agKnowledge
"The Independent Fertiliser Experts"
Autumn 2017

Fertiliser Review

ISSUE 38

PRICE WATCH

There is a new force in the fertiliser market. Dickie Direct are importing made-up products from overseas sources. The table below compares their current prices, over a range of common fertilisers used in New Zealand, with the costs from the two co-operatives; Ballance Agri-Nutrients Ltd and Ravensdown Cooperative Ltd.

Table 1 Comparison of the prices for a range of common fertilisers from Dickie Direct or the co-operatives Ravensdown and Ballance.

Product	Price ($/tonne)		
	Dickie Direct[1]	Ballance[2]	Ravensdown[2]
Triple super	570	750	750
DAP	685	741	737
Urea	440	507	507
Ammonium sulphate	385	512	495
Ammo blend 31	425	516	506
Ammo blend 36	432	515	518
Potassium chloride	538	595	584
Sulphur 90	558	660	615

Note: 1) Ex warehouse but can be purchased 'Direct Shipment' at typically $20/tonne cheaper than the prices shown.
2) Ex works

Two points emerge from this data. Across this range of products the ex works prices from Ballance and Ravensdown are very similar as is generally the case for these generic products. This may not be the case for the branded products.

But, more importantly, the Dickie Direct prices ex warehouse are on average about $90-100/tonne cheaper. This represents considerable savings for the individual farmer.

The table below compares the annual cost of fertiliser on a typical dairy farm and sheep & beef operation, for the same inputs of P, K and S, purchased from either Dickie Direct or one of the co-operatives. For these two examples the overall cost saving is about 12%.

Table 2 **Annual cost of fertiliser to provide the same inputs of P, K and S purchased from either Dickie Direct or one of the co-operatives. .**

Farm type	No. of blocks	Total area (ha)	Co-operative	Dickie Direct
Dairy farm	4	238	$68,670[1]	$60,404[1]
Sheep & Beef farm	3	374	$48,516[1]	$40,263[1]

Note: 1) Cost delivered to the farm but excluding spreading costs

How will the market react to this challenge? I do not know but the following points are to be noted:

1. The co-ops, Ballance and Ravensdown, pay a rebate, typically in the range $20-$30 per tonne of fertiliser purchased.
2. Historically, direct importers are tolerated until their market share gets big enough to upset the balance sheets of the two big co-operatives. At that point they are bought out and things return to 'normal.'
3. The co-operatives have to carry the cost of large superphosphate manufacturing plants. This will continue for as long as they wish to continue to provide superphosphate - their base-product – to the market. I guess they will have some big decisions to make if and when these plants need replacing.
4. Both of the co-operatives support large national networks of Science Extension Staff. Will the co-ops continue with this business model given that the trend over the last 30 years has been toward a more corporate style of management focused on sales and market share rather than on providing technical advice to farmers?

POTASSIUM

Over the last decade there has been a war-of-words over the use of potassium in clover-based pastures in New Zealand. The latest skirmish was in the Wairarapa. In 2016 I was invited to give a talk about soil fertility and pasture nutrition at a Beef & Lamb field-day.

One of my take home messages was that clover needs 16 nutrients and can only grow as fast as the most limiting nutrient. I noted that the most frequent deficiency we come across in clover-based pastures on sedimentary soils is potassium (K). I reminded the farmers that those old fertiliser recipes, that granddad and dad used on these soils, may not now work because we have mined the soil K reserves over decades of farming.

Subsequent to this talk I was invited to visit four Wairarapa sheep and beef farms to assess their current soil fertility and fertiliser policies. Potassium deficiency was diagnosed on all four farms and hence potassium (muriate of potash) was included in their revised fertiliser programs.

Importantly, three pieces of evidence are required to be confident of a diagnosis of K deficiency: visual assessment – are the symptoms of K deficiency evident in the pasture, are the soil K levels <6 and is the K concentration in the clover < 2%.

I was therefore very interested to read an article "How Much Potassium Do Sheep and Beef Pastures Need?" published in Baker and Associates, AgLetter 21 January 2017. It was written by Mr Jeff Morton of MortonAg, formerly of Ballance AgriNutrients Ltd.

