The importance of soil nutrition for the young grapevine

8 NOVEMBER, 2008

Introduction

As our knowledge of soil function and nutrient cycling increases and new diagnostic tools are developed, fertiliser requirements can be predicted more accurately. Soil moisture and nutrition needs to be considered along with the requirements of the vine in order to maintain good soil structure and to assist with nutrient availability to the root system.

Vineyards have different nutritional requirements depending on the developmental stage of the vine, the type of rootstock, soil type, and climate. Electro-Magnetic Induction (EMI) surveys and Multi-Spectral Imaging (MSI) are valuable tools that can be used to assess soil composition, soil and vine nutrient status, plant health and moisture levels.

Soil Profiling and nutrient testing

A soil profile provides valuable information about the depth of soil horizons. Other useful information that can be assessed during soil profiling include changes in soil structure, compaction zones or pans that limit water and nutrient movement, worm populations and soil-borne pests. Observation of existing plant cover can indicate soil drainage properties, fertility and pH.

Most soil samples taken for nutrient testing are taken from the top 30 cm of soil, yet the active root zone of vines stretches well beyond this layer. It is important to test the nutrient levels in the 30-60 cm subsoil zone every three to four years as active uptake of nutrients also occur in this subsoil region.

Fig 1. Soil pit. A valuable way to assess the soil profile in a potential vineyard block

Soil tests can provide information on organic matter, pH, the ability of the soil to hold Calcium, Magnesium and Potassium (CEC value), nutrient reserves of Nitrogen, Phosphorus, Sulfur, Calcium, Magnesium and Potassium as well as trace minerals. There are tests available that estimate nutrients that exist in plant -available form such as the Reams test.

SEE ALSO
Diagnostic Co
RELATED NEWS
Research upd trunk diseases
Development PCR techniqu
Grapevine Tru
Hot water trea

Managing the organic matter in the soil

Organic matter plays a vital role in the soil. It provides food for fungi and bacteria which in turn plays an important role in the nitrogen cycle as well as the development and maintenance of soil structure. Peat soils have an abundance of organic matter, but many viticulture soils require additions of compost, mulch, vermicast, manure or humic and fulvic acids. Grapevines prefer to grow in soils that contain a diversity of fungi and bacteria but are fungal-dominant.

Bacteria prefer green manure or high nitrogen foods such as fish hydrolysate and simple carbohydrates such as sugar or molasses. Bacteria feed on organic matter and produce adhesive substances that help bind soil particles together. As the bacterial population increases, so will their predators such as Amoeba and other protozoa, bacterial-feeding nematodes as well as worm populations.

Alternatively saprophytic fungi prefer woody compost or mulch, combined with a carbohydrate source such as molasses or sugar and trace minerals. These fungi will break down the organic matter and fungal-feeding nematodes will release plant available nutrients from the fungi back into the soil.

Winter and Spring are great months for saprophytic bacteria and fungi to decompose leaf litter and vine prunings because of the abundance of food and water. It is preferable for this composting phase to be complete prior to planting vines, otherwise,the bacteria and fungi will deplete nutrients in the soil during the composting process. Nitrogen held by bacteria and fungi will remain unavailable to vines until predators digest the bacteria and fungi, thus providing slow release nitrogen that cannot be easily leached.

A soil test by Soil Foodweb, can provide information on the diversity and activity of soil bacteria and fungi as well as ascertaining if the soil is fungal or bacterial dominated. If the soil micro-biology is low or there is low diversity or activity, then live inoculants may be added to the soil in the form of active compost, compost tea, vermicast or formulations containing sleeping micro-organisms.

Land that has a history of intensive farming practices is more likely to have a build-up of soil-borne pathogens such as Cylindrocarpon. Compaction, water-logging and anaerobic conditions will also promote the growth of soil pathogens. Good aeration and drainage of the soil will promote the growth of beneficial bacteria and fungi in the soil.

Preparation of blocks that have been intensively cropped

If planting a vineyard that has previously been an orchard, intensively cropped, or rather simply replacing vines that have died, it is important to remove as much of the old root and plant material as possible. Diseases can remain in the old roots or plant material if left in the soil and these will re-infect young vines. As soon as old trees or vines have been ripped, or the crop harvested, any roots or large pieces of organic matter should be broken down. The best time for this to happen is during late Autumn and Winter (post ripping when the soil is aerated) during

which time there is an abundance of moisture. This process normally takes place over several months.

There are several products available which can enhance the activity of existing bacteria and fungal decomposers in the soil. A recipe that works well when replanting existing vineyards is a single application of:

- 4 L/Ha of Digester (Biostart)
- 10L/Ha Mycorrcin (Biostart)
- 20L/Ha Humic acid/Humates/Fulvic acid
- 2.5L/Ha sea minerals
- 1.5L/Ha of Molasses or sugar syrup

The end products of Winter decomposition include a range of nutrients and organic substances that will enhance growth of the new vines as well as improve soil structure.

Use of soil amendments during vine establishment

Application of compost, green manure or mulch directly around the roots of young vines during planting is not recommended. These products easily become water-logged, causing root or collar rots and can cause mineral depletion if still in the composting phase. However, there are a range of soil amendments that can be added to the soil to enhance the growth of native soil organism populations during vineyard establishment and subsequent growing seasons.

