

Common Problems with Soils

1. Soil too low in organic matter
 - Reduced biological activity resulting in low nutrient efficacy
 - Inability of the soil to hold moisture
2. Low to nonexistent biology in the soil is not as nature intended, but a product of such practices as:
 - over cropping
 - heavy use of toxic chemicals
 - too little being done to keep all soil factors in a balanced state e.g.liming
3. Light sandy soils with low CEC (a soil's capacity to attract the nutrient from fertiliser and keep it in the root zone for the plant over the growing season)
4. Heavy clay based soil types with high levels of iron or aluminium. These clay soils will have high CEC, but due to iron and aluminium, the phosphorus applied to the soil is too tightly held for the plant to be able to access. High fertiliser prices and low grain prices are now making it a 'lose –lose' situation for the grower.
5. Poor advice in obtaining the best results from liming practices. Some liming products, eg beach sand, are not likely to deliver what they promise, ie they are too slow to react and don't have a high enough analysis of reactive Calcium. Given the high costs of transport, growers cannot afford to be paying freight on products that will not deliver what they claim.
6. Calcium in the soil is very mobile, particularly in light soils, therefore to get best results from a liming program it may well prove to be beneficial to put burnt lime (fast to react in the soil) with some compost that will help to keep the calcium in the root zone.

Given these common issues faced by many Australian growers, it needs to be understood that many current agronomical practices need to be reviewed.

Controlled traffic and conservation tillage will assist in protecting the surface of the soil and will maximise the activity of soil animals (biology), increasing the infiltration and the water holding capacity of the soil. The addition of organic amendments (retained stubble, green manures, composts) in combination with inorganic products such as gypsum, lime or dolomite will overcome the dominance of sodium in the clay particles, and will improve the aggregation of the soil.

A deficiency of an element makes it difficult or impossible for the plant to complete a vegetative or reproductive stage of development. A deficiency is better addressed before it occurs. What this means is that a model of ideal nutrition needs to be worked to, providing a buffer to minimise a deficiency from occurring in the first place. Due to the constraints of various soil types, the following needs to be considered :

- Quality seed dresses

- Monitoring of nutrient levels at 3-5 leaf stage
- Applying a foliar product that does deliver what it claims to deliver.

Plant issues:

A plant's limitations are generally a function of the soil where they grow. To better understand the plant it needs to be put in the context of it being part of a bigger picture.

The most obvious limitation to healthy plant growth is generally moisture. As there is no control over rainfall, the issue of moisture must be addressed in a way that can be controlled. Organic carbon levels must be raised to a point where the soil is better able to retain moisture. To increase organic matter soils cannot afford to be sterilised with overuse of fertilisers and chemicals. Like all things, a balance must be struck.

If there are soil limitations and hence impediments to plant growth, the physiology of the plant must be better understood. This highlights what the plant is capable of and how best to make use of its capacities to react positively with farm inputs.

If confronted with soil types that don't respond to high rates of granular inputs, then one option becomes feeding the plant through the seed and then later, through the leaf tissue.

Plants are not like a highly absorbent sponge – some things just don't readily pass through leaf tissue. And some, even if they do, are not in a form that is able to be used by the plant. If nutrient is applied via the leaf, a full understanding is required of what will work and what won't. A knowledge of chelating with regard to foliar sprays is necessary.

If a plant is deficient in a particular nutrient it is likely that it won't just be one nutrient that is lacking. Plant health is not dissimilar to animal and human health, we all require various nutrients and they need to be in a form that is both balanced and available.

Some foliar products, despite their claims and large advertising campaigns, are lacking in a scientific basis and just do not measure up to being efficient in a foliar program.

The plant itself has a biology associated with the leaf. This biology that lives on and in the leaf tissue plays a role in both protecting and feeding the plant. This biology is not able to tolerate the toxicity of many chemicals and nutrients that are applied through foliar applications.

Importantly, the plant tissue has a pH that must be taken into account when applying both chemicals and nutrients. Some products will have a tendency to burn the plant tissue and destroy the biology. Better quality products will be formulated in such a way as to use the plant bacteria to increase the efficacy of the product being applied. The solution that is being applied may need to have the pH of the water adjusted to achieve the desired result. This is easy to test for and relatively cheap to adjust.

Farm advisors need to be able to see and appreciate the strengths and short comings of various foliar products in the market and steer their clients away from those that, quite simply, are not able to deliver.

Soil Biology:

Before various agronomical practices began, the soil had a balance that lead to a range of flora existing that was well adapted to the environment. It was better able to adapt due to the life in the soil that played an important role in the provision of nutrition required by the plant.

The crops that have been grown in agricultural areas are often not ideally suited to the environment and thus need as many factors as is possible to be working for them if they are to continue to support the grower.