The summary was set out in bullet points:

- "Sheep and beef pastures on sedimentary soils are generally self sufficient for potassium on grazed areas of sheep and beef farms.
- It is very difficult to justify the application of potassium fertiliser to these soils.
- All the scientific evidence shows that the general advice given by most advisors not to apply potassium fertiliser where the soil supply of potassium is sufficient for sheep and beef pastures is sound."

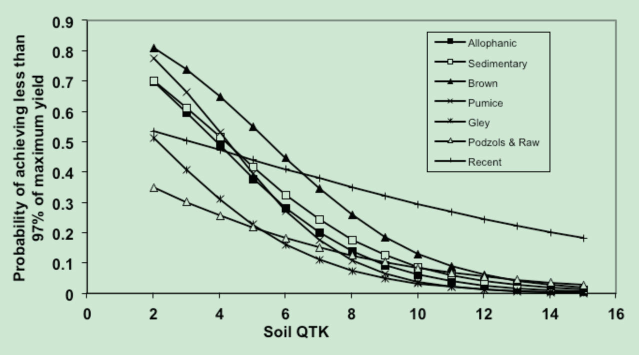
To support these conclusions Morton relied upon the results from large soil testing laboratory databases, comprising 120,000 soil test results over the last 7-10 years. He noted that:

- "Over 90% of the soil QK K levels are within or above the economic optimal range (4-5) for an average sheep and beef farm."
- "There has been no decline in the soil QT K levels over time indicating that soils are still supplying enough potassium."

My rebuttal is as follows:

1. Soil tests (QT K) alone should not be relied upon as the sole diagnostic criteria for K deficiency. This is because it is very easy to get elevated soil K readings if the proper soil sampling protocol is not followed (i.e. avoiding all nutrient rich areas)
2. Also, as noted above, we rely on three pieces of evidence before accepting a diagnosis of K deficiency (visual assessment, clover – only K concentration tests, and soil QTK levels). Of these the most compelling test is the clover-only K concentration, but with the qualification these samples must also be collected avoiding those nutrient rich areas.
3. It is always economic to correct soil K deficiency (i.e. soil QTK levels < 7-10). To say otherwise is equivalent to not giving insulin to a Type A diabetic because it is not economic.
4. Morton quotes an "economic optimal range (4-5) for sheep and beef farms". I do not know how this was derived but if it relies upon the use of the Overseer Econometric K Model it needs to be noted that this K model is out of date.
5. The graph below was derived from a review of hundreds of field trials in New Zealand. It relates the soil QTK to the likelihood of achieving a pasture response to fertiliser K. The lower the soil QTK the higher the probability of a response. From this and other data a range of QTK 7-10 has been set as the optimal range. Even at these levels the probability of a response is not zero.

Figure 1 The relationship between soil Quick Test K (QTK) and the probability of getting a response to fertiliser K.



There is a delightful twist to this 'tale.' Quite serendipitously, the BakerAg newsletter containing Morton's article was sent to one of agKnowledge's clients in Southland, who in turn sent it to Dr Robert McBride who works for agKnowledge. He was so incensed by the article that he penned the following response. Baker and Associates chose not to publish it. It is worth reading.

Dr Robert McBride's response to Mr Jeff Morton

I have worked in soil fertility for my entire professional career. When I came to New Zealand I was somewhat perplexed by the almost universal avoidance of applying potassium (K) to pasture. I would visit farm after farm that had years of soil and clover tests showing that K was deficient, while at the same time there were obvious visual symptoms of K deficiency, yet they were not applying any K. Ninety five percent of the farms I have visited in the last 7 years required at least maintenance applications of K, and less than 5% were doing so.

The reasons given for not applying K fell into three general categories:

- Concerns about livestock health
- Reliance on soil reserve K test
- Were told it 'didn't pay'

It is true that K can induce a Magnesium (Mg) deficiency in livestock if soil K levels exceed soil Mg levels by two to three times. However, if K is deficient this is not an issue, and in New Zealand where soil Mg levels typically exceed K levels, it is never going to be an issue.

