

Sorting the wheat from the chaff of sustainable soil management

By Dr Charles Merfield

The last ten years have seen an upsurge of interest among growers and farmers in soil and nutrient management. However, along with this interest has come an equal growth in ideas about how to manage nutrients and improve soil 'health', to the point where it is difficult for producers to separate the wheat from the chaff.

There are a considerable number of well-proven techniques that growers can use to reduce their environmental impact, while improving their bottom line at the same time. A true win-win is really possible.

A sustainable soil management strategy should consider:

- Selective application for environmental benefits and increased profitability through input cost reductions.
- Increased focus on micro/trace nutrients.

- Choosing proven concepts based on scientific data.
- Implementing ways of minimising or preventing soil compaction to complement nutrient management.
- Including soil organic matter through carefully planned crop rotation and/or use of green manures.

From just chuck the super on to targeting application

The mainstream fertiliser approach has moved on from the old 'chuck 50kg of super on and she'll be right' approach to regular soil testing and

only applying nutrients that are below 'optimum'. However, this approach still mostly uses soluble forms of fertiliser, especially nitrogen, so it can still result in significant nutrient losses. While wider society is worried about the effect of these on the environment, the biggest issue for producers is that this is cold hard cash going straight down the plughole. This is a great opportunity for a win-win situation: ensuring that more applied nutrients go into the plant not the waterways (i.e. nutrient use efficiency), means cleaner water and better profits, with the profitability increasing as fertiliser prices increase (which is the inevitable long-term trend).

Don't forget the micronutrients

In addition, most of the testing and fertilisation focus has been on the macro-nutrients, nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg) and sulphur (S) as well as acidity (pH). This is not entirely unreasonable, as it is the macronutrients that reduce the quickest and need replacing in the largest amounts. However, the micronutrients are just as critical for plant growth as the macronutrients, and globally, scientists are increasingly showing that failure to include the



Excellent soil structure

micro/trace nutrients in the testing and fertilising system is resulting in significant micronutrient deficiencies in many soils.

Not all new ideas are as sound as they sound

At the other end of the spectrum are growers and scientists who are passionate about soil, and are keen to protect it and improve its 'health' or 'quality'. While these objectives are now lauded, there are a growing multitude of ideas about how to achieve these aims. Some are well grounded in scientific data, others less so.

One of the ideas attracting interest is the concept of the base-cation saturation ratio (BCSR) approach to soil nutrient management (see http://en.wikipedia.org/wiki/Base-cation_saturation_ratio). While this is an attractive idea, the problem is soil science cannot provide a plausible mechanism for how it may work in terms of an increased plant yield, and the experimental work that has been done on the technique also fails to support it. While some producers appear to be getting very good results

with the system, it is not clear if it is due to the BCSR approach itself, or to other factors, such as the fertilisers used often having significant amounts of micronutrients in them. So while BCSR might be a valid approach, more research is required to show that one way or the other, and in the meantime, standard soil tests are the better proven bet.

Another objective of healthy soil advocates is to improve soil biology, often with a focus on microbes, again another laudable aim. However, the multiplicity of strategies to do this are bewildering, and many of them are based on proprietary and expensive products, most of which have not been scientifically validated, so their efficacy is simply unknown. Again, scientific evidence is lagging behind for many of these products and approaches. Until the science is done, it is very much caveat emptor!

Techniques that have been shown to work

However, the good news is that there is a substantial and growing body of evidence for what does work to

improve soil quality. Much of it is relatively inexpensive for growers to implement, and not only do the results achieve society's wider aims for horticulture and agriculture, they can also boost growers' profits, i.e. these are win-win solutions.

Turning more fertiliser \$ into profit

For example, using lower solubility fertilisers, and better targeting fertilisers to crop needs, e.g. banding, and split applications, so more of the (expensive) fertiliser grows the crop and makes profits, and less is unprofitably lost to waterways. This is already well established technology being used by an increasing number of growers.

