

**Jefferis**, David (2010)

Biological farming in New Zealand

# **BIOLOGICAL FARMING IN NEW ZEALAND**



**DAVID JEFFERIS**

**FOR**

**KELLOGGS RURAL LEADERSHIP  
LINCOLN UNIVERSITY  
2010**

## **CONTENTS**

- Introduction
- What is the purpose of agriculture?
- What is happening in NZ agriculture?
- How and where do we start biological farming in NZ?
- NZ soils
- Earthworms
- Humus
- Humates
- Calcium and boron
- Carbon
- Artificial chemicals and fertilisers
- Organic agriculture
- Biological vs organics
- Human health
- Biological farming in NZ
- Conclusion
- Acknowledgements

## **INTRODUCTION**

This paper discusses the principles, outcomes and benefits of biological farming in New Zealand. New Zealand agriculture is at present extremely reliant on petrochemical based fertiliser and chemicals to produce commodities. Biological agriculture is about increasing efficiency, productivity and profitability by working with a natural system rather than against it. Agricultural produce in New Zealand is inextricably linked to the health and viability of the human population it serves. We are what we eat and this ultimately comes from the health of the soil where our food is grown. This paper discusses soil, plant, microbe, animal and human health and highlights how critical it is that we look to the health of our soil to support New Zealand agriculture and human health into the future.

## **What is Biological Agriculture?**

- Biological Agriculture is a mix of conventional and organic farming practices including grass, crop and soil monitoring to ensure optimum yields, nutritional density, humus production and profitability
- Combining the best of chemistry, physics, biology and microbiology with sound farm management practices
- Addressing and solving weed, disease and insect pest problems at their root cause rather than merely masking the symptoms

## **Fundamentals to Understand**

- Consider people, their health and well being as the result of the food, and the environment that we create in agriculture
- Placing value on soil and its biology as the basis for all fertility
- It is an approach, not a product
- Nutrition comes from agriculture, and only agriculture
- Human health and disease are directly related to nutrition
- It is about increasing farmer efficiency, productivity, and profitability by working with a natural system, not against it.
- Agricultural practices worldwide over the last 60 years have substantially reduced plant vitamin and mineral levels degenerating our food, our environment, and our health

## WHAT IS THE PURPOSE OF AGRICULTURE?

- To produce food and fibre for human consumption
- To provide comprehensive nutrition for growth and development, and recovery from illness

In addition:

Whatever we farm, we act within a belief system that sets up the rules and management regulations by which we function. This is called a paradigm.

Over the past 60 years agriculture has functioned in a paradigm whose philosophy says that nature is flawed, and must be controlled with man made materials.

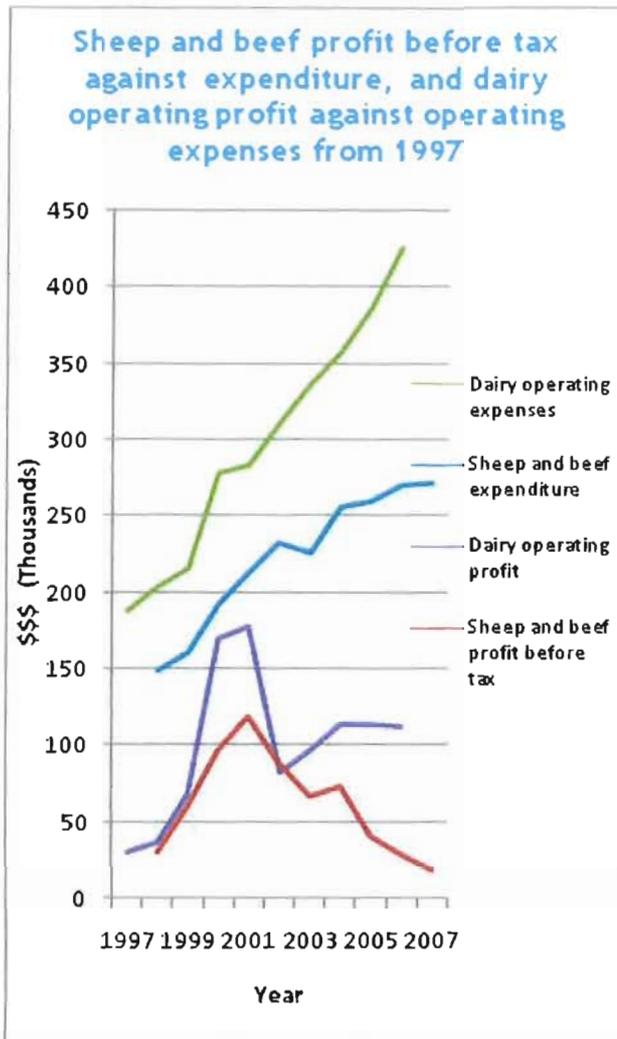
This paradigm has placed agriculture in a state of constant war with nature, continuously battling pests and diseases.

Biological farming without prejudice is simply moving to the next paradigm.

*"Truth goes through three stages - first it is ridiculed, second it is violently opposed, third it is accepted as being patently obvious." Schoepenhauer*

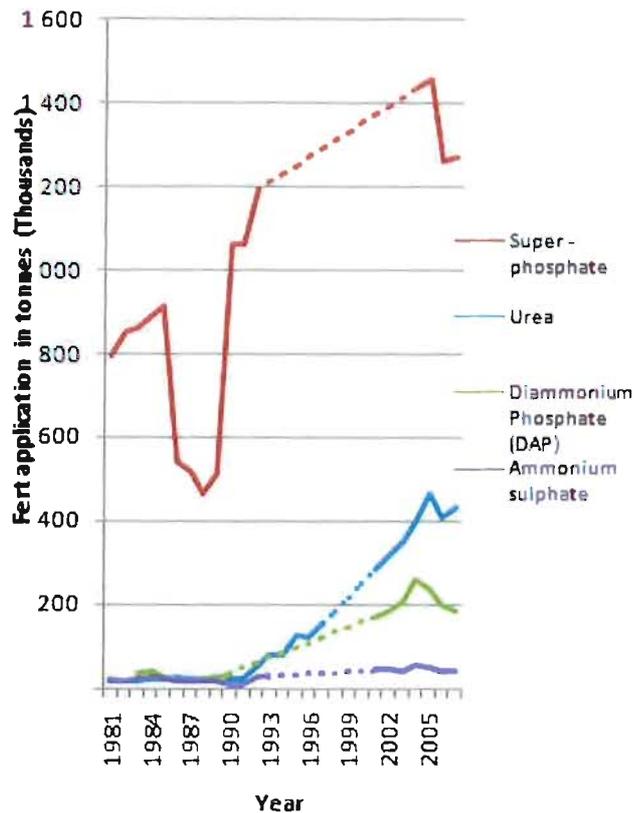
## WHAT IS HAPPENING IN NZ AGRICULTURE?