Research has shown that the reserve K test does not provide any more information than the standard MAF test (QTK). That is, if the soil test says K is deficient, it is. Logically if the clover only test indicates that the plant is deficient in K, the mythical 'reserve K' is not keeping up with demand. Yet with this information in hand, people still cite 'reserve K' as a reason not to apply K.

Countless farmers have told me that when they asked their fertilizer representatives about low K levels they were told that it 'didn't pay.' It has been known since 1828 that plant growth is limited by the most limiting nutrient. If K is the most limiting nutrient (and it commonly is), it is the only nutrient that pays. It does not matter how much super is applied, the pasture is not going to respond if it is K limited.

When having this discussion with farmers they ask me why they have been led to believe that they do not need to be applying K when they so clearly do, and I do not have an answer. New Zealand is rather unique in having a fertilizer industry that works to suppress the use of K. Anywhere else in the world if any nutrient is deficient it is amended until it is no longer limiting. End of story. In the simplest terms that is the objective of every fertilizer program.

Yet this week a client once again questioned my K recommendation for his farm and sent me a recent article written by a prominent New Zealand scientist associated with one of the fertilizer companies. The article reiterated the same anti-K themes of reserve K and that it 'didn't pay.' In addition low pasture production, competition from browntop, sheep and beef pasture having lower K requirements, topography, and the weather were given as reasons for not applying K. This of course makes no sense whatsoever, but is a blatant example of the concerted effort against the use of K fertilizer. Again, I cannot explain this. Pastoral farming is suffering from an epidemic of K deficiency and people in the best position to address the problem are actively working against the obvious and readily available solution. It is all very strange, and something farmers should be aware of.

TOW AND FERT

You may have seen the Tow and Fert™ advertisements in the rural papers. The one presently in front of me is from Rural News January 17, 2017. It states;

"Technology developed in Dannevirke is becoming noticed as breakthrough technology with research agencies in other pasture grazing markets around the world. Tow and Fert, designed and manufactured by Metalform, has the ability to either reduce fertiliser input costs without impacting pasture yields, or maintain fertiliser inputs and improving dry matter and protein production."

The technology to which they refer are machines that can apply aqueous urea – foliar urea. The company cites results from a trial conducted in Somerset, UK in 2016 on pasture. Three rates of 'Tow and Fert' aqueous urea (25, 50 and 75 kg urea/ha) were compared with a control plot receiving 75 kg urea/ha applied as prilled (solid) urea. The results indicated a large benefit (about 80% increase in pasture production over two harvests) of aqueous urea relative to prilled urea at the same rate of application of N.

These results appear to be at odds with New Zealand data (see Fertiliser Review 3 and 27), which show that the form of fertiliser (solid versus suspension (FPA) versus liquid) has no effect on pasture production when compared at the same rate of nutrient application.

I have raised with the company some concerns about the design and conduct of this trial and I am awaiting a reply. Until this is available I have no way of deciding how much weight can be placed on the results. I note also that they have other trials underway.

My advice?

Lets wait and see

A NEW FERTILISER COMPANY?

At a recent (March 2017) Beef & Lamb field day at Lochiel Station in the Lower Waikato, I became aware of a new[1] fertiliser company, Landco Fertilisers. In fact their presence at the field day was annoying because they wanted to dominate the discussion when the topic turned to fertiliser. Fertiliser companies should be reminded that these field days are for farmers not for the fertiliser companies to peddle their wares.

[1. According to their website they are not new but have recently evolved from a company called Hortigro Ltd]

Given the discussion that occurred at the field day I decided to investigate what this company was about and the fertiliser products it sells.

The website is unambiguous: "We are proud to use the Kinsey scientific philosophy of soil management that was developed and used by Dr William Albrecht…"

As discussed elsewhere (Fertiliser Review No 26) Albrecht's approach to soil fertility using the Ratio

Theory and base saturation ratios has been debunked by science. When it is used as the basis for offering fertiliser advice it results in incorrect and expensive fertiliser advice.

The company states: “Throughout our website we have emphasized that Landco Fertilisers has products that can mitigate the issues resulting from phosphate and N loss.” This angle appears more specifically in their claims made about one of their main products ‘G-Phos.’

