Time to take that step to reduce fertiliser use

It is imperative that both conventional and organic growers genuinely think about reducing their dependency on inputs if we are serious about creating sustainable and regenerative farming systems. While this is truer for conventional producers, the concept of replacing artificial inputs with organic inputs (although an important transitionary intermediate) still leaves the production system exposed should the inputs ever become unavailable or uneconomical.

By Joel Williams

Photo: Rhonda Bay

There are no hard and fast rules on starting this process, and indeed there are many different approaches which can be taken to achieve this goal, but let's reflect on a few key considerations. Please note this article will look at steps to start reducing fertiliser use, not how to use no fertilisers at this stage.

Don't guess it – soil test it

Some land managers, who understand their soil types and production system, can identify fertility based issues in-field without any lab-based analysis. For the majority of growers however, a soil analysis is fundamental in my view, chiefly to identify which nutrients are sufficiently present, or alternatively those that are in limited supply.

As we build the soils reservoir for storing and holding nutrients, there will be a reduced need to constantly apply spoon-fed applications of nutrients.

The management action from this is simple – why waste dollars applying nutrients that are already present in the soil? If we are going to spend money on fertiliser, only spend it on the limiting factors. This perhaps sounds too simple to be a worthwhile thought; however it bewilders me the number of growers that apply a 'standard blend' (usually containing certain nutrients that are already sufficient) purely because of the convenience factor. Make a little extra effort, and source the individual nutrients that your soil actually requires.

Standard soil analyses mostly test for forms of nutrients that are more active, in other words, they measure plant available forms. This is of course important to ensure nutrient supply to a growing crop is sufficient; however, soils contain significant reserves of insoluble and unavailable nutrients that make up the total pool of nutrients. These total reserves can often be in excess of ten times greater than the plant available pool.

So this begs the obvious questions – do we really need to apply a nutrient that is limited in plant available form when there is already a significant total reserve present? Would we not be better just accessing the total pool, cycling these unavailable nutrients into plant available forms? The answer to this is a resounding yes, and the life in the soil plays a key role in accessing these reserves (see waking up soil biology below). But building soil biology can take time, and in the short term, until soil biology is up and functioning and cycling nutrient reserves, some crop fertiliser may need to be applied.

At the time of application

If we have identified a nutritional requirement, the most important rules for fertiliser application are really quite straight-forward. Firstly, where possible, split input applications – in other words, space out the applications to deliver smaller amounts of nutrients more regularly throughout the season, rather than one bulk amount at the beginning. After all, do we consume our day's food intake at breakfast, or all our week's food intake on a Monday? Plants are no different and prefer little and often.

Splitting fertiliser application also prevents a spike in certain nutrients in the soil, which can often have unintended effects such as suppressing soil microbial activity, tying up nutrients or competing with other nutrients for uptake.

Secondly, all fertiliser inputs (solid or liquid) should be combined with a carbon source. Carbon binds to applied nutrients, forming a carbon-nutrient bond that is more stable than the straight nutrient alone, and as a result is less prone to; (i) leaching, (ii) volatilisation, (iii) locking up with other nutrients (becoming insoluble) and, (iv) causing damage to soil life. Carbon feeds soil life, which is responsible for cycling and making nutrients available, and carbon compounds themselves (acting as chelators) can enhance plant uptake of nutrients. **So the message is simple, a fusion approach of carbon and fertiliser improves fertiliser efficiency, thereby reducing the need to apply as much fertiliser.**

Fertiliser checklist

- ☐ 1. Take a soil test and identify limiting nutrients.
- ☐ 2. Don't waste money on applying nutrients that are already in sufficient supply.
- ☐ 3. Consider asking the lab for a 'totals' analysis – it will be an eye opening experience to see how nutrient rich your soil really is.
- ☐ 4. Maximise soil biological function to access total reserves and increase nutrient cycling into plant available forms.
- ☐ 5. If short term additions of nutrients are required, split fertiliser applications where possible.
- ☐ 6. Feed and protect soil life by applying all fertilisers with a carbon source.
- ☐ 7. Consider foliar applied nutrients to improve nutrient delivery while bypassing the soil environment, especially at key plant developmental stages.
- ☐ 8. Implement seasonal fertiliser programs while also focusing on longer term strategies, like building the soil's CEC for holding applied nutrients in the root zone.

Thirdly, the delivery of nutrients via the foliage is more efficient when compared to soil based feeding. Nutrients that are applied via the soil can potentially leach through the soil profile, or lock up into unavailable forms, before they are taken up by the plant. Foliar applications target nutrients specifically onto the desired plants, key nutrients can be timed according to particular crop developmental stages to optimise crop performance, and are applied at significantly less application rates compared to soil applied nutrients. Foliar nutrients should always be combined with a wetter/sticker, carbon based chelating agent (fulvic acid or amino acids are particularly effective), and ideally applied early morning or late afternoon.

Holding on to "what we got"

Improving fertiliser efficiency relies on a combination of both short term and long term strategies. One of the most important longer term methods is to build the soil's nutrient holding capacity (often termed Cation Exchange Capacity or CEC). As we build the soils' reservoir for storing and holding nutrients, there will be a reduced need to constantly apply spoon-fed applications of nutrients. The most important way to increase the soil's CEC is to increase the soil organic carbon (SOC) content. SOC plays a key role in storing both moisture and nutrients until such time as the plant requires them.