- In all pastoral sector farm profits before tax tracked around \$100,000 per annum in 1999. In 2007 the farm profits before tax tracked at \$50,000 per year
- Between 1983 – 2007 the total nitrogen and phosphorus fertiliser applied to our farms went from 913,724 tonnes to 1.9 million tonnes
- From 1990 to 2005 sheep and beef farms used 60% more fertiliser per unit of output, while the dairy industry used 40% more fertiliser per unit of output
- MAF figures show agricultural output grew 1.5% between 1988 and 2006 while productivity grew 2.2% per year. In the same period NZ use of nitrogen fertiliser increased by over 600%
- Pasture production in dry matter (DM) has not increased significantly since the mid 1980s despite increased fertiliser use and grass seed breeding
- NZ soils have lost significant amounts of both carbon and nitrogen in the last 20 years
- Regional Councils in NZ are discussing and implementing caps on stocking rates, stock types and fertiliser use to prevent the pollution of waterways



Source: Meat and Wool NZ, "Form Surveys: Per farm data" (2008); DairyNZ Economic Survey "Time Series Tables Owner Operators" (2007).

## Fertiliser application in New Zealand from 1981



Source: MAF. 'Fertiliser use statistics'. (2007)

Profitability within NZ farming systems has also been affected by currency and commodity volatility, government policy, increased land values, and weather.

Nearly all of those factors are out of what farmers are able to control from "within the farm gate".

## Worldwide

- Mineral DEPLETION in soils over 100 years up to 1992, Europe 72%, Asia 76%, North America 85%  
*Rio Earth Summit 1992*
- Mineral DEPLETION in our food since WW2 has increased in vegetables by 40%, fruit by 21%  
*The Composition of Foods, Ministry of Agriculture, Fisheries and Foods and the Royal Society of Chemistry, UK*
- Farmers have been brainwashed to believe that fertile soils grow weeds and their domesticated crops equally well
- Majority of farmers believe that weeds detract from their crop, steal water and nutrients, and ruin the “clean techno farm” image
- Approximately 80% of all food and crop research worldwide is funded by chemical and drug companies  
*Dr Anne Razvi: Mineral Depletion in Soils, 2006*
- Not one herbicide since 1950 has solved weed problems in farming  
*Dr A Anderson: Science in Agriculture, 2006*

In 1992, the official report of the Rio Earth Summit concluded “there is deep concern over continuing major declines in the mineral values in farm and range soils throughout the world”.

## HOW AND WHERE DO WE START BIOLOGICAL FARMING IN NZ?

It starts with the SOIL

“We are not standing on dirt. We are standing on the roof of another world”

Dr Jill Clapperton, Leithbridge Research Center, Canada

Soil is the prime source of minerals on which every living cell depends for its structure and function.

Vitamins, enzymes, protein and other biologically active substances are essential for plants, animals, and our bodies to function properly.

“You can trace every sickness, every disease, and every ailment to a mineral deficiency originated from the soil.”

Dr Linus Pauling, 2006, twice Nobel Peace Prize winner

## NZ SOILS

### What is healthy soil?

A healthy soil is a soil that can breathe freely. This requires mineral balance, microbial support, and human intervention. A healthy soil should contain a minimum of 5% humus, and have a pH (an indication of the soils acidity or alkalinity) of 6.4 to facilitate maximum nutrient up take. A healthy soil must have a fully functioning soil food web, beneficial fungi, and very importantly **earthworms**.

### How do we improve our soil?

- Informed management of our soils
- Physical soil assessment monitoring
- Livestock farmed and managed relative to soil type, avoiding pugging
- Monitor mineral levels in soil by plant available testing, in plants by plant testing (tissue sampling, brix levels), in livestock (blood tests, liver biopsies) and in testing produce harvested
- Understand plant and soil relationships
- Incorporate crop residues and green manure crops rapidly into the soil where possible to increase humus formation
- Feed the soil what it needs relative to the crop being grown, and subject to the monitoring. We do not eat once in a season and we should not expect plants to either
- Be flexible, but keep it simple. Sustainability includes profitability – we are farming for profit

## EARTHWORMS

The essence of soil health

- Earthworms are the indicators of the biological health and condition of the soil because population density and species of worms are affected by the soil properties and management practices.
- Earthworms assist in the aggregation of soil particles
- Provide food for increasing microbe population and assist root growth
- Earthworms distribute microbes and minerals within the soil
- Earthworms increase the level of top soil by movement (aeration) and by what they excrete (vermicast). Vermicast contains 7 times more phosphorus, 10 times more potassium, 5 times more nitrogen, 3 times more magnesium, and 1.5 times more calcium than the worms' surrounding soil
- Earthworm populations are governed by the amount of "food available" organic matter, moisture, temperature, texture and pH in the soil
- It is preferable to have worm populations of 25 to 40 per shovel full of soil.
- If beneficial fungi, especially mycorrhizal fungi, are apparent in the soil, then its likely there will be favourable numbers of worms

Earthworms increase the beneficial bacteria available 3 fold within the soil thus assisting the decomposition of organic matter to humus. The result of this is an increase in the supply of plant available nutrients for pasture production. Soils with optimum populations of earthworms have the ability to increase pasture production over poor earthworm populated soils by up to 30%.

