Dear Readers

When in Chile last December I was asked to answer five questions for the El Mercurio Newspaper in Chile.

This is the oldest and the most widely read newspaper in Chile.  They had heard me speak at the Sustainable Agriculture Conference at the Fonterra University in Temuco Chile and needed more clarification on the topic of ecological/biological agriculture.

I was honoured but pressured due to timing to get the questions answered.  I thought that these questions and answers may be of interest to you.

**Q1** **How can a poor soil be improved?**

**Adding Humus is one alternative.**

In a handful of fertile soil there are more organisms than all the humans that have ever lived on earth, they work for free day and night.

If a poor soil is to be improved then farmers need to adopt certain management and fertility practices that will create an active soil biology. Practices such as no-till, rotational grazing, cover cropping, stubble retention are a part of the picture, however it is time for the focus to turn to rejuvenating soil microbiology.

Environmentally responsible agriculture structures a farm management practice to enable the farmer manipulates the interaction of the biological (microbes), physical (structure) and chemical (mineral) processes so that all three functions are enhanced and their natural interplay used to deliver a commercial outcome that is sustainable in the short and long term.

It is the soil microbiological that changes the structure, creates the glues that creates the organic matter and creates soft tilthy soils which are the basis to improving soil oxygen vital to improved soil fertility.

Soil compaction is a world-wide problem that has turned our soils from ‘fluffy chocolate cakes’ to ‘terracotta tiles’, preventing natural cycles from functioning, hence the inputs of soluble salt based fertilisers to ‘feed’ the plant.

Sadly, many of the microbes important for soil function have gone missing in action. Can we get them back? Yes, this is possible through working with nature, minerally balancing the soil and keeping the soil covered to feed the microbiology.

Humus Compost is one of the most effective ways to improve a poor soil because the value of humus compost comes from its ability to restore or enhance biological activity in the soil allowing nutrient cycles to function and recycle nutrients. There are certainly many other principals, practices and products required to grow healthy crops and healthy pastures.

However, for farmers to change firstly there needs to be a paradigm shift and the application of principals to allow for nature to return soil to a living functioning organism rather than a medium to hold up plants.

**Q2 How much carbon can a plant absorb?**

**What effect does carbon have on the soil.**

Plants feed on the energy (gathered and created) that comes from two sources, the soil and the atmosphere. If we consider that 20% of plants’ mineral energy’ comes from the soil and the rest of the plants’ energy comes from the atmosphere 80%. Both the soil and the atmosphere ‘feed’ the plant. The more efficient the soil ‘energy’ is, the greater the plant extracts mineral energy from the air (Beddoe, 1986).

The well-known principal of photosynthesis is nature’s way of taking carbon dioxide from the atmosphere and converting it into sugars (liquid carbon) to pump down into the soil. The plant gives up 30% of these sugars to feed soil microbiology which in return supplies nutrients to the plant via networks of beneficial fungi in the correct quantity at the correct time. Oxygen is then released back to the atmosphere. This process is the basis of mitigating climate change by sequestering carbon.

Soil carbon (Humus) is one of the powerful ways of holding on to soil nutrients in an available non-leachable form. With fresh water becoming one of the world’s most limiting resources to produce food it is imperative that soil organic carbon levels be increased. Just 1% increase in organic carbon will hold 140,000 litres more soil water, prolonging the life of crops, decreasing the amount of irrigation and reducing the lowering of water tables.

**Q3 How to increase the biological activity of the soil?**

Microscopic organisms such as fungi, bacteria, algae, protozoa, nematodes and ciliates are the engine room for soil fertility. The role these organisms play in crop production, quality and disease resistance is profound. However, until relatively recently, these vital players have largely been overlooked and regarded as inconsequential. In many cases we have paid the price in declining soil fertility, increasing input costs, and increasing disease pressure.

*It should be emphasised that soil biology is not studied in isolation, but rather dovetailed in with existing knowledge regarding soil structure and nutrient. The interplay between these three factors is the essence of increasing soil biological activity.*

*It is environmentally responsible farming that is becoming increasingly accepted by farmers worldwide to ensure the long-term productivity of their land, while growing better crops and reaping the profits.*

When we talk soil biology, we are not just talking earthworms, as important as they are. We are looking down the microscope into the universe of micro-organisms.