Quoting direct from the website we have:

“Landco’s G-Phos is a natural Guano Phosphate which incorporates an abundant number of other beneficial nutrients, these along with its unique properties and characteristics make it a super-hero of phosphates. Guano is mined as a rock and used extensively throughout NZ as an alternative to other phosphates, esp water soluble phosphates. Due to its excellent properties, it is our opinion Guano is one of the best if not the best type of phosphate in the world, so we are fortunate to have G-Phos to use as our mainstream phosphate and as a single or blended option.”

“Landco takes pride in the quality of its fertiliser products and G-Phos is no exception, its uniform size, granular structure, nutrient combination, efficiency, and effectiveness, support our quality standards, and also customer expectations. Helping to minimise phosphate loss via leaching, runoff, and lock-up in soil is a big part of what G-Phos can offer; up to 70% more can be retained compared to water soluble synthetic phosphates and for this reason you need to apply a lot less than traditional phosphates. Quite simply it makes sense to use G-Phos for nutrient management control, the environment, and soil and stock health.”

Leaving aside the obvious hyperboly such as “super-hero of phosphates” and “…one of the best if not the best type of phosphate in the world…,” what do these claims boil down too?

Guano is a Spanish word and means; the accumulated excrement from seabirds, seals and cave-dwelling bats. This product is very similar in origin to many of the phosphate rocks being brought into New Zealand, either to manufacture super or for direct application as Reactive Phosphate Rock (RPRs).

G-Phos we are told contains 10% P but we are not told how much of this is plant available. It is claimed to also contain Calcium (Ca) and Silicon (Si). Because these two elements are not required on pastoral soils in New Zealand the claim“incorporates an abundant number of other beneficial nutrients, these along with its unique properties and characteristics….,” appears redundant. Despite the hype, there seems to be nothing special or unique about this product.

It is claimed that G-Phos is more efficient than water soluble synthetic phosphate. This claim has been made for slow release phosphates (such are RPR, reverted supers and dicalcium supers) for many years, despite the fact that the trial data shows otherwise. The efficiency of all these products, measured as the kg pasture production produced per kg plant available P applied, is similar. It follows that there is no basis for the claim that losses of P from this product (leaching, runoff and P ‘lock-up’) are less than for other sources of fertiliser P.

In any case so called P ‘lock-up’ is largely a myth used by salesmen (see Fertiliser Review 1, 2 and 3) and furthermore P does not leach in most of our New Zealand soils. There are some exceptions to this general rule - P leaching may occur on soil with a low Phosphate Retention (PR) (now called Anion Storage Capacity) under high rainfall such as may occur on some peats, podzols and coarse textured soils (e.g. West Coast).

My Advice?

Not a company I would recommend for its goods (G-Phos) and services (Base Saturation Ratio Theory).

FINE LIME

Two fine-lime products have recently been brought to my attention: "Rapid Lime" (from Rapid Lime Ltd) and "Optimize" (from CP Lime Solutions). Both companies make similar claims for their fine-lime products – they say that because the lime is finer less lime is required. Is this a valid claim?

The FertMark specification for agricultural lime (ag lime) is that 95% must pass through a 2 mm screen and that 50% must pass through a 0.5 mm sieve. A typical particle size analysis for ag lime is given in Table 3. This criteria was set back in the 1960's and was based on accumulated evidence from field trials and other laboratory information which suggested that this was a good practical compromise between the speed of reaction of the lime with the soil, and the longevity of the effect (fine particles react more quickly but do not last longer) together with the desire to have a product which was convenient to handle and spread.

Based on this specification the rule of thumb, which applied to most soils and ag limes, was to apply 1 ton/acre (2.5 tonnes/ha) of ground limestone every 4-5 years. With this particle size it would take about 12 - 24 months for the lime to have its maximum effect on soil pH and this effect would last 4-5 years depending on the rainfall and temperature.

Table 3 Particle size distribution for a typical ground limestone (ag lime) (from Graton 2010).