Earthworm species can further indicate the overall condition of the soil. Yellow tail (*Octolasion Cyaneum*) worms indicate adverse soil conditions. Other worm species prevalent in NZ soils are *Lumbricus Rubellus* (red brown or red purple), *Aporectodea* (grey pink), *Aporectodea longa* (grey brown with black head).

If your soil contains 25 earthworms per shovel then they will produce 300 tonnes of castings per/ha – significant free fertiliser.

## HUMUS

“Humus is the life blood of a living soil system.”

J Tink, Abron, 2008

Humus is the colloidal material from the breakdown of plant or animal organic matter. Micro organisms (bacteria, fungi, worms) are recognised as decomposers that take fresh organic matter and convert it to **humus** through a process called microbial decomposition.

Humus is only created by microbes and is the most bio chemically complex substance on earth. It is the result of microbial/biological polymerisation processes in the soil.

“Humus is the most important source of human wealth on this planet.”

S Waksman, 2<sup>nd</sup> Edition. Williams & Wilkins Co, Baltimore, 1938

### Function of humus

It is the “pantry” of vital plant nutrients.

- It buffers the soil against toxic substances and changes in soil pH
- Humus is a carbon rich substance produced by bacteria, fungi and worms which also serves as their base.
- Holds a high cation exchange capacity preventing leaching
- Holds water, as 80 - 90% of its weight is water
- Holds three times more nutrients than clay, and is structureless

### Humus – the unrecognised solution

Humus and soil carbon have been equated and misunderstood by many NZ Ag Researchers. They are NOT the same thing. Soil carbon can eventually become humus IF it is digested by soil microbes in a well mineralised healthy soil food web.

Current NZ standard soil tests measure soil organic matter/soil carbon and inadvertently soil humus by simply burning up soil sample and measuring CO<sub>2</sub> that comes off the sample. The result includes useless locked up carbon in thatch and roots that are not yet

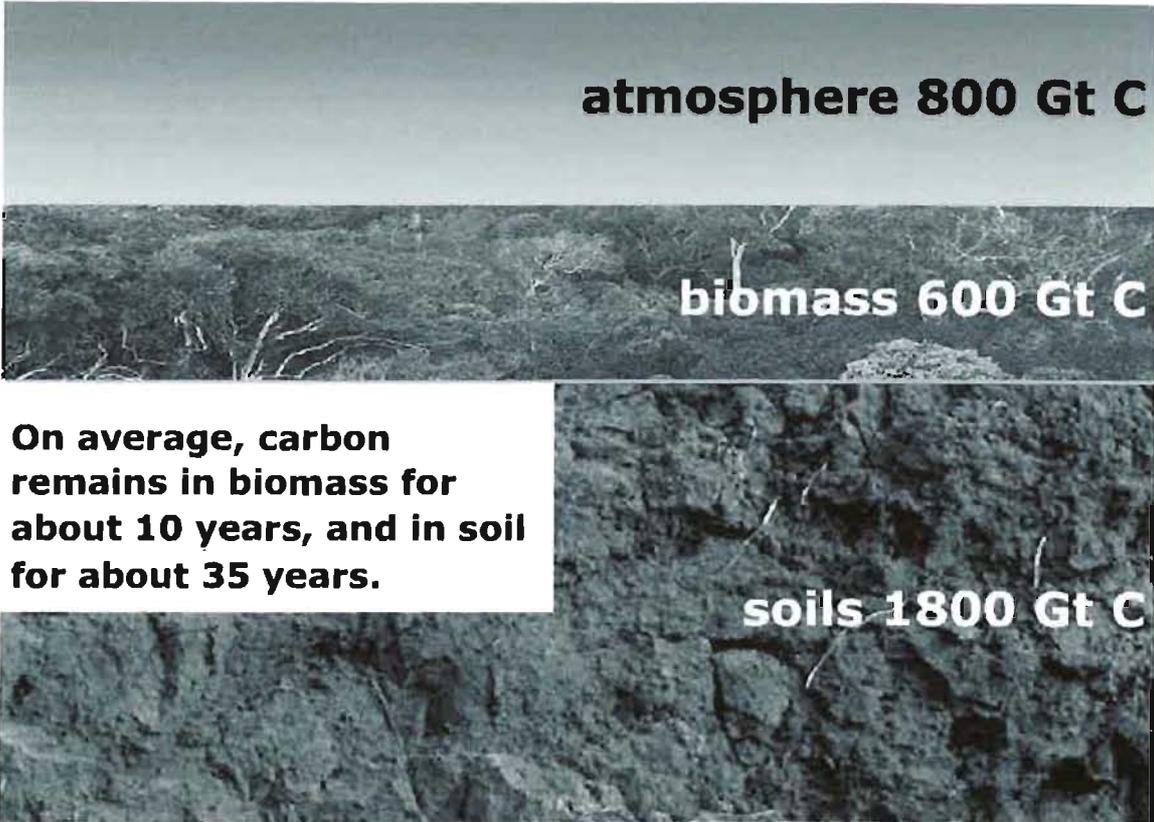
completely decomposed but it does not include good humus levels and a functioning soil. Currently there is no direct test in NZ that measures humus.

Many NZ Ag Scientists contend that NZ soils are high in carbon so there should be little concern about soil fertility and biological principles when in fact we are experiencing a decline in true humus, and high levels of water repelling thatch.