A field trial conducted at Corbans Viticulture tested the effectiveness a number of formulations during vineyard establishment. These formulations include fertilisers such as Bioplex™ soil drench containing a mixture of fish hydrolysate, urea, sea minerals and sugar and BIO-GRO certified Solid Rok™ with an NPK ratio of 1:5:9 plus trace elements, as well as formulations containing elicitors such as Vitazyme and Mycorrcin. Three products containing live inoculants of mycorrhizal fungi, including *Glomus intraradices,* (Myco-gro™) and *Glomus intraradices, Glomus mosseae* and *Scleroderma cepa* (Mycomax™), and Superzyme containing *Trichoderma, Bacillus* and *Pseudomonas* species.

These products were added to the soil during the planting of young Sauvignon Blanc vines grafted onto different rootstocks in October, with a second application in early Summer. Three months after planting, vines were assessed for nutrient deficiencies and mycorrhizal colonisation and soil biology assessed by the Soil Foodweb laboratory. After eight months, the growth and survival rate was assessed.

Of the two fertilisers tested, Bioplex™ was the most effective during vine establishment. The mixture of readily-available nutrients provided the best vine growth during the first months of vine establishment, which coincided with Spring rainfall. However, deficiency symptoms began to appear after two months, suggesting it has a limited period of effectiveness. The less soluble nutrients in the Rok Solid fertiliser provided better growth in the Autumn, coinciding with

Autumn rainfall, but leaf and petiole tests showed some nutrient deficiencies in vines prior to that time. Overall, the vines treated with Bioplex™ were considerably bigger after the first season than those treated with Solid Rok™. Bioplex™ had the most beneficial effect on the vines grafted onto Riparia and Schwarzman rootstock.

Mycorrcin™ was the most effective of the elicitor formulations, with vines exhibiting good Spring growth due to soluble nutrients included in the formulation but unlike Bioplex™ they had another flush coinciding with Autumn rain. Mycorrhizal colonisation was slightly better in the vines treated with Mycorrcin™ compared to Bioplex™ and the untreated controls. Mycorrcin™ had the most beneficial effect on the vines grafted onto 3309, 101-14 and 5C/SO4 rootstock. Vines treated with Vitazyme™ were bigger than the untreated controls, but this product is recommended more as a foliar application than as a soil amendment.

Without addition of any other fertilisers, all of the formulations containing live inoculations were ineffective at enhancing Spring or early Summer vine growth. The vines given Superzyme™, Mycomax™ and Myco-gro™ all exhibited some nutrient deficiencies within three months of planting. However, vines given these treatments fared the best during the dry Summer and Autumn months. In particular, the vines treated with Superzyme™ showed good growth during the second half of the growing season for all of the rootstock varieties and vine growth was consistently better than the untreated control vines.

Good vine growth during the first year of vineyard establishment is important to ensure vines have well established root and canopy systems prior to cropping. These results highlight the importance of planning a soil fertiliser programme for the first two years that include a balance of readily available nutrients during the Spring time, promoters of soil biology to help the vines get through the drier months, and some slow release fertiliser with low nitrogen content to coincide with Autumn rainfall.

Tools used to identify differences in soil variation and vine growth

Electro-Magnetic Induction (EMI) surveys provide a snapshot of soil and depth variation across the site being surveyed. From this data a number of inferences can be made such as the ability of each major soil zone to hold and transport water and minerals. This information is powerful for enabling the most appropriate viticulture management such as nutrient application.

Multi-Spectral Imaging (MSI) is another tool that can be used to assess the growth and health of a vineyard. This method involves the production of high quality imagery from specialised cameras that measure the light penetration of plant cells. An MSI gives an indication of vine stress, canopy density and vine growth. It determines areas of variation in the vineyard and can highlight the effects of irrigation, fertiliser programmes, pruning methods and/or disease spread.

Fertigation or foliar feeding programmes

Vines obtain most of their nutrients from the soil and any fertiliser programme should have a base application of fertilisers over the Winter, with soil amendments added during Spring, followed by foliar feeds or fertigation during the growing season if required. Regular monitoring for nutrient deficiencies will serve as a guide as to any modifications required for the fertiliser programme.

During Summer leaf and petiole tests can be used to determine appropriate quantities of fertiliser for foliar feeds or fertigation requirements. Brix testing of leaf and petioles can give an indication of photosynthetic activity during the growing season. Fertigation/foliar feeding is best applied little and often to avoid flushes in vegetative growth and delayed lignification of canes.

Conclusion

Several factors should be considered when designing a fertiliser and irrigation program for optimum vine performance. Traditional Albrecht soil tests should be complemented with physical observation of soils and vines. Leaf and petiole tests taken at key times during the season will provide a good indication of nutrient deficiencies . Digital tools such as EMI and MSI surveys can provide valuable information when assessing variation within vineyards and enable nutrition and irrigation requirements to be tailored accordingly. The active biology in soils play an important part in nutrient retention and availability, testing can help identify imbalances and the most appropriate amendments or management strategy. The factors that effect nutrition and irrigation requirements are complex but a basic understanding along with observation and testing will lead to more sustainable fertiliser and water use.