Is your nutrient deck missing a suite?

Expanding soil testing to the micronutrients is dead simple: the soil sample being sent to the lab for P, K, Mg, S and pH testing can also be tested for the full range of micronutrients. As soil levels of these nutrients change at a slower rate than macronutrients, they also don't need testing every time. >

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For instance if macronutrients are tested every three years, then micronutrients could be tested every six or nine years, depending if the levels are low (in which case testing every 6 years is advised) or optimum (when testing every 9 years is all that is required). Also due to the small amounts that are needed, applying micronutrients won't break the bank, and where levels are low the crop responses can be such that the returns are very profitable indeed.

Compaction, the silent yield killer

Compaction is the silent yield killer. Although scientific research into compaction is almost non-existent (it's no longer fashionable or fundable) compaction is still one of the top causes of large yield losses in mechanised farming. Indeed, once soil macronutrient and micronutrient levels and pH are in the optimum range, the biggest destroyer of yields and therefore profit is nearly always compaction.

The good news is there are well established means of preventing or minimising compaction, with the emphasis on prevention; curing compaction is a much longer and harder job than just getting the deep rippers out. A major means of controlling compaction is controlled traffic farming (CTF) using GPS (global positioning systems). These ensure that the same wheelings are used year-to-year, decade-to-decade, so the rest of the field never sees a tractor tyre again. The positive spin-offs are multitude: better soil conditions in the 'gardens', which means better crops and more profit. There is also less need for cultivation to break up compaction induced clods, which again means better soil quality, less time, diesel and tractor hours on cultivation. Plus the very hard wheelings mean field

access in wetter conditions is possible without bogging the tractor.

Awareness of the value of reduced tillage (RT) in improving soils and bottom lines is also growing dramatically. RT can be as basic as just deciding there is no good reason to turn a field over so the plough is left in the shed, through to carefully designed systems where eliminating tillage as much as possible is the aim. Another option is to decide on a complete no-till policy. There are pros and cons for all approaches, and especially in horticulture, full-blooded no-till is rarely possible. However, at the very least, reducing tillage means less diesel burnt in tractors which is a significant saving, leaving aside the benefits for the soil and crop growth.

Soil organic matter – worth its weight in gold?

The many benefits of increasing soil organic matter have been demonstrated time and time again over many decades, although the practice of doing so rather fell out of favour from the 1960s to the 1990s. However, with the changing environment of horticulture, such as ever rising fertiliser and fuel prices, the cost benefit of refocusing on organic matter management is improving all the time. For example, better water and nutrient holding capacity means that less fertiliser is lost, soil conditions are improved so less tillage is required, and so on. The good news is that no magic or expensive proprietary products are required to improve soil organic matter levels, there are a host of inexpensive techniques that are already farm proven. Rotations are really valuable, especially where there is a pasture phase, though these face financial hurdles in vegetable production. A key alternative is green manures or cover crops, and these

are also very effective at holding onto nutrients that could otherwise be lost, especially nitrogen over winter. Studies have shown that 50kg to 100kg of nitrogen can be retained through using over-wintered green manures. And for intensive cropping adding compost where it is locally available is hugely beneficial. The value of N, P, K, Mg, and S in compost can often be less than the bag fertiliser price – do the numbers yourself! But when you add in the liming effect (increasing pH) the micronutrients and soil organic matter, the value of compost is often a no-brainer.

Win-win

So, while there is a lot of concern in the farming and growing communities about the impacts of new environmental legislation on profitability, there are a considerable number of well-proven techniques that growers can use to reduce their environmental impact while improving their bottom line at the same time. A true win-win is really possible.

A range of additional information on this topic can be found on the BHU (Biological Husbandry Unit) Future Farming Centre's website at www.bhu.org.nz/future-farming-centre both in the 'information' and 'FFC Bulletin' areas.

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