

### Neat Urea not so neat

All farmers want to be farming for a better environment as well as profit. Farmers DO care. So how have we ended up with the slug of serious problems in dairying that we didn't have 40 years ago such as reliance on supplemental feeds and antibiotics, poor conception rates, calf scours, high milk urea (MU), nitrate leachate and a stink profit margin? We're spending fertiliser money creating 'funny protein' grass that burns out our cows at 2.5 lactations, pollutes our rivers, propels us in the direction of very expensive barns, alienates consumers and reduces the very healing qualities of milk fat that the world desperately needs and increasingly values. We've gone beyond shooting ourselves in the foot. Despite the temporary illusion created by the recovering dairy pay out...the muzzle is aimed higher off the ground.

We CAN grow larger volumes of high soluble solids, complete protein, diverse species pastures that beat the pants off the competition. We can do it by driving our fertiliser programs with lime, key trace elements, humic acid granules and judicious use of foliar urea - all at lower cost than our present reliance on 350 + kg/ ha/year of urea and certainly at less cost to our environment and our health. And it can be done at Olsen P phosphorous levels below 20. There is no need to continue large applications of cadmium and fluoride tainted Super Phosphate to maintain Olsen P ratings that are already through the roof. Our fertiliser cooperative executives are selling us down the river because there is no margin in lime and they need the high turnover figures to justify their salaries. Sorry, guys. It's time to call a spade a spade. All of these band-aids we 'need' to apply because we grow stink, urea-addicted grass makes everyone else money except us. Farmers are the patsies in all this.

The first illusion that must fall away is that agriculture and pastoral production can successfully function as a chemical system based on petroleum inputs. No, it is a complex biological system governed by microbes which need to be fed the full range of macro and micronutrients in their most biology-friendly forms. Soil microbes crash when we burn them with urea and Superphosphate.

Using urea as the basis for pasture growth creates high levels of nitrate nitrogen in the forage. We've all been assured that we grow 'good' pasture with a crude protein content of 20% plus. The international standard for ideal pasture crude protein content is 16%. What our pasture crude protein test actually cheaply measures is elemental nitrogen. It's expensive to measure amino acids or real protein content, so the test measures nitrogen and then multiplies it by 6.25 to get an assumed level of 'protein'.

It is indeed a crude measure since to actually get usable protein from nitrogen you need a range of other minerals, lots of metabolic energy to change nitrate into amino acids chains and then into real protein. To turn the grass nitrate into usable protein, the cow's rumen microbes need high levels of carbon/sugar/ energy and trace elements in their diet. The easiest way to get that is to grow grass that's high in soluble solids or Brix. This simply doesn't happen with reliance on urea as the main fertiliser. One of the most visible effects of high nitrate grass is projectile cow poos.

When we apply urea directly to paddocks, the majority of the nitrogen either off-gases into the air or becomes nitrate leachate through the soil. The nitrate leachate takes calcium, magnesium, copper and other key minerals with it when it heads into the water ways. So we end up with low mineral levels in our grass. Thus we put high nitrate, low energy and low mineral grass into our cows and the

rumen microbes can't cope with the excessive nitrogen. And this is where the urea ill-health cascade really kicks in:

Excessive nitrate in the forage promotes the growth of methanogen bacteria in the rumen. This class of bacteria can digest high N feed better than the optimal rumen microbes. Problem is these methanogen microbes create methane which the cows then belch out and get tarred with the 'nasty greenhouse gas producing' shame label. Ruminants don't inherently pollute, it really depends on what they eat and the integrity of the farm's soil ecosystem.

Excess nitrate in the rumen becomes ammonia and seeps into the blood through the rumen wall. Ammonia is toxic to the animal. It reduces oxygen in the blood. The result is basically sick, underperforming cows that are overtaxing their livers and pulling lactose/ sugar out of their systems in an attempt to convert the excess nitrate/nitrite/ ammonia back to urea and get it out of their bodies by every conceivable means.