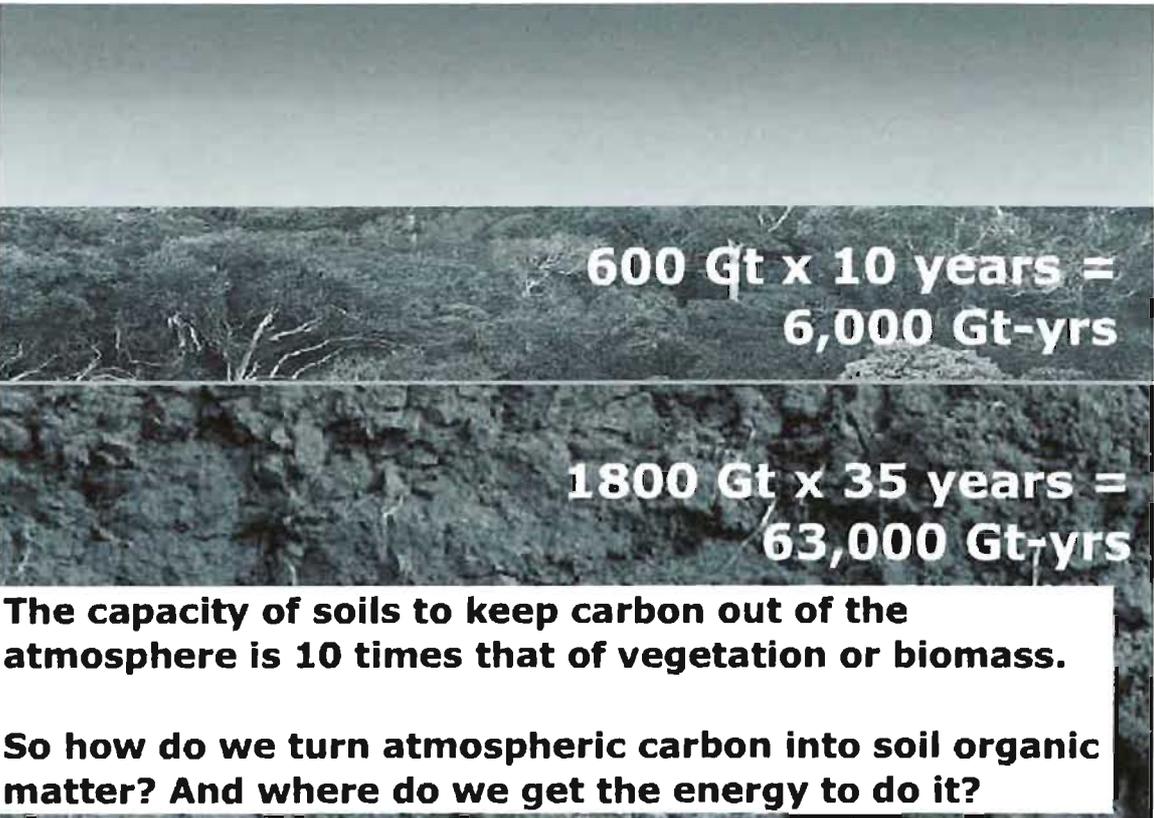
The majority of the world's emphasis to date has been upon developing alternatives to burning coal, including water and solar power. We are also implementing various carbon taxes and the reduction of emissions.

It must be recognised by primary industry and governments that the majority excess CO<sub>2</sub> in the atmosphere originated from the soil, and that there should be urgency to return it to the soil.

On average, carbon remains in biomass for 10 years and in the soil for 35 years. The capacity of soils to keep carbon out of the atmosphere is 10 times that of vegetation or biomass.



**On average, carbon remains in biomass for about 10 years, and in soil for about 35 years.**



Graham Sait: Healthy Soil, Hardy People, Happy Planet, 2010

## The confusion with organic matter and humus

Cell humus (wastes, residues, and remains of living organisms) is raw organic matter but not all organic matter is humus.

Organic matter is a combination of raw organic matter, active humus, and stable humus

Organic matter improves aeration, protects soil from weathering, provides soluble nutrients, and leaves a reserve supply of nutrients. The downside is that it locks up some available nitrates.

	<b>Pool</b>	<b>Description</b>
Living biomass	Above-ground biomass	All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage. Where forest understorey is a relatively small component of the above-ground biomass carbon pool, this may be ignored so long as the methodology is used consistently throughout the inventory time series.
	Below-ground biomass	All living biomass of live roots. Fine roots under, say, 2 mm diameter may be excluded as they often cannot be distinguished from soil organic matter or litter.
Dead organic matter	Dead wood	All non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. This includes wood lying on the surface, dead roots, and stumps (usually defined as having a diameter of at least 10 cm).
	Litter	All non-living biomass with a smaller diameter than that used for dead wood (say, 10 cm), lying dead, in various states of decomposition above the mineral or organic soil. This includes the litter, fomic, and humic layers. Live fine roots (of less than the diameter limit for below-ground biomass, say 2 mm) may be included here.
Soils	Soil organic matter	Includes organic carbon in mineral soils to a specified depth chosen by the country and applied consistently through the time series. Live fine roots (of less than the chosen diameter limit for below-ground biomass) to 30 cm depth may be included here.

Last updated: 3 August 2009 <http://www.mfe.govt.nz/issues/climate/lucas/glossary/carbon-pools.html>

There are two acids that can be found in humus:

### **Humic acid and fulvic acid.**

The major role of these two acids is to chelate (act like a bond) minerals to enhance plant uptake. They also provide a strong system for beneficial exudates (minerals, vitamins, antibiotics), and as an excellent detoxification process for breaking down chemicals.

Humic and fulvic acid are derived from deposits of plants that pre date the dinosaur era. Humates are plant tissues that have not fully decomposed. Humates can be derived from either lignite or leonardite.

In many NZ soils high nitrogen use and cultivation practices have reduced active humus levels. Therefore there are major advantages to re-building these carbon sources back into the soil and plant systems.

Humic and fulvic acid can be used to kick start natural humus formation. Their natural chelating, magnification, and stabilisation abilities are very beneficial to agriculture.

Their magnification effect increases the uptake of nutrients called cell sensitisation. Essentially the plant cell becomes more permeable acting as the medium of up to 30 % more nutrition than non treated soils.

## **HUMATES**

Humates are entirely natural substances mined from coal fields both here in NZ and in Australia. Humates key components are humin, humic, fulvic, mycorrhizal fungi and bacteria, and the carbon to feed these fungi and bacteria.

Natural humates appear in the soil in the form of insoluble salts as a result of the interaction between humic acids, and metal ions of soil solution. It is humates that determine a soil's genetic, environmental, and agronomic functions.

Humates can be mixed with fertiliser and seed in powder, pellet or liquid form and should be applied at rates of 5 – 10 kgs per 100 kgs fertiliser per ha.

Currently NZ farmers use 2000 tones per year of Humates, but it is projected that figure will increase to 10,000 tonnes per year.