Particle diameter	< 2.0 mm	1-2.0 mm	0.5-1.0 mm	0.25-0.50 mm	0.25-0.15 mm	< 150 mm
% mass	5	20	25	20	10	20

The 'Optimize' website has an eyecatching diagram implying that one truck and trailer of 'Optimize' is equivalent to 10 trucks and trailer loads of ag lime. The 'Rapid Lime' webpage makes the same claim by posing and then answering question: How can 250 kg/ha be as effective as 2.5 tonnes/ha of conventional lime?

So is it true that finely ground lime is 10 times better that agricultural lime? A little bit of chemistry is useful:

Limestone contains calcium carbonate – it is the carbonate component of the limestone which is the active ingredient. It is the carbonate which reacts with the acids (H^+) in the soil and neutralises them – that is why the soil pH goes up (less acid) when carbonate is applied. The chemical equation can be written thus:

Calcium carbonate + acid = carbon dioxide + calcium hydroxide

$$CaCO_3 \quad + \quad H^+ \quad = \quad CO_2 \quad + \quad Ca^{++} \quad + \quad {}^{-}OH$$

As implied by this equation, the amount of change in pH (i.e. the change in the amount of acid in the soil) depends directly on the amount of carbonate added and the rule of thumb was that one tonne of aglime/ha will increase the soil pH by 0.1 pH units (e.g. from 5.5-5.6). Importantly, note that the benefits that arise from liming, such as the increase in pasture production, are in turn proportional to the amount of change in soil pH.

So if 1000kg/ha of ag lime increases the soil pH by 0.1 pH what is the change in soil pH if only 1/10 of the amount of carbonate is applied per ha. The answer is 1/10 of 0.1, namely 0.01 pH units!! To say otherwise is to defy the rules of chemistry.

What the "fine-lime" folk are confusing is the size of the effect on soil pH with the speed of the reaction between the soil and the lime. As the particle size decreases, the time it takes for the lime to dissolve and 'mop-up' the acid, decreases. For any given rate of application, fine lime is faster (quicker change in pH) but not more effective (does not result in a greater change in pH).

Lets make a few assumptions and get the calculator out. From the information that can be gleened from the respective websites the typical rates of application of these fine-lime products is about 200 kg/ha and they cost about $200/tonne. We will assume that they are ground such that 100% is < 150 microns (0.15 mm). For ground agricultural lime we will assume the particle size analysis above in Table 3 and that it costs $30/tonne.

Thus: One tonne of ag lime, costing $30/tonne, contains 200 kg 'fine lime' (< 150 microns). This represents 20% of the weight of the product and therefore costs about $6 ($30/5). By contrast: granulated fine lime cost about $200/tonne i.e about $40 per 200 kg fine lime. So when you buy your 1 tonne of lime for $30 you are purchasing 200kg of fine lime at about 15% of the cost.

[These calculations assume that all particle sizes less than 2 mm have equal value which is reasonable given the science]

My Advice?

Not a product that I would recommend to a farmer who is focused on financial and economic efficiencies.

CARBON DIOXIDE: FRIEND OR FOE?