We're feeding our animals unnaturally high levels of nitrate. We observe their frantic efforts to get rid of the nitrogen and assume it's normal. It's NOT; it's just average and a poor, expensive average at that. Cows can be a powerful positive source of soil regeneration but not with the way we're fertilising. If we took the hundreds of millions we're spending on Greenhouse Gas research and used it for lime and trace element applications we'd markedly reduce emissions, have healthier animals AND prompt humus formation, CO<sub>2</sub> sequestration and better water infiltration and water holding in our soils.

Since we mistakenly assume that high crude protein/nitrate levels in pasture are good, we don't generally take the timely measures to compensate: things like long stemmed hay for more carbohydrate/dry matter and a good rumen mat; bentonite clay and humate powder for detox; and molasses for extra energy. Eventually the cow's liver can't cope with the demand to convert ammonia to urea and the ammonia ends up circulating in the blood where it accumulates in the extremities contributing to lameness. Converting ammonia to less harmful urea in the liver requires lots of energy from the cow prompting the negative energy balance and rapid loss of body condition we see post-calving just when the demands of high milk production coincide with....you guessed it – high nitrate, lush, urea-fuelled spring grass.

A cow in a negative energy balance, losing condition, is not going to figure it's a good idea to ovulate and sustain a pregnancy as that could threaten her very existence. So we have non-cycling cows, use of CIDRs to force ovulation, increased phantom pregnancies and an embarrassingly low first mating conception rate of 48% with an overall fertilisation rate of 67%. Even if the cow conceives, the circulating ammonia is toxic to foetus which could help to explain our disappointing breed back rates.

So now we have a pregnant cow producing, but losing condition, on a minerally deprived diet which leads to an impaired immune system. We purchase supplemental minerals to put in the water or in the ration to compensate for what is not coming through in the pasture. Where are these soil minerals that the cow's system needs? Well, enough of them weren't in the soil in the first place, or they're locked up or made less available by the low soil pH created by urea and Superphosphate applications or by glyphosate lock up. Or they've ended up in the rivers having been pulled out of the soil profile by the nitrate leaching from straight urea applications and from high N cow urine.

To put it crudely – we are pouring fertiliser nitrogen down a rat hole. We're wasting protein components in the rumen because we're growing minerally poor, low energy grass and the rumen microbes can't utilise all that nitrogen. So the nitrogen goes into the cow's blood where it creates a variety of havoc and then spills out into the environment where it damages water quality and the ecosystem in general. The cow also excretes excess nitrogen into the milk reducing milk quality, cheese quality and payout. We're creating many of dairying's problems and expenses through outmoded fertiliser programs.

You actually get more dry matter and higher sugar content in pasture using a dry fertiliser blend, based on the calcium in lime plus trace elements supplemented with liquid foliar nitrogen, at a fraction of the normal urea used. Production does NOT go backwards with this smarter approach as the Dairy NZ monitored Backtrack Dairy trial is showing. The resulting higher plant mineral levels and better pasture quality gives more milk for the same fert cost, reduces animal health costs, uses less water and can deliver better profits. This practical approach reduces nitrate leachate and creates better quality milk. We can do...it is being done here right now.

### **The Future is Fat**

We're missing out on the real future of milk, which is not in its protein content but in its fat content and the allied fat soluble Vitamins A, D, and K<sub>2</sub>. These vitamins can only be found, in their right form for us, in saturated animal fats. So I'm –ticking off the vegans here, too. Wake up, folks. Pretty much all our modern health problems can be traced back to poorly mineralised soils growing nutrient deficient crops compounded by a serious lack of the fat soluble vitamin activators. They're called activators because without vitamins A and D as catalysts, the other minerals and vitamins in our diet can't be fully used to create proteins. Proteins are the basis for hormones, enzymes and blood. They are involved in every process in our bodies. Vitamin D<sub>3</sub> and A deficiencies are now being implicated in every health problem we've got – heart disease, cancer, osteoporosis, diabetes, mental disorders. And here's the kicker – Vitamin K<sub>2</sub> has to be present for A and D<sub>3</sub> to work properly. K<sub>2</sub> is high in butterfat when cows graze green grass. We've been chasing the wrong health train for 50 years. It's not about avoiding natural animal fats, it's about embracing them! Our appalling and deteriorating health stats should have made that clear to us decades ago....must have been the impaired mental capacity from lack of butter in our diets.