*NZ Humates Ltd, May 27, 2010*

In 2010 NZ Solid Energy has discovered lignite seams in Southland's New Vale Mine containing up to 43% humic acid. This is one of the highest quality seams discovered in NZ.

NZ humates in general contain 33.6% humic acid, 15.3% fulvic acid, 51% carbon.

*HZ Humates Ltd, May 2010*

### **Why use humates?**

Continuously treating the soil with humates helps to improve soil structure. Humates interact with calcium, magnesium, aluminium, and iron always present in the soil to resist soil water and wind erosion, to hold moisture and air to create favourable conditions for micro organism activity, and to increase soil fertility. Effective use of humates increase the soil's uptake of minerals meaning a reduced amount of fertiliser can be applied, as non treated fertiliser will leach more quickly. "It is generally accepted that we only access 28 of the 46 units available in granulated urea applied without humates. Adding humates increases the utilisation by 30 – 40%".

*G Zimmer, Nutri-tech Solutions Sustainable Agriculture course, 2009*

## CALCIUM AND BORON

“Calcium is the trucker of all minerals and boron is a synergist for calcium.”

Gary Zimmer: *Balancing Soils for Profit*, Dr A Andersen, 2008

Calcium is the most important mineral in the soil. It is a component of every living cell and essential for cell strength. Calcium plays a key role in the transfer of materials in and out of the cell.

Calcium contributes to the raising of brix levels of plants, and stimulates seed germination.

Boron is responsible for the uptake and efficient use of calcium in the plant. It is the synergist. It is essential for cell division and development, particularly in the growing points of shoots and roots. It promotes flowering, and is required for the movement of sugars so plays a major role in photosynthesis.

**Soil pH becomes self adjusting when calcium, magnesium, potassium and sodium are in proper equilibrium. pH is the result, not the cause of nutrient interaction in the soil.**

Dr A Andersen, 2006

## CARBON

The value of carbon can be considered in terms of sustaining productivity. It holds water, nutrients, and supports biological activity in soil organisms, which improves nutrient recycling and aeration.

Soil microbes break down carbon in organic matter (roots, plant litter etc) releasing it to the atmosphere as carbon dioxide as well as releasing nutrients for plant growth. The bulk of carbon dioxide captured by plants during photosynthesis is returned to the atmosphere by plant respiration. In a hectare of grazed dairy pasture, microbial respiration in the soil turns over 15 to 18 tonnes CO<sub>2</sub> equivalents annually. Soil typically contains 300 to 400 tonnes CO<sub>2</sub> per ha equivalents in the top 30cm.

Organic matter levels in NZ soils are on average 30% of what they were 100 years ago. Soils have dropped from 5% organic matter to an average of 1.5%. When 1% of organic matter per ha is oxidised, due to over tillage or over use of carbon free fertiliser then 20 tonnes of CO<sub>2</sub> per ha is released.

G Sait, Nutritech – Solutions, 2010

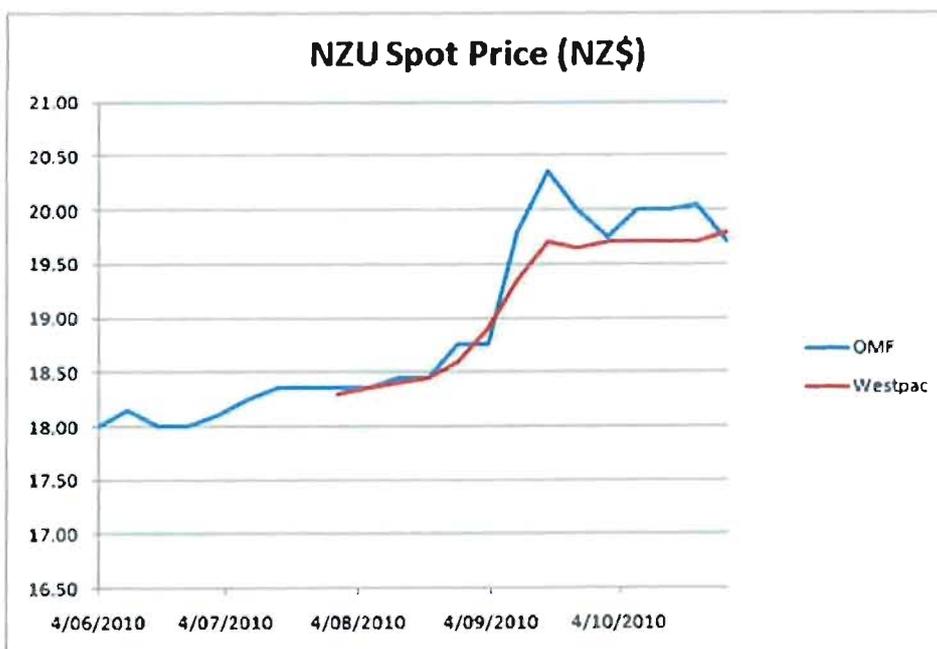
## Carbon trading

The trade in greenhouse gas emissions has been developed internationally in an effort to limit overall emissions. Emissions trading allow one source to increase emissions of greenhouse gases when another source reduces them, theoretically maintaining an overall constant emission level.

Market trading of so-called “carbon credits” rose from \$68 billion in 2007 to \$118 billion in 2008. In 2009, trade volume increased by 68% while the value of trade was similar, as the carbon price fell in line with commodity prices.

Carbon has been traded in New Zealand under various voluntary “carbon-neutral” programmes at around \$22 to \$25 per tonne of CO<sub>2</sub>.

Until April 2009 most carbon trading in New Zealand had been under a voluntary market situation (pre Kyoto, or outside Kyoto Rules). The compliance market (under Kyoto rules) has been active in Europe for 5 years. New Zealand has experienced significant trade under the ETS with sales to local and European buyers.



[//www.carbonfarming.org.nz/](http://www.carbonfarming.org.nz/)

## **ARTIFICIAL CHEMICAL FERTILISERS**

The soil contains bacteria, fungi, plant and animal life in a state of constant interaction and balance. Task specific soil micro-organisms have the capacity to fix nitrogen from the atmosphere, solubilise phosphorus and create humus.

