in any criticism and not interested in discussing the matter further. This is not how science works – science invites debate and discussion knowing that as a result progress will be made.

I wrote a further letter to Dr Hill dated July 14 2010. He did not formally reply but when prompted, sent me an email on 23 September 2010 which again rejected the technical criticisms I had raised. Because of the importance of the issues involved, and given that Dr Hill has shown no inclination to date to deal with them, I have decided to publish my letter to Dr Hill as an "Open Letter" for discussion.

Open Letter

agKnowledge
"The Independent Fertiliser Experts"

July 14, 2010

Dr Roger Hill
Hill Laboratories
PB 3205
Hamilton 3204

Dear Roger

SOIL AND PLANT TESTING

Judging by your response to my letter of 28 May 2010, my initial approach, following the scientific method of objective analysis and criticism, failed. I will try another approach.

With the demise of soil science in New Zealand and the consequent closure of the science-based, publicly-owned and operated soil testing laboratories, Hill Laboratories are now perceived as the market leader in terms of providing advisory soil and plant testing. But, as I see it, this leadership comes with a responsibility to ensure the ongoing scientific integrity of the soil and plant tests required for modern farming.

This responsibility comes with a noble heritage. Many soil scientists in New Zealand over the past 60 years have devoted their whole careers to developing and then calibrating soil test and plant test suitable for New Zealand conditions.

This has been no trivial task involving careful research to understand the relevant soil chemistry, through to the conducting thousands of field trials to test and calibrate the various soil tests. All the scientists involved can be justifiably proud of their contribution to this huge effort. In the international context this achievement is second to none.

The simple principle underlying all this work is that a soil or plant test is if no use in advisory work unless it is calibrated. Without appropriate calibration in the field, such tests cannot be interpreted, rendering them worthless. I refer here to many of the tests offered by Hill Laboratories including: most trace element tests on soils, Mehlich test results, Resin P test, bloat index, hypomagnesaemia index, and at the extreme end, the use of Base Saturation Ratios, which have been proven to result in misleading advice to farmers.

To see the historical body of scientific research in New Zealand undermined and trivialized by the increasing adoption of unproven and un-calibrated soil and plant tests greatly saddens me, because it is not in the interests of agriculture or of the nation for that matter. I do appreciate the commercial imperative but this must surely be guided by a more noble purpose.

In the interests of science, and in the interest of New Zealand agriculture, I urge you to reconsider your position on this important matter.

Yours sincerely
Dr D C Edmeades

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YOUR QUESTIONS

Question 1

A Bay of Plenty correspondent asks: “Do the Bay of Plenty hill country soils need lime on a regular basis,” adding that, “the soil tests last spring showed low calcium levels?”

Answer: All soils need lime from time to time. That is not because you are doing anything wrong. There are many biological reactions in the soil which produce acids. The rate of acidification in our clover-based pasture ranges from about 100 kg/ha limestone equivalent per year (low producing pastures in the drier regions) up to about 500 kg/ha limestone equivalent per year on highly productive pastures under high rainfall.

The soil pH determines whether lime is required. Where lime can be ground spread, lime to a soil pH 5.8 - 6.0. If it is necessary to apply lime by air, then the economic optimal pH, is about 5.5 -5.6, at current costs and prices.

What about calcium? The active ingredient in lime is the carbonate not the calcium. It is the carbonate which changes the soil pH. Furthermore calcium deficiency is unheard of in New Zealand. So ignore the soil Ca test. It is irrelevant in our situation.

(Further Reading: See Fertiliser Review 2, 6 and 7 and Fertiliser Review: Special Edition: Lime and Soil Acidity).

Question 2

A farmer from Waiterimu asks; when should soil tests be taken? This arises because his farm went from very dry to very wet, very quickly. He was told not to soil test because the soil was dry and then later, told not to soil test because it was too wet! I can empathize: I had work held up in autumn 2010 and again in Spring 2010 for the same reasons.

A study I got my technician to do back in my Ruakura days was to soil sample 14 sites around the North Island every month for several years. We were looking to see how soil test levels changed from month-to-month. We concluded that soil samples should be collected at the same time each year. What we really meant was that soil samples should be collected each year when the soil moisture content is similar. In practice this means if you normally soil test in spring or autumn then stick with that. The problem which has arisen recently is that normal autumns and normal springs have not occurred. What to do? My advice is to stick to the principle of sampling when the soil moisture conditions are similar to the last time. This may mean in some instances delaying the soil testing and hence the fertiliser program.

Question 3:

A Morrinsville correspondent asks about the new test for organic soil sulphur test. Some years ago, 1995 I think, Dr Watkinson of Ruakura developed and calibrated a soil test which measured the amount of organic S in the soil which, in a normal year, will become plant available (ie broken down by the soil bugs from unavailable organic forms of S to the plant-available sulphate form). This was a major breakthrough, because up until this time, the only soil test we had for S was the sulphate S test, and sulphate levels in the soil a notoriously variable, and in any case, sulphate S makes up only a tiny (<5%) part of potentially plant available plant S.

When the test was introduced some laboratories did not have the equipment to measure what was then called extractable organic S (EOS). However they were able to measure the Total Organic S (TOS). Fortuitously, as it turned out TOS was precisely ten times greater than EOS. So as a matter of convenience the labs are now reporting TOS. So when you get your results simply divide the TOS reading by 10 and you have EOS. They are the same entity (see also Fertiliser Review 20).

Question 4:

Relating to the above, a correspondent asks which is better; urea or ammonium sulphate, or a mix of both, such as N Rich Ammo?

Research shows that a kg of urea-N has the same agronomic value (kg DM/kg N applied) as a kg of ammonium sulphate-N. Thus, let price be you guide. At present N is urea costs $1.34/kg and the N in sulphate of ammonia costs $2.19/kg, allowing for the value of the sulphate S at $0.35/kg S. So if you want N and only N then the choice is straight forward.

Things become more complicated when the soil is S deficient. If the soil tests for both sulphate and organic S are less that 10-12 then fertiliser S will be required to maximise pasture production by supplementing the organic S that will become plant available during the year. Typical inputs range from 30 to 50 kg S/ha/yr depending on the soil group and rainfall. If this S has already been applied then it is unlikely that S will be limiting and hence there is no advantage in using ammonium sulphate and N Rich Ammo relative to urea.

And now the interesting bit. The point has been made that organic S is not plant available until it is broken down by the soil bugs to sulphate S. But this biochemical process depends on the weather. If it is too cold, wet or indeed dry, the bugs will be less active and may not 'release' sufficient S to meet the pasture demands and hence the pastures may become, temporarily, S deficient. Under these circumstances adding a little bit of S with the N (as in ammonium suphate and N Rich Ammo) may be beneficial.

Note – this in conjecture on may part. What are needed are field experiments to test and quantify this effect, if it occurs at all. But when I am on-farm in early spring doing the routine soil testing and find clover plants showing signs of S deficiency, even though the soil S levels are good, I recommend one round of a N together with S.

YOUR QUERIES...

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

Please contact us:

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Dr Doug Edmeades