So how do we get high vitamin A, D<sub>3</sub>, K<sub>2</sub>, butterfat? Here is where our not so secret but undervalued advantage comes in. Vitamin K<sub>2</sub>, which makes butter orange coloured, is only created from cows grazing directly on rapidly growing green, well-mineralised, high calcium, low nitrate pastures. We have the nearly unique potential to create THE natural food components that are critically needed by all pre-conception parents, pregnant women, children, athletes, the aging.... well, everyone, really. These are the same natural, saturated fat vitamin components that give great flavour to the world's great dishes and which solve the pressing problems of dental caries, orthodontia, dementia, atherosclerosis, kidney stones, birth defects and cancer, to name a few.

Instead we're focusing on milk protein. We export dried, oxidized cholesterol milk powder around the globe, particularly to babies in China, setting them up for a life of immune and mental deficiencies through lack of the natural fats in mother's milk. New Zealand milk companies have made butter oil for decades as a way of preserving cream components for reconstitution with dry milk powder in overseas factories. Butter oil is where the gold is, literally. We need to go back to

marketing milk for its real value – butterfat, and its high content of crucial Vitamins A, D<sub>3</sub> and K<sub>2</sub>. Keep the milk solids at home and add value by giving them to grass-raised pigs which we then sell to China. Hint...pork lard has the highest Vitamin D<sub>3</sub> content of any food except bear fat and we're not about to start farming bears.

Our present high nitrate, low soluble solids (low mineral content) forage and the resulting water quality problems from leachate is NOT a good reason for sacrificing our low cost pasture-based advantage by moving into barns and total mixed ration for our cows. Fix the basic soil and nutrition problem instead. Use our cheap lime to drive quality grass growth that creates high vitamin A, D<sub>3</sub> and K<sub>2</sub> butter fat, healthy long-lived cows and a premium product that transforms human health.

We can easily produce the world's best medicinal butterfat at an eye-watering premium while improving the quality of our soils, water and health. There could be tremendous job satisfaction knowing that we're creating food that truly nourishes and eventually heals both people and the environment at a great profit.

References list available on request.

Phyllis Tichinin True Health Ltd.

Dairy Support, Soils Consultant and eco-nutritionist

Hawkes Bay

**Urea Cascade Citations** – hundreds of other citations exist that corroborate the impacts of excessive applications of neat urea

## **Fert Applications & Soil Impacts**

### **Urea amounts applied**

Dexcel predictions for average all grass system applications for 2010 of 170 kg N/ha (or 370 kg urea/ ha)

### **Nitrogen loses**

Numerous articles on nitrogen in pasture settings and greenhouse gas considerations [http://www.greenhouse.unimelb.edu.au/Online\\_Articles.htm](http://www.greenhouse.unimelb.edu.au/Online_Articles.htm) and [http://www.greenhouse.unimelb.edu.au/publics.htm#Peer\\_Reviewed\\_Reports\\_Refereed\\_Conference\\_Papers](http://www.greenhouse.unimelb.edu.au/publics.htm#Peer_Reviewed_Reports_Refereed_Conference_Papers)

Summit Quinphos “on average 50% of the nitrogen from the ordinary urea you apply is lost after application.” Dairy Exporter Sept 2009 p 28

Only 30 -40% N applied to soil (fert +dung & urine) gets used to grow more plants. 300% increase in Australian dairy farm use of N early 1990's to early 2000's with only 65% increase production Weak correlation N applied & farm profit in Ireland, Australia and NZ Nitrogen – Growth Promotant for Pastures Richard Eckard Univ. Melbourne 2006

N<sub>2</sub>O, nitrate and soil carbon losses increased, with N fert application Visual Soils Assessment Vol 1. G. Shepherd 2009