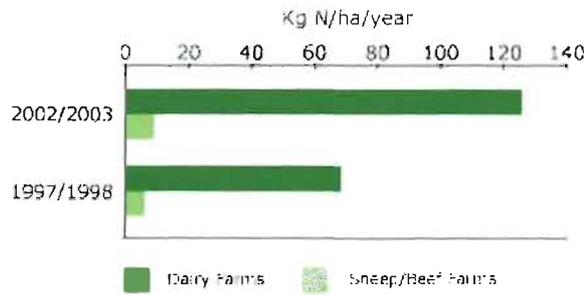
Every one of these organisms needs dozens of different minerals to survive and play its part in the ecosystem. Specific bacteria play a key role in converting soil minerals into chemical forms that plants can utilise.

The NPK fertilisers (used in modern farming that only contains nitrogen, phosphorus, and potassium) gradually change the soil pH level to an acidic condition which disadvantages beneficial soil bacteria and fungi. Excess nitrogen and phosphorus can suppress the health and functionality of mycorrhizal fungi that provide moisture and minerals to plants through its extensive network of fungal hyphae.

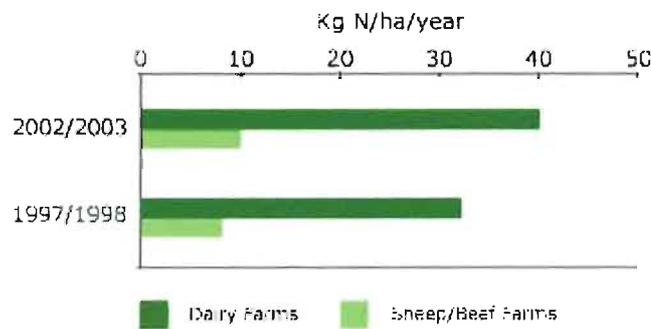
Plants require in excess of 16 minerals for maximum plant growth and health. This enables plant to build complex carbohydrates, proteins and fats for high performance, insect resistance and high quality nutrition for stock and humans. High quality produce is difficult to achieve under a fertiliser regime that provides only soluble N, P, K.

To combat soil acidification lime can be spread adding back calcium and magnesium which not only raises soil pH; increases the availability of the majority of other plant essential minerals in the soil; stimulates bacterial, fungal, worm populations to enhance soil structure, mineralisation and plant health. The goal of biological agriculture is to stimulate the soil micro organisms to drive high performance plant production through correct soil and plant nutrition practices.

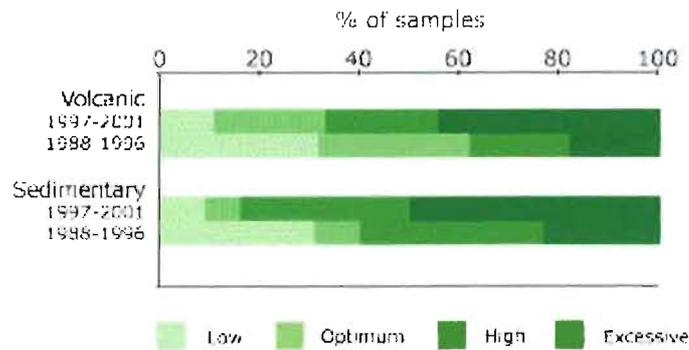
**Nitrogen fertiliser use for dairy and sheep/beef farms in the Waikato region.**



**Nitrogen leaching on dairy and sheep/beef farms in the Waikato region.**



**Phosphorus levels in soil for dairy farms in the Waikato region**



- Nitrogen leaching is increasing at a similar level for sheep/beef and dairy farms.
- On average, phosphorus fertility on dairy farms is near the maximum for a high producing farm. Many soil samples from volcanic and sedimentary material show excessive phosphorus

fertility. Fewer sheep/beef farms have excess phosphorus fertility.

The data were collected for 1997-1998 and 2002-2003. Phosphorus (Olsen P) values for volcanic and sedimentary soils were collected for the period 1988-2001

[www.ew.govt.nz/Environmental-information/Environmental-indicators/Land-and-soil/](http://www.ew.govt.nz/Environmental-information/Environmental-indicators/Land-and-soil/)

## **Pesticides and Herbicides**

Disease pathogens and pests are always present, yet not all plants come down with diseases or are attacked by pests. This fact tells us that diseases and pests are not inevitable and that insects and plant pathogens are not the real cause of the problem.

Pests and diseases are merely there ready to eat or infect unhealthy plants that are weakened. Some disease and pest vectors play an important ecological role in the recycling of defective plants back into the soil carbon cycle. Defective plants would not be optimal for human or animal consumption.

Insect pests and diseases do not successfully attack healthy growing plants, because like animals and humans, plants have various methods of resistance to the attackers. However, modern agriculture and horticulture has largely ignored this concept and treats the insects and diseases with chemicals... and we eat the inferior produce anyway.

Pesticides and herbicides reduce the plant's function to uptake trace minerals

[Dr Linus Pauling, Soil Mineral Depletion paper, www.physicalnutrition.net](http://www.physicalnutrition.net)

Plants have an important relationship with certain fungi that can form "networks" covering several hectares. These fungi obtain carbohydrates from the plant root at the same time supplying plant with nutrients it draws from the soil. This gives the plant access to a vastly greater mineral extraction system than is possible by their roots alone.

Chemical fungicide sprays destroy these beneficial fungi and again, reduce the ability of plants to absorb soil minerals.

Insecticides can also reduce trace mineral uptake by deactivating choline containing enzymes in plants essential for the absorption of manganese and other minerals.

## **History of Chemicals and Fertilisers**

The agricultural industry of today, called the “Green Revolution”, was the dream child of the chemical weapons industry of WWI and WWII. Out of this industry sprang the use of the chemical nitrogen, high analysis phosphorus and potassium fertilisers.

Following this is a plant breeding industry that selects and breeds plants that grow the greatest **volume** of product on the narrow spectrum of high analysis fertilisers. As a natural result of using these unbuffered high analysis fertilisers, weeds, insects, and disease problems have exploded. 80% of all agricultural and medical research is funded and controlled by chemical and drug manufacturers.

