Leaf Analysis as a Tool for Managing Crops of Southern Highbush Blueberry

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- For monitoring of crop nutrition status, take leaves for analysis during summer
- Compare nutrient values to sufficiency ranges and if needed, review growing conditions and practices
- Regular analysis identifies "hidden hunger" from nutrient deficiencies or excesses helping guide fertiliser rates to maximise yields while preventing environmental pollution from excess nutrients
- For diagnosis of symptoms, compare leaves from symptomatic plants with those from healthy plants but only compare these with the sufficiency ranges in summer

How leaf analysis works

The profile of nutrient concentrations in leaves are reflective of plant health and can be used to guide fertiliser rates to ensure that yield is not limited, and that the environment is not polluted by excess nutrients not taken up by the crop. In conducting leaf analysis for blueberry, between 50-75 mature leaves from new growth, representative of the crop, are sent to an analytical laboratory for processing and chemical analysis. The reported chemical concentrations in the leaves of the essential nutrients are then compared to sufficiency ranges established for southern highbush blueberry (Table 1).

Leaf analysis conducted as part of a crop monitoring program can identify unbalanced nutrition that would otherwise not appear as symptoms, including the “hidden hunger” of nutrient deficiencies, and luxury levels of some nutrients that can accumulate in tissues beyond the need of the plant. Once these issues have been identified, fertiliser supplies can be reviewed and revised, if needed, to redress nutritional problems. However, since many other factors can impact on plant nutrient status, such as disease, supply of water or light, or soil or substrate characteristics, the interpretation of leaf analyses is very much an art, and must be made in the context of the crop and its growing conditions.

When symptoms appear

Sometimes, symptoms can appear for no apparent reason and in this case, leaf analysis can be helpful in diagnosing the problem. In this situation, to help with diagnosis, it is necessary to record as much information as possible about where the symptom occurs on the plant, including the tissue type and maturity, and the location of symptoms within the crop, and any recent changes in the weather, growing conditions or practices.

If the problem does not occur in summer, the sufficiency ranges will not be relevant to the interpretation of any leaf analysis.

Instead, it is wise to collect plant tissue from healthy, unaffected plants, and affected plants so that their analyses can be compared. The possible causes of plant symptoms are endless and may not need plant analysis, just some detective work! Apart from ordinary causes like blocked drippers, restricting the supply of water and nutrients to roots, or over-enthusiastic herbicide use sprayed onto foliage, the source of the problem can be more complicated. In one case, symptoms occurred as a result of increased soil pH after the completion of a limestone path next to the crop.

Table 1. Leaf sufficiency ranges for essential plant nutrients in southern highbush blueberry. For comparison with this table, mature leaves from new growth are collected during summer.

Element	Unit	Concentration at sufficiency*
Nitrogen	%	1.44-1.65
Phosphorus	%	0.09-0.11
Potassium	%	0.44-0.72
Calcium	%	0.62-0.73
Magnesium	%	0.15-0.27
Sulfur	%	0.15-0.17
Iron	mg/kg	90-100
Manganese	mg/kg	186-253
Boron	mg/kg	14-27
Copper	mg/kg	6-11
Zinc	mg/kg	22-116
Molybdenum	mg/kg	0.02-0.05

*Based on Bryson, G.M., and Mills, H.A. (2015). Plant Analysis Handbook IV - a Guide to Sampling, Preparation, Analysis and Interpretation for Agronomic and Horticultural Crops (Micro-Macro Publishing Inc.)

A research update on the nutrient status of southern highbush blueberry in Australia

As part of our research, the Clean Coastal Catchments Project (NSW DPIRD) is currently investigating the nitrogen needs of evergreen southern highbush blueberry, grown as a fertigated crop, in soil and potted substrate. We have regularly conducted leaf analyses of several commercial crops of cultivar 11-11 around Coffs Harbour (mid-north coast NSW) and of our experimental crop based on the north coast of NSW, over several seasons.

To date, we have observed two key trends in our data. The first, is that we have observed extreme fluctuations in the concentrations of both nitrogen and phosphorus in leaves (Figure 1). The pattern is seasonal, with the concentrations at their lowest in winter and their highest in spring.

Summer concentrations are the least extreme and this time is the most appropriate time for collecting leaves for analysis and comparison with the sufficiency ranges. To sample at any other time would report nitrogen and phosphorus concentrations either well below or well above the sufficiency ranges. And any action taken in response to modify fertiliser management would be inappropriate.

The second trend is in the comparison of our monitoring results with the sufficiency ranges (Table 1). For the crops we monitored, nitrogen (1.6–1.9%) and phosphorus (0.15–0.23%) are generally high, and calcium (0.18–0.42%) and magnesium (0.1–0.17) are generally low. So, why would our monitored crops contrast to the sufficiency ranges?