Milk Urea N an excellent predictor of urinary N excretion. Using Milk Urea Nitrogen to Predict Nitrogen Excretion and Utilisation Efficiency in Lactating Dairy Cows. J.S. Jonkers et al 1998 J Dairy Sci 81:2681-2692

### **Reduced N usage Possible**

NZ dairy farms can use 1/3<sup>rd</sup> the solid urea and produce 21t DM while leaching less than 18 kg N/ ha. Using Humic Compounds to Improve Efficiency of Fertiliser Nitrogen. P. Schofield et al. Fertiliser and Lime Institute 2012

Multiple abstracts on biological fertiliser/management effectiveness. Comparisons between 'conventional' and low-input 'biological' [www.biologicalfarmers.co.nz](http://www.biologicalfarmers.co.nz)

## **Plant Uptake Issues and Results**

### **Nitrate Content Impacts Pasture Quality**

**Higher Nitrate levels Assoc with weight loss, milk reduction, abortions. Most NZ dairy forages are Nitrate accumulators: rye, wheat, maize. Mineral deficiencies in cows reduce ability to convert NO<sub>3</sub> to protein. Ammonium uptake by roots preferable to nitrate uptake.** *A Review of factors affecting and prevention of pasture-induced nitrate toxicity in grazing animals.* Bolan and Kemp NZ Grasslands Assoc 2003

**Nitrate content in pasture increases with N fertilisation** Massey No 4 Dairy unit experiment 2002 cited in Bolan and Kemp 2003 *above*

**Prolonged use (16 yr) of N fertiliser caused massive declines in blood copper levels in cows resulting in reduced milk yields, increased anaemia, depressed immune response, more virulent viruses Copper necessary for catalase formation. Bacteria become pathogenic because blood and tissues are catalase deficient.** *Soil, Grass and Cancer.* Andre Voisin 1959. Acres USA 1999

**Highly fertilised pasture, esp clover, result in high N being released in rumen without adequate energy for microbes= health problems with ammonia toxicity.** *Nitrogen - Growth Promotant for Pastures* Richard Eckard Univ. Melbourne 2006

**Excess nitrate in pasture is a health issue for ruminants. The breakdown of these harmful nitrates happens faster on a diet rich in readily available carbohydrates - high brix grass - because the anaerobic rumen microbes use the fermentation products of carbohydrates to speed up the nitrate reduction reaction.** *Takahashi, et al. Effects of dietary protein and energy levels on the reduction of nitrate and nitrite in the rumen and methemoglobin formation in sheep.* *Jpn. J. Zootech. Sci.*, 1980, 51, 626-631

### **Acidosis**

**Lush, high CP, nitrogenous pasture reduces rumen pH.** *Nutrition and Lameness in Pasture-Fed Dairy Cattle* C.T. Westwood & I.J. Lean *Proceed. NZ Soc. Ani. Product.* Vol 61 Jan 2001 p 128-134

### **Need for Calcium and Traces**

**Soil calcium percentages determine availability of trace elements and microbe health.** *The Albrecht Papers Vol 1.* William A Albrecht. Univ Missouri AcresUSA 1999

**Science in Agriculture** A A Andersen 2002 AcresUSA

**Many NZ cows suffering from potassium excess and Ca/Mg and traces deficiencies - link with N fert use.** *Balancing minerals shown to increase milk production* Dr Gavin Wilson March 1998 [www.royalsociety.org.nz/1998/03/03/balancing-minerals-shown-to-increase-milk-production/](http://www.royalsociety.org.nz/1998/03/03/balancing-minerals-shown-to-increase-milk-production/)

**Higher Calcium levels promote efficient plant uptake of N. Use of foliar N with humic acid more efficient.** Visual Soils Assessment Vol 1 p 116 – 117 Graeme Shepherd 2009

### **Mycotoxins and Endotoxins**

**Penicillin moulds in Silage.** How they affect Rumen Health 2010 Dr. Anna Catharina Berge  
<http://en.engormix.com/MA-dairy-cattle/dairy-industry/articles/mycotoxins-in-silage-t1662/472-p0.htm>