Dr Linus Pauling, Soil Mineral Depletion paper, 2006, [www.physicalnutrition.net](http://www.physicalnutrition.net).

## **Understanding the Facts**

- The chemical sprays and pesticides that we apply to plants will never provide nutrition to plants, animals, and humans
- Weeds and pests are present because the grower has created the environmental conditions for them to be present and survive
- In over 70 years of chemical use on our food and soils they have not solved one disease, weed or insect pest problem. We actually have resistant weeds, diseases and insect pests
- It is common knowledge within NZ farming that we now have worm resistance to various animal health products

## **ORGANIC AGRICULTURE**

### **Worldwide Overview**

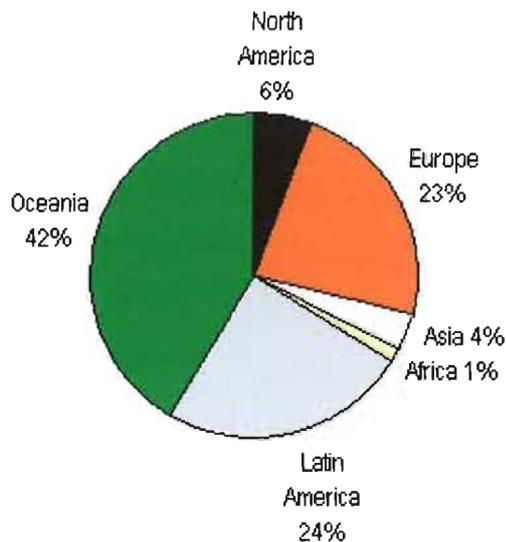
The organic industry has become a profitable and fast growing retail sector in Europe and the US over the last decade. Sales across Europe have doubled since 1998, and consumers in Italy, Spain, Germany Britain and France spent a total of €8 billion on organic food in 2003. In the US, the market for organic foods and beverages has been reported to be growing at 20% each year. Nevertheless, the organic sector is still a niche in the total food sector. The organic market share in Denmark is estimated at almost 3% of the total food sales, probably the highest in the world. It is followed by Switzerland and Austria with 2% and 1.8% respectively.

Organic food often costs more than other food due to lower yields, more labour-intensive production and expensive materials. In some countries insufficient supply and additional distribution costs also push up the price. For these reasons, organic products seek premium prices in a market dominated by low commodity prices for agriculture and horticulture products. However, the extent of the market premiums varies considerably from commodity to commodity and from time to time according to market conditions.

More than 24 million hectares of farmland are under organic management worldwide, according to the International Federation of Organic Agriculture Movements (IFOAM) 2004 report. The market for organic products, previously dominated by Europe and the US, is now growing in more than 100 countries around the world. Its market value in 2002 was estimated at \$US 23 billion and in 2005 was predicted to be valued at \$US 31 billion -a projected increase of 34%.

Statistical information on organic production in developing countries is hard to find even though they often practice organic management. The proportion of land under organic farming on each continent is as follows: Australia/Oceania holds 42% of the world's organic land, followed by Latin America (24.2%) and Europe (23%) as shown in the figure below.

## Total area under organic management - share for each continent 2004



Source: IFOAM report 2004

Organic farming has been increasing at a slower rate than it was five years ago and even in some countries a drop in organic farm conversions has been observed. For example in the Netherlands the number of farmers in the process of converting from conventional to organic methods fell by 30% between 2002 and 2003. The area under conversion also fell by a third to 3000 hectares.

International Developments in Agriculture, MAF, 2005

What is clear is that it is difficult for a representative of the organic farming industry to provide independent data that concludes that organically produced food has any greater nutritional value than conventionally grown food.

## BIOLOGICAL VS ORGANICS

The goals and philosophy of biological and organic farming are the same – create healthy food within the natural system, and without pesticides.

Our science understanding of soil, plant and microbe interactions has burgeoned since the establishment of organic practice in the 1930s. Instead of relying exclusively on amendments that occur naturally as organic farming does, biological farming has a more evolved science of monitoring and uses only substances that pass the test of “does nature approve?” In other words, will the product added to the soil or plant increase microbial diversity and soil humus, improve plant sugar and mineral levels, and boost plant resistance to disease and insect attack? If the answer is yes, then the product can be used. Biological farming relies on the plant’s response, not a certification hoop to tell us what is best.

Conventional farming pushes harsh water soluble, nitrogen – dominated fertilisers into the plant roots creating weak, watery growth that is low in essential trace elements.

Organic farming avoids any artificial fertiliser, but often organic plants still need to be propped up using organic pesticides that kill soil and leaf microbes.

Biological agriculture quickly creates robust, diverse microbe communities that feed and protect plants supplying them with substances they need to grow, and repel insects and disease pests naturally.

Too many organic conversions fall over or produce poor quality food due to a lack of understanding of soil microbe and mineral processes. If they still have pest problems, it’s an indication of system imbalance and failure to create the optimum quality of plant tissue which is unpalatable to insects.

P. Tichinin, Abron Ltd

## HUMAN HEALTH

“The foundation of human health is the quality of the food we eat, which relies ultimately on the vitality of the soil on which it is raised”.

Dr A Anderson: *Science in Agriculture*, 2006

### Overview

Minerals are required for the proper formation of blood, tissue, and bone. They are required for maintenance of healthy nerve function, heart beat regulation, and reproductive and foetal development. They are also essential to the process of growth, healing, and energy release.

The presence of minerals in the human body must also be at the correct ratios to each other. The level of each mineral has an affect directly or indirectly on every other, so if we are out of balance, the whole system is affected.

Minerals are an essential part of our natural diet, and lack of them increases susceptibility to “diseases of our civilization” such as heart disease (lack of magnesium), cancer (selenium), diabetes (chromium), and mental illness (zinc).

Dr Linus Pauling, *Soil Mineral Depletion paper*, 2006, [www.phyiscalnutrition.net](http://www.phyiscalnutrition.net)

### Nutrition

Nutritional supplements are an important addition to a holistic health plan but we cannot live by supplements alone, and to achieve the ultimate health we all seek, we must receive and utilise comprehensive nutrition via the food we eat.