Simply stated to build healthy soil biology is a function of four main factors, namely soil mineral balance, soil carbon levels, structures and absence of toxic residues. All four factors are interrelated and each is reliant on the other for maximum soil performance. Tillage practices, fertiliser properties, stubble/trash management and chemical use all impact on soil biology.

Awakening these beneficial microbes primes the pump for further humus formation as plant root exudates feed these microbes in garden, orchard, pasture and broadacre operations. At some point such re-enlivened soils can reach a level of biological activity and become self-fertile and self-sustaining with diversified cropping and carbon farming, this is the way how nature had worked for billions of years sustaining huge amounts of biomass around the globe.

**Q4 How to reduce reliance on synthetic fertilisers and other chemical products such as herbicides?**

Reducing synthetic fertilisers and chemical inputs requires a shift in the paradigm of solubility. From one of supplying soluble fertilisers to push production to one of allowing the plant to extract minerals from the soil and atmosphere by the interaction of the soil, roots and microbes.

When we use salt based synthetic fertilisers on soils we scald soil microbes, burn out soil carbon and make crops thirsty, watery and weak, which invites pests and diseases and further seduces us into a dangerous dance with poisons. At one time the cheap availability and industrial scale of inputs made this sort of agriculture seem efficient.

However, the inevitable result can no longer be ignored — progressive degradation of our land and an attendant rise in degenerative diseases with cancer and heart disease leading the cue. Our only sensible choice — the only choice left — is to learn to work with what nature gives us for free.

Weeds and disease are a symptom of a failing system, we must learn from them and instead of applying ‘bandaids’ we must go back to the cause of the problem, which is a tight, lifeless soil.

With over 74,000 tonnes of nitrogen above every hectare you have to wonder why it is necessary to ‘buy’ nitrogen out of a bag?? When a soil is healthy, breathing and living the soil microbes and rhizobium can fix this nitrogen into the soil. However, the more soluble fertilisers we use the more mono crops we grow we reduce the activity of soil biology.

Environmentally responsible agriculture is in a worldwide growth phase and in the near future a focus on biological processes will replace the focus on the ‘conventional’ NPK, pesticide and herbicide farming practices.

Until farmers understand that soils are alive they will never reduce their inputs.

**Q5 How can increase the yield without increasing the costs?**

Yield has become a ‘standard’ measure in convention agriculture with little emphasis given to nutritional density, the cost to the environment and mining of precious resources. What legacy are we leaving for future generations?

By teaching the farmers the principals of soil health they will work out what they are to do and begin to understand how nature works and integrate this into their farming practices.

As Rachel Carson’s book, The Silent Spring back in the 1940’s saw the ramifications of many of our farming practices, however still today we are ignoring solid, scientific evidence of how we are undermining things that keep us healthy as a species.

The belief that monocultures and intensively managed systems are more profitable than diverse biologically-based systems does not hold up in practice. Monocultures need to be supported by high and often increasing levels of inorganic fertilizer, fungicide, insecticide and other chemicals that inhibit soil biological activity. The result is even greater expenditure on agrochemicals in an attempt to control the pest, weed, disease and fertility problems that ensue.

Skilful environmentally friendly farmers have learnt how to solve their underlying (nutritional) problems and thus have reduced or removed their need to use costly inputs, especially agro-chemicals; these often only assist farmers in suppressing recurring symptoms of a sick farming system (e.g. disease, weeds, pests)

A global soil health revolution is taking place, based on plant diversity. Due to the soil priming effects of multispecies crops and pastures, farmers in many parts of the world are finding they are able to significantly reduce or even eliminate the need for inorganic fertiliser with the associated cost reduction of their operation.  
  
As well as improving soil function, multispecies crops and pastures provide habitat and food for insect predators. Recent research has shown that as the diversity of insects in crops and pastures increases, the incidence of insect and pests decline, hence avoiding the need for insecticides.

**Our collective future depends on ecologically sound agricultural practices. Enhancing above and below-ground diversity is the key to the restoration of resilient, profitable, environmentally-friendly farming.**