**Higher N fertilisation raises mycotoxin levels.** Breaking the Mold. State of Science Review. Charles M. Benbrook <http://organic-center.org/reportfiles/MycotoxinReport.pdf>

**Fewer infections with less or no N fertilisation** B. Birzele, A. Meier, H. Hindorf, J. Krämer and H.-W. Dehne (2002) Epidemiology of Fusarium infection and deoxynivalenol content in winter wheat in the Rhineland, Germany European Journal of Plant Pathology 108 (7), 667-673

### **Species composition**

**N fertilisers reduce clover %.** The Effects of Urea and ASN on Product. Qual. Irrigated Dairy Pastures In Canterbury NZ. Moir et al 2003 Fert. & Lime Institute

### **Antibiotics**

**FDA Phasing Out Certain Antibiotic Use in Farm Animals Dec 11 2013**  
<http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm378100.htm>

## **NZ Antibiotic use**

**Ionophores (monensin) is 34% (17.82T active ingredient) of ABs used on animals and 20% of all antibiotics used in NZ.** NZ Expert Panel Review 1999 p 14-15

**Dietary monensin increases survival of deadly EcO157 pathogen.** Communities and Survival of *Escherichia coli* O157:H7 in Monensin-Treated Wastewater from a Dairy Lagoon. Ravva et al. Published online 2013 January 22. [10.1371/journal.pone.0054782](https://doi.org/10.1371/journal.pone.0054782)

**Only 3% difference in cure rate between untreated and antibiotic treated mastitis quarters. There are numerous types of Strep uberis pathogens even on a single farm. These organisms adapt to varying conditions and need to be dealt to with changes to environmental conditions on farm.** Mastitis in the NZ L.V. Douglass PhD thesis Massey Univ 1999

**58% of sample d calves showed bacterial resistance to commonly used antibiotics** MAF Technical Paper 2011/5.3 <http://www.mpi.govt.nz/Default.aspx?TabId=126&id=1038>

## **BUN & MU**

**NZ levels 19 to 65 mg/dl milk urea.** Peter Thomson, MAF OIA 11-243 17 Jan 2012

**NZ Crude Protein in pasture about 20 %** Jane Kay, DNZ Dairy Exporter Nov 2013 p 40. Also indicated, "Research suggests these high MU values are not detrimental to the cow," but no research cited. Also "Lowering MU values will not necessarily reduce environmental N loading as there are numerous other factors....supplements, stocking rate, pasture utilisation."

## **Metabolic connections**

**BUN, MUN, urea excretion all proportionally related. Using MUN to Predict Nitrogen Excretion and Utilisation Efficiency in Lactating Dairy Cows.** Jonker et al 198 J Dairy Sci 81:2681-2692

**Excellent layman's overview on cow health implications excess nitrate in feed.** True Protein vs. 'Funny Protein' Dr Jerry Brunetti A CRES USA Feb-April 2004 Vol 34

## **Ammonia impacts**

**Lameness**

**Increased CP in pastures & high BUN increases histamine and compromises hoof germinal cells. Low effective fiber & high degradable protein increase risk of laminitis. High CP in pasture and high BUN associated with lameness. Low pH maize silage and lactic acid in fermented feeds prompt rumen acidosis.** Nutrition and Lameness in Pasture-Fed Dairy Cattle C.T. Westwood & I.J. Lean Proceed.NZ Soc. Ani. Product. Vol 61 Jan2001 p 128-134

**The Link Between Nutrition, Acidosis, Laminitis and the Environment** J. Nocek  
[www.wcds.afns.ualberta.ca/Proceedings/1996/wcd96049.htm](http://www.wcds.afns.ualberta.ca/Proceedings/1996/wcd96049.htm)

## **Infertility**

**DNZ: we've arrested the decline in fertility but in calf rate at 6 week is 67% with 48% first service conception rate vs 2003 program performance target of 78% by 2016.** Dairy Exporter June 2012 p 139