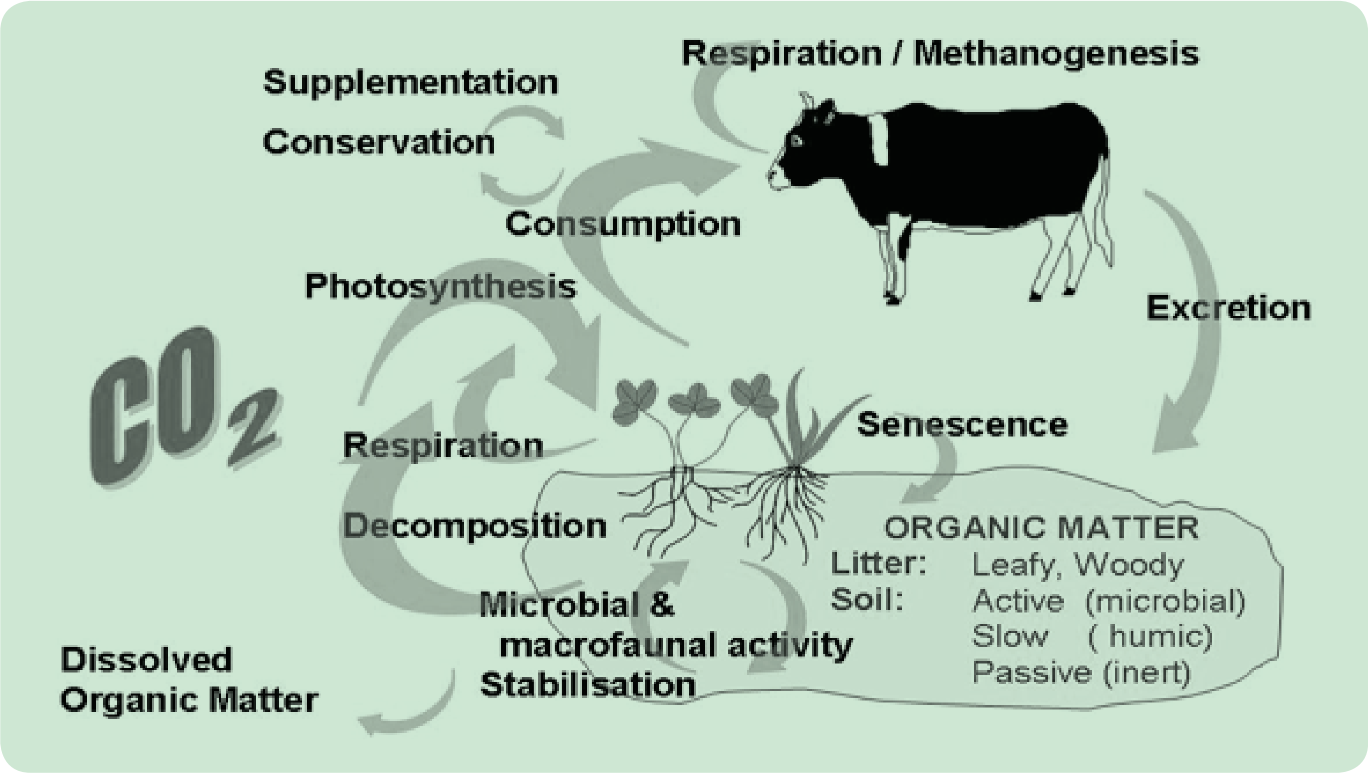
This gas has been demonised by those who are of the view that it causes global warming and that humans, who increasingly rely on fossil fuels for their energy, are therefore the cause. Indeed there are some who want it to be treated as a pollutant.

[Carbon dioxide is colorless and odorless. The white plumes of gas belching from factory chimney's are therefore not carbon dioxide despite the implication that the viewer is invited to take]

Irrespective of where you sit in the human induced global warming argument there is much to say about carbon and carbon dioxide which is positive.

Carbon is one of the 16 nutrients essential for plant growth. Plants take up carbon dioxide from the atmosphere by photosynthesis *(Figure 4)* converting it initially into sugars from which complex carbohydrates that form the structure of the plant are 'built.' Pasture plants typically contain about 40% carbon and have a carbon: nitrogen ratio of 10:1.

Figure 4 The carbon cycle in a grazed pasture.



In this context carbon dioxide should be understood and treated as a fertiliser and indeed hundreds of studies show that plant growth increases with increasing carbon dioxide concentration. I can recall back in my MAF days that considerable money was spent, at the then Levin Horticultural Research facility, sealing a glasshouse so that they could experimentally modify the 'atmospheric' carbon dioxide concentration to study its effect on plant growth.

Dr Craig Idso the founder of the CO2 Science website (www.CO2.science.org) compiled a list of 45 crops which make up about 95% of the world's food production. He then calculated, based on the scientific literature, the likely increase in production for each of these crops, as a consequence of increasing the carbon dixode concentration by 300 ppm. The range was 13 to 77% depending on the crop and was typically between 30-40%.

From this information he then calculated the likely dollar value of these crops worldwide for an increase in carbon dioxide from 280 ppm (the 1961 concentration) to 390 (the 2011 concentration) and then from 390 ppm to 700 ppm (the estimated carbon dioxide in 2050).

