# Fertiliser in vineyards: What has changed?

Using his skills as a viticulturist, **Sam Bowman** explores what has changed in fertiliser technology over the past 30 years. The article compliments a piece from 1987 on pages 32-36.

When the previous article by Clarrie Beckingham was written in 1987 I wasn't even a twinkle in my father's eye, nor did I know I would end up working with wine and grapes. It's interesting to look back on what has changed in ones lifetime.

Too young to remember records, just old enough to remember cassettes, I've seen CD's go to MP3's to iTunes and funnily enough back to records in the space of my short life. If it's anything like technology, fertilising winegrapes has surely been put through the wringer. Lets see how.

Synthetic fertilisers were first commercialised in 1913 and were predominantly nitrate and phosphorus based (think urea and super phosphate). The agricultural landscape was changing at this time. A need for improved efficiency in the farming sector was beginning to take place, due to the development of tractors and other mechanised processes.

Skip to the 1970's and granular fertiliser was refined closer to the way we see it today. In 1974 Roundup was released to improve weed control for the growing population's food sources, and in 1982 the first Genetically Modified crops were produced. They were commercialised just two years later, in 1984. A stark contrast to agriculture only mere decades ago.

When the preluding article (see pages 32-36) was written in 1987, by the sounds of things, less was more. And crop production, at least in the Hunter Valley, were minimal compared to today's standard yield.

1987 was the tip of a boom that would see a rapid expansion of vineyard area and cropping levels that hadn't been achieved before. This boom brought with it the need to improve vine nutrition to support larger crop loads. In turn, rapidly developing methods of sampling, application, and the products themselves.

## The major changes

### Identification of soil microbiology and its role in nutrition

I'm sure when this article was written, soil microbiology would not have been discussed the way it is today. I still have growers saying they don't believe there are bugs in the soil. In every gram of soil, there are upwards of 10 billion individual bacterial cells making it one of the most diverse ecosystems in all of nature.

With improvements in genetic testing, scientists are now able to extract DNA and RNA directly from the soil to identify separate species rather than the painstaking process of individually plating and staining for identification.

This DNA modelling has allowed scientists to better estimate the role of soil organisms in multiple processes including the mineralisation of nutrients, control of pathogens and remediation of pollutants.

The role of fungi has also been discovered, with composts becoming an important part of many viticultural practices due to the many benefits of building humus in the soil. Fertiliser practices have in turn changed with the new knowledge that our soil microbial diversity plays just as large a part to amend certain issues. Many products available now contain microbe inoculants and are designed to feed the microbiology as well as the plant.

### Urea and the NPK boom

Urea was first isolated from urine in 1727 and first produced inorganically in 1828 by treating silver cyanate with ammonium chloride. This was a major breakthrough for organic chemistry as never before had two inorganic compounds successfully been artificially synthesised without the assistance of living organisms to produce an organic element. And so started the use of urea in agriculture.

Many things outside fertilisation have changed since 1987, especially greenhouse gas emissions and targets for the sustainable production of energy and materials. The process used to produce urea is intensive in energy consumption and can't be a long term sustainable option environmentally.

In 2012 there were 184 million tonnes of urea produced with an energy expenditure of 24,666khw per 1kg of equivalent nitrogen (N) extracted. To do the sums is pretty scary, especially when you compare the same amount of N derived from compost adds up to 138kwh. Our need now for more sustainable options has pushed growers to look for other methods to feed the need for N.

We also have a better handle on the N cycle and its uses in grapevines. Nitrogen is the main mineral found in chlorophyll, the green pigments that allow the all-important photosynthesis and the production of amino acids. Nitrogen is also the main component of DNA which allows plant cells to grow and replicate.

Because of this high requirement it is also the most misused and misunderstood mineral applied to vineyards. Ammonium and nitrate nitrogen, we now know are needed in certain ratios for a healthy, balanced vine. 1:1 in soil and 3:1 in plant tissues respectively.