Too many practices have disregarded the role soil biology plays and we are now faced with a situation that has become a vicious circle, ie too much fertiliser, imbalances in the soil, weak plants, high chemical applications to protect the plants but which wipe out the soil biology and hence the capacity to build up the organic carbon levels and so on.

If organic carbon levels aren't built up, much of the water soluble nutrient disappears into the sub soils and beyond and there is nothing in the soil to sustain the biology. Organic material not only holds moisture but it ties up nutrients that become available as a result of the action of soil biology.

If you are farming a property with light soil types (low CEC) and your organic carbon levels are low, ask your farm advisor how he can justify putting out high rates of granular fertilizer. Then ask him how he plans for you to build up your organic carbon levels. If his planning is not clearly heading you in this direction you might ask him how you are going to stay viable in the years to come.

If your current levels of organic carbon and hence soil bacteria are low, you must vary your approach to plant nutrition to a method where you are getting value for money when it comes to inputs.

Water:

Many growers, when asked about the quality of their water will respond by saying that it is fine, about neutral pH (7.0–7.5). The reason why it is so important to have your water at the right pH is critical to the efficient uptake of the particular nutrient you are applying through a foliar application.

The various nutrients that are applied through both granular and foliar methods all have their own charge, whether it is a negative charge or a positive charge. Not only do they have an electrical charge associated with them, but they vary in strength this needs to

be considered when taking into account the fact that the leaf itself has a charge associated with it.

To achieve a high plant absorption of foliar applied nutrient it becomes critical that the pH of the water is adjusted so that this absorption of nutrient can take place.

High quality foliar inputs will use methods that allow for the various nutrients and their differing electrical charges to efficiently pass through the leaf pores and then to be used by the plant.

Due to the pH of the plant leaf tissue being what it is, it is necessary to reduce the pH of the solution being applied so that it is more easily absorbed.

Buffering solution is cheap and easy to use; however there are right ways and wrong ways of doing things. This is particularly so when more than one product is to be applied in the same pass. There is an order to doing things in these circumstances.

Foliar Products:

Unlike many granulated products, foliar products vary greatly in how effective they are for maintaining sufficient levels of nutrient in the plant and addressing plant nutrient deficiencies.

Foliar products vary greatly in what they are able to do.

At the very inefficient end of the market are products that are quite simply raw materials supplied in a drum. These products have never been specifically designed for foliar uptake and have a molecular weight that gives very poor rates of actual uptake. These products are often high analysis and the vast majority of it will end up on the ground, ready to either leach or get tied up into chemical compounds that are not readily available to the plant.

Chelated products are, without doubt, the most efficient products on the market for foliar purposes. However, due to loop holes in the marketing regulations many of these products have a relatively low rate of chelation and as such, do not represent good value for money. Often their efficacy is low, or they use a cheap chelate that has not been tailored to meet the positive or negative charge associated with a particular nutrient. Be aware that a product marked prominently with the word "Chelated" is not necessarily the same as the one next to it.

Another thing that the grower needs to be aware of with regard to chelated products, is that there are in the vicinity of 300 to 400 different chelates and they are not all the same or readily interchangeable. The science of foliar products is largely to do with what chelate works best with what nutrient; given that nutrients all have varying levels of electrical charge associated with them.

Some products use a chemical bonding approach to attach to the nutrient, depending on the strength of these bonding agents some are so strong that although they get

absorbed into the plant they are not able to release the nutrient from this bond. As a result, the nutrient is not able to be utilised by the plant. This can then result in a distorted leaf tissue analysis, as the report may show adequate levels of the various nutrients but they are either stuck on the leaf or not able to be released within the plant due to the chemical bond holding them.

The best chelated products are:

- Very low in molecular weight and as such are easily absorbed into the leaf tissue, and
- Use a chelate that is best suited to the particular nutrient and its charge. This allows the nutrient to be released, translocated within the plant and used by the plant at the site and the rate that the plant requires it.

Because of the efficacy of these better quality products they are able to be much lower in analysis and ultimately more cost effective.

With the issues facing growers with regard to:

- Soil
- Soil Biology
- Plant tissue, and
- Water,

one way forward in the short term is to get away from wasteful amounts of granular product up front. Given how much is not used or able to be used by the plant, it becomes far more cost effective to monitor crop development as the season progresses and to apply nutrient in a form that it is available and when it is required.

It is also prudent to take action before the crop is deficient, as you will not catch up with late applications to correct deficiencies. Keep the nutrition balanced and at ideal levels throughout the growing season.

Going forward the best approach must be to get your soil working for you. When this approach is taken, the potential savings will be in both lower fertiliser and chemical use.