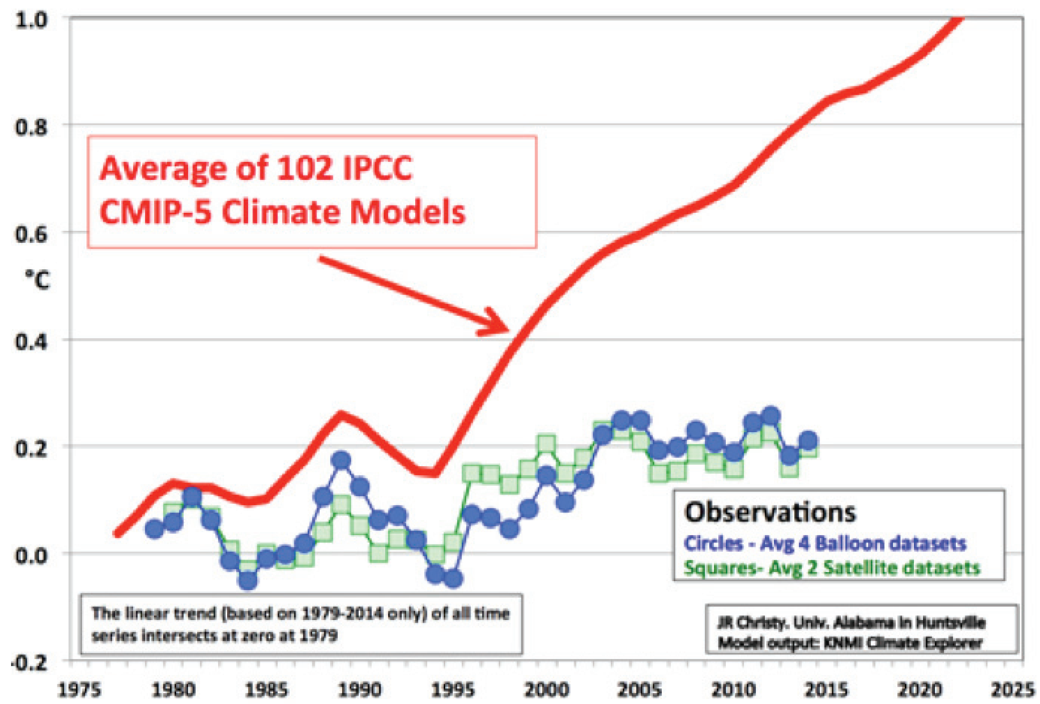
The estimated annual value of these crops for the fifty years (1961 to 2011) increased from 18.5 billion in 1961 to 140 billion in 2011. The sum of the annual benefits over this 50 year period was $3.2 trillion (constant US dollars). The accumulated increase in the value of the 45 crops from 2012 to 2050 was estimated to be $9.8 trillion.

We could crudely do the same sort of calculation for New Zealand's pastoral sector. This sector currently earns about $28 billion annually in exports. Assume that the carbon dioxide concentration will increase by 300 ppm from now to 2050 and that this will increase pasture production by about 30%, being conservative. The predicted increase in annual export earnings for this sector will be about $8b, give or take a little. In other words by 'deliberately' increasing the concentration of carbon dioxide in the atmosphere will mean that the pastoral sector would easily meet the Hon Nathan Guy's aspirational goal for the sector to increase productivity 20% by year 2025.

All of this assumes that there is no downside to an increase in carbon dioxide. There are many computer models that predict that as the carbon dioxide concentration increases so too will global temperature. These models are the basis – the foundation - for all the dire predictions regarding sea level rise, extremes in climate, human health and welfare etc, etc, you name it, global warming causes it.

The graph below *(Figure 5)* compares the average predicted temperature changes derived from 102 climate models with the actual observations based on weather balloons and satellite data. These model, all of them, over-estimate the effect of increasing carbon dioxide on global temperatures.

Figure 5 Temperature changes since 1975 derived from IPCC climate models versus actual observations.



So it seems to me we have a stark choice when pondering our future. Believe in the hard scientific evidence about the beneficial effects of carbon dioxide on crop production, or, believe in the dire predictions of carbon dioxide driven climate models.