On a scale of 0 – 100, mineral supplements will only get us to 75 – 80. The remaining 20 – 25 must come from food – real food with dense nutrition. The natural tissues of living plants and animals that we eat are vital to maintaining human health.

Dr A Anderson, *Human Health Starts in the Soil*, 2006.

## Understanding How We Achieve Optimal Human Health.

- Regular exercise, at least twice a week.
- To use the term “eat a balanced diet” is only credible when the soil growing the fibre, meat or tissue that humans eat has plant available nutrients. A plant cannot provide to the consumer any nutrition not present in the soil that grew it.
- For ultimate **human health**, focus should be on **soil health** demanding farm practices on growing soil humus levels, which allow growth of nutrient dense food. It cannot be solely be about volume of food.

### Reduction in average mineral content of fruit and vegetables between 1940 and 1991

Mineral	Vegetables	Fruit
Sodium	-49%	-29%
Potassium	-16%	-19%
Magnesium	-24%	-16%
Calcium	-46%	-16%
Iron	-27%	-24%
Copper	-76%	-20%
Zinc	-59%	-27%

Dr Linus Pauling, Soil Mineral Depletion paper, [www.physicalnutrition.net](http://www.physicalnutrition.net)

USA Dept Health and British Ministry of Food and Statistics show our food is up to 60% lower in basic nutrients than it was 50 – 60 years ago. This decline has occurred in spite of all the technological advances in agriculture.

A new study published show mineral levels in animal produce reflect the same picture in plant foods. Comparing levels measured in 2002 with those present in 1940, iron content in milk was less 62%, calcium and magnesium levels in cheese had fallen 70%, and copper in dairy produce had fallen 90%.

## What is New Zealand Eating?

- 94 % of NZ people consume a regular omnivorous diet
- 1 in 5 adults eat the NZ Nutrition Taskforce (1991) (NZNT) recommended fibre intake per day
- 1 in 3 NZ people met NZ Nutrition Foundation (NZNF) recommendation of eating 3 different vegetables per day
- 1 in 2 NZ people meet NZNF recommendation of eating 2 pieces of fruit per day
- From 1989 to 2009 the percentage of people classified as obese by the NZNT has increased from 17% to 35%. An additional 15% are described as overweight
- There are low levels of iron, magnesium and calcium in all food consumed in NZ
- 50% of elderly people in NZ are at high risk of malnutrition. These people are eating food that lacks the nutritional value that their bodies require

A positive statistic is that since the global financial crisis of 2008 domestic NZ home gardens have increased by 22%.

[www.foodinfo.org.nz](http://www.foodinfo.org.nz) October, 2010

## **BIOLOGICAL FARMING IN NZ**

Currently biological farming is practiced on 250,000 ha in NZ, up from 100,000 ha in early 2008.

*Nicole Masters, Integrity Soils NZ, 2010*

Commentators are suggesting that some of the increase is due to stricter environmental regulation – not that this is a bad reason.

### **Case Studies**

#### **Kevin Davidson, 1500 cows, Hawkes Bay**

Prior to biological programme

- 2006 soil analysis, low plant available calcium, magnesium, phosphorous
- Falling DM production and MS production
- Excellent management and staff

Commenced biological farming in 2006

Results after 2 years

- increased MS production by 178 kgs MS/ha with 29% less nitrogen
- Milk protein content, 7.5 % increase. Milk fat increase 8.2%
- Better soil structure, improved drainage
- Improvement in animal health
- \$86/ha increase in fertiliser cost
- Increase in EFS by \$981/ha
- 2008 Hawkes Bay/Manawatu Dairy Farm Manager of the Year

## **Waikiwi Ltd, 485 ha, Waikato, dry stock and cropping**

Prior to biological programme

- Downward trend in maize silage and grain yields
- Conventional fertiliser application.
- Livestock area receiving up to 110 units N/ha
- Poor root depth, collapsed soils, low brix levels
- Continuous animal mineral supplementation
- Facial eczema issues
- Declining EFS/ha

Commenced biological program in 2007

- 2009 record maize silage yields for farm (average growing season)
- Reduction in N use on grassland area by 50%
- Minimal facial eczema challenge, decline in spore counts
- Decline in mineral supplementation for livestock
- Virtually nil worm challenge for livestock
- Better soil structure, root depth and brix levels
- Increased EFS in maize & lamb income despite 2008 and 2010 droughts
- Decrease in chemical use by 70% over entire farm
- Increase in clover

## CONCLUSION

This report has highlighted the facts currently faced by NZ farmers relating to the fertiliser inputs they have chosen to apply, and its affect on the soil, and NZ farmers' current profitability.

Conventional farming practices as described in this report, especially in relation to fertiliser use both here in NZ and worldwide, ARE resulting in a soil that is declining in mineral content and is producing food that has poor nutritional value. The statistics on the fall in the nutritional value of food worldwide, and human health highlight this.

Relating to agriculture, corporate chemical (born out of WWII weapons industry) and drug companies have funded the majority of research and development.

Biological farming has been presented as an alternative to conventional farming practices. The principles of biological farming are based on science – chemistry, biology and physics related to maintaining soil health, and that the soil is growing food for people. The practice of biological farming involves a change in thinking described in this report as a paradigm shift. This requires proactive rather than reactive decision making to the challenges faced in growing crops, produce and animals.

There are challenges and legislation related to agriculture's affect on the environment long term. Biological farming practices are offered as way of mitigating some of those challenges.

Farming in NZ faces many challenges – many out of the farmer's control. Arguably the most important resource the farmer has 100% control of is the soil. Our future depends on farmers understanding this, so that they make the right decisions to continually grow nutritious food profitably.

## **ACKNOWLEDGEMENTS**

Thank you to the following people for their insight and help

Abron Living Soil Solutions [www.abron.co.nz](http://www.abron.co.nz)

Russell Snodgrass

Jacqui Tink

Phyllis Tichinin

Graeme Sait Nutri-tech Solutions [www.nutri-tech.com.au](http://www.nutri-tech.com.au)

Genetic Technologies [www.pioneer.co.nz](http://www.pioneer.co.nz)

Lyndi Jefferis