The imbalance or reversal of these ratios leads to plant health issues and in the case of reversal, high nitrates will actually exacerbate pest issues. We also now know the relationship between other minerals and the utilisation of N but we will get to that later.

The issue with high N is the limitation it puts on many other nutrients important for growth, fruitfulness and bud initiation in the following season. High N will shut down the uptake of calcium, potassium and boron which are all crucial for plant health and development. Phosphorus (P) has become better understood in the utilisation of humates and fungi to unlock bound P. When the original article was written there would have been limited knowledge of the lockup of P and how to utilise the bound nutrients. In a standard P application, ~73% will end up bound in the soil - not the most pleasing addition in terms of return.

In recent times, many growers have utilised products such as humic acid to unlock bound P and tap into this underutilised resource. The efficiency of rock phosphates in combination with humates has drastically changed the way we fertilise with P for the better.

### Rise in knowledge of micro nutrients and their importance to viticulture

In the 80's NPK was king, and it still is, in many viticultural landscapes. These nutrients are absolutely crucial for healthy vines and yields but so too are micronutrients. In the 1980's they would have been very much an afterthought. The importance of calcium (a macronutrient) isn't touched on in great detail in the article, though we now know this mineral is responsible for the supply of at least 7 other minerals to the vine.

If anything, calcium is the forerunner to take over from N for the importance of balance in plants and soil. The ratio between calcium and magnesium is also now highly publicised and is my first port of call when assessing soils.

The more interesting developments I see are the identification of the roles of silicon and molybdenum. Molybdenum is the main mineral involved in bacterial nitrogen fixation to utilise atmospheric nitrogen. It is also crucial in fruit set and inflorescence development.

The mineral is a negatively charged ion so can only be held by positively charged humus. With low organic matter in most soils, it's easy to see why molybdenum doesn't present in many soil tests.

Needed in tiny amounts, it is often neglected but when put in context, this is a precursor to your entire vines developmental cycle; something we definitely wouldn't have been thinking about 30 years ago.

Silicon is something I've had an interest in for years and the clients who have used the additions of potassium silicate have always had great results. The xylem and phloem vessels of a plant which transport all of the sugars and water from the leaves to the roots and back again are made from silicon. The better the balance of silicon in the soil and plant, the stronger your pipes are to get what you put in straight to the vine.

Silicon, in conjunction with calcium forms the cell walls of leaves and berries, which prevents infection and penetration from insects. Again, the stronger the layer the more natural resistance a plant has to fight off infection and attack. With work being done on Silicones application for use as a mitigation for UV damage, it will become more prevalent as time goes by.

The improvement of foliar options for viticulture has been astounding even in my time. Applying through the leaves is 12 times more efficient in giving the plant what it needs compared with fertigation, it's no surprise that micronutrient folia's have become commonplace in a majority of our vineyards to bypass lockups in the soil and supply the minute amounts directly into the tissue.

### Application

Prior to modern irrigation systems, ground spreading was once commonplace and granular fertilisers were really all that was available. Drip irrigation has now become standard practice but prior to this many vineyards were still under flood or sprinkler. When dripline rolled out across the country so did the development of more soluble liquid products for direct application.

I still remember the first time I tried fertigating a "liquid gypsum" thinking I would save money and ruined two hectares of late 90's Netafim dripline – wasn't a great phone call to the owners. Screening practices improved and now a majority of growers supply nutrients via fertigation. Those that do spread in a granular form now have many benefits such as chelating agents to assist in rapid uptake and efficacy.

I see people moving back to ground spread, utilising the addition of compost blends and building soil health. It will be interesting to see how the industry as a whole looks at fertilisation practices as we move towards a more positive period financially.

Writing this article has me thinking about what I will see next in my lifetime. I hope as a 60-year-old we have an emphasis on soil health and treating our pest and disease issues at the root cause rather than throwing money at symptoms like we have been doing in the past. I think our knowledge of soil microbiological systems will improve and we will be treating the ground first and the vines second because of this fact. Who knows what our vineyard regions will look like then, I suppose I'll let you know in 2047.

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