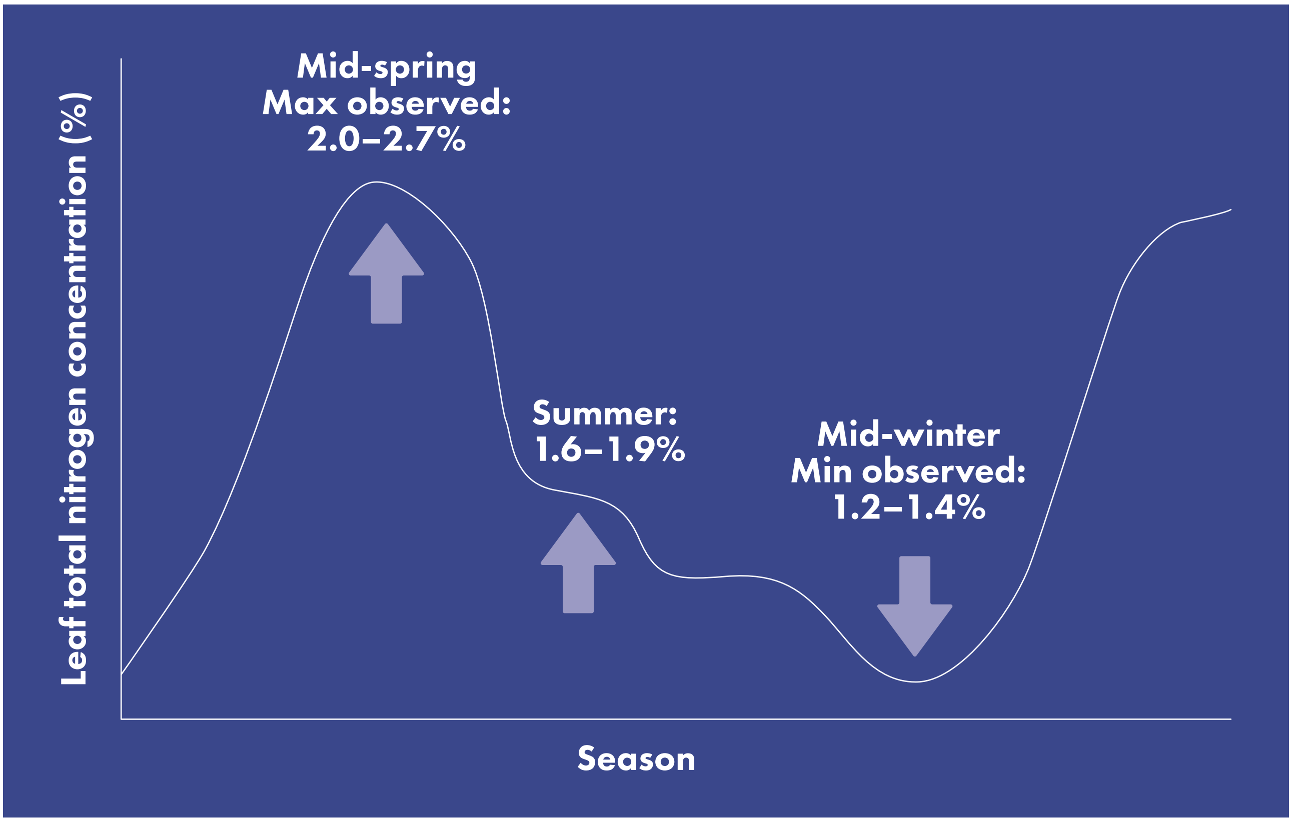

Figure 1. Some observations of the dynamics of leaf nitrogen in southern highbush blueberry on a seasonal basis

One hypothesis is that the sufficiency ranges are not reflective of evergreen systems, since these ranges were established on blueberry crops grown in northern America which are deciduous. In other words, the sufficiency needs of nutrients in evergreen blueberry are different to deciduous types.

Another hypothesis is that nitrogen and phosphorus fertilisers are being over supplied to our monitored crops, which in some cases can impede the root uptake of other nutrients. It is possible that excess nitrogen supplied as urea or as other ammonium forms can be taken up at the exclusion of calcium and magnesium.

We are currently reviewing our database of chemical analyses from leaf and soil samples to help us to better understand the underlying causes of these trends and this report will be available in early 2025.

This coming summer, we are also investigating how the rate of applied nitrogen relates to the nitrogen concentrations in the leaves that you would typically collect for analysis, and how nitrogen supply relates to the yield that we have just finished harvesting this season.

Watch this space for more of our research updates!

NSW GOVERNMENT

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