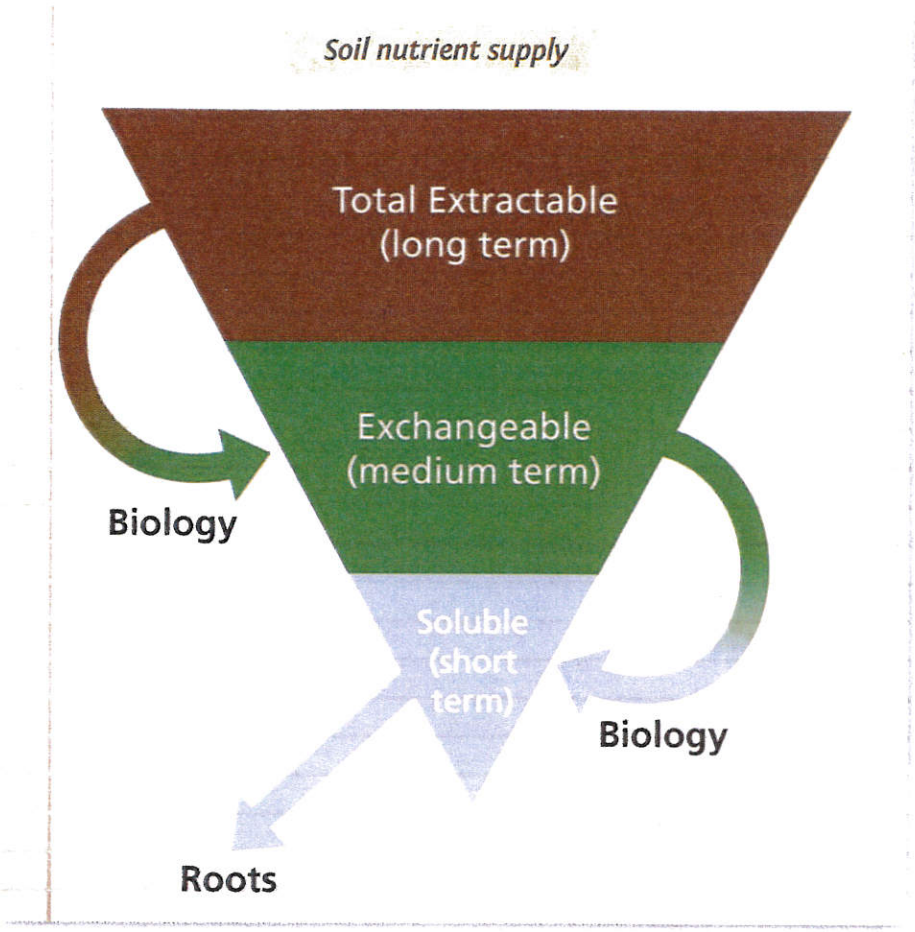
SOC can be increased by applying other sources of carbon, such as compost, manure, green manures or plant residues.

Combine dry fertilisers with:

- Good quality aerobic compost
- Humates – powdered or granular form
- Green manures at the time of soil return

Combine liquid fertilisers with:

- Seaweed Extracts
- Fish Hydrolysates
- Molasses
- Humates – humic or fulvic acids in liquid form
- Plant Extracts/Teas



Alternatively we can sequester carbon from the atmosphere into stable forms in the soil via plant root exudates. On a daily basis plants release sugars and carbohydrates from the root system into the soil to feed soil life. Soil organisms use these carbon compounds for their growth; and in the process convert these compounds into more stable forms of carbon which have a greater nutrient holding capacity over the long term.

Soil fungi are more important for this process, but all soil microbes play a role nonetheless. It is also possible to increase the soil's CEC via the application of clay materials such as zeolite. Zeolite is a volcanic clay material which is a permanent addition to the soil after application, and will continue to store both moisture and nutrients on its clay surfaces over the long term, feeding the plant as required.

Waking up soil biology

Another strategy to assist with nutrient management, and ongoing nutrient supply, is to ensure the life in the soil is active and functioning. Soil biology plays a key role in cycling of nutrients and making them available for plant uptake. This applies to accessing soil reserves as well as solubilising any applied fertiliser nutrients – the break down and release of applied fertilisers is improved in biologically active soils.

There are many different methods to build and maintain a healthy soil biological population, and each method has it merits depending on the circumstances. One of the most important and easiest ways to keep the soil biota functioning is to maintain a constant soil cover of living plants. This provides a steady flow of root exudates and decaying root matter into the soil, which is valuable food for biology. Green manures are similarly an ideal food supply, and provide additional support when the plant biomass is returned to the soil.

Soil life can also be fed via the addition of other carbon based food sources (biostimulants), such as those listed to combine with fertiliser applications (see box). New populations of soil organisms can also be applied into the soil (biofertilisers) such as composts, manures (preferably composted though), liquid compost extracts, and commercially available inoculums. These inputs must be considered within the context of the whole farming system. In isolation they will not be as effective if not used at the right time, and in the right place, within a farming system that is actively creating the right soil conditions (food, air, water) for their survival and proliferation.