A significant negative association was found between MU level and pregnancy rates in 36,000 cow sample. **Relationships Between Milk Urea and Production, Nutrition, and Fertility Traits in Israeli Dairy Herds** Hojman et al J Dairy Sci **Volume 87, Issue 4, April 2004, Pages 1001-1011**

**Excess urea impairs reproduction.** Using Milk Urea Nitrogen to Predict Nitrogen Excretion and Utilisation Efficiency in Lactating Dairy Cows. J.S. Jonkers et al 1998 J Dairy Sci 81:2681-2692

**Lower MU levels less likely to reduce fertility than MU levels above 38 mg/dl in first parity. MU of approx. 26 mg/dl was ideal.** Milk Urea Nitrogen and Fertility in Dairy Farms J Anim.Vet. Advances 2010 Vol 9 Issue 10 P 1519-1525.

**Milk Urea Nitrogen and Fertility in Dairy Farms** J Anim.Vet. Advances 2010 Vol 9 Issue 10 P 1519-1525.

## **Negative Energy Balance and BSC**

**Low fat%, high CP diet, high MUN associated with low fertility, esp. first parity cows.** MUN and Fertility in Dairy Farms Nourizi et al J Animal & Vet Adv. 2010. Vol 9 Issue 10  
[www.medwelljournals.com/fulltext/?doi=javaa.2010.1519.1525](http://www.medwelljournals.com/fulltext/?doi=javaa.2010.1519.1525)

**73% heifers below target weight at calving** LIC data 2013 as cited Bas Schouten Rural Weekly 23 April 2014

**25% of heifers left in herd at end of third lactation** Bas Schouten, NZ Grazing vet. Rural News 23 April 2014 p 45

## **Mastitis**

**A healthy udder has <25,000 somatic cells/mL. For every clinical mastitis case likely to be 15 to 40 cases of subclinical responsible for up to 70% of the production losses associated with mastitis. \$1 spent on mastitis control returns \$15 - 20 in production, premiums, and reduced death and culling.** Linda Tikosfsky extension vet Cornell Uni March 2008 NODPA News p 34

*Dairy NZ's mastitis specialist, Jane Lacy Hulbert, creator of the DNZ SAMM mastitis program, confirmed by phone message that, consistent with the figures on their website (under Farmer / Industry information), average mastitis rate is 50% of the NZ dairy herd. Phone 9 March 2013*

*Risk of coliform mastitis increases in housed cows. Who Controls Mastitis? You or the Bugs? Lacy-Hulber & Woolford Dairy NZ*

## **SCC**

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**The Pursuit of Happiness: How Nutrient-dense Animal Fats Promote Mental and Emotional Health.** Dr Chris Masterjohn Wise Traditions Journal Volume 9 No. 4

**5 Times more CLA from cows feed on pasture with no supplements.** Conjugated Linoleic Acid Content of Milk from Cows Fed Different Diets Dihman et al [Journal of Dairy Science](#) [Journal of Dairy Science Volume 82, Issue 10](#), October 1999, Pages 2146–215. [sciencedirect.com/science/article/pii/S0022030299754585](http://www.sciencedirect.com/science/article/pii/S0022030299754585)

**Herbage based milk higher in CLA** Characterization of milk from feeding systems based on herbage or corn silage.....Hurtaud et al [Dairy Science & Technology](#) March 2014, Volume 94, Issue 2, pp 103-123 <http://link.springer.com/article/10.1007%2Fs13594-013-0147-0>

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## **Financial impacts intensification and urea fertilisation**

### **Effects on farm profit**

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**Brian Hockings Stratford Project - low input dairies can be as or more profitable than high input dairies** Dairy Exporter Dec 2013

**Profitable milk production possible without N fertiliser.** Profit/ha increased in only 3 out of 10 years with N. Use Fertiliser wisely and well. Chris Glassey DNZ Dairy Exporter Feb 2014

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### **Future is Fat Soluble Activators**

**Vitamins A, D, K<sub>2</sub> crucial to utilisation of all other minerals and vitamins.** Nutrition and Physical Degeneration Weston A Price 1945 Chpt 22

Phyllis Tichinin

True Health Ltd.