Project title:	Nutrient management in Hardy Nursery Stock (NutrHONS project)
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[The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.]

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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GROWER SUMMARY

Headline

Several on-nursery, hand-held pieces of chlorophyll and substrate conductivity measuring equipment have been tested across a range of hardy ornamental species and the readings compared to traditional laboratory techniques to monitor leaf tissue nitrogen levels. Some of the equipment is promising, but a benchmark for your nursery must be established to make effective comparisons.

Background

This 3 year trial aimed to establish a protocol for collecting and monitoring the nutritional inputs and outputs of container hardy nursery stock growing systems. Several on-nursery hand-held pieces of equipment have been tested across a range of ornamental species and the readings compared to traditional laboratory techniques.

The final year of the trial provided data that clarified the relationship between three pieces of electronic equipment, an iPhone App and laboratory derived leaf tissue Nitrogen levels in an effort to enable growers to determine nutrient status and modify nutrient applications to gain optimum plant growth with minimum nutrient leaching or wastage.

Summary

The four pieces of equipment used in the trials were all within the costs that a grower would be prepared to pay. The ‘atLEAF+’ device is now available again after a period of redesign. All the three devices and the iPhone App can give an indication of trends in crop nutrient status and showed whether additional, reduced or no nutrient applications were necessary.

In the third year of the trial all the plants had been potted at during week 19 and whilst the initial leaf tissue N% levels were quite good at or near potting, the N% figures dropped for plants after the beginning of June and in many cases resulted in N% tissue levels being below the standard values. As in the second year trials, high nitrogen leaching from the pots straight after potting was observed. Once the root system was active, leaching levels quickly dropped. Mid-season spikes in Nitrogen leaching was seen when trimming took place. In the case of Azalea and the atLEAF+ device the data was inconclusive, which may have been due to the very hairy nature of the leaf being tested allowing daylight in and interfering with the readings.

From the analysis of the data it is now possible to provide a graph that relates Nitrogen tissue levels to equipment output, for each of the plants trialled, (as examples, see Figures 1-4). The work highlighted the varying nutrient requirements of crops and the need to categorise them into

'high', 'medium' and 'low nutrient requirement' groups rather different groups such as 'trees', 'shrubs' or 'herbaceous perennials'.

Buddleja

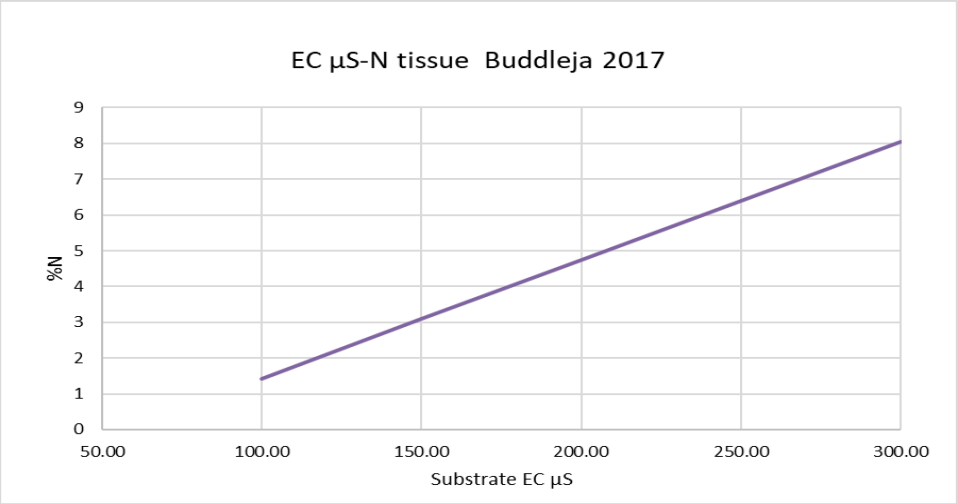

Figure 1 shows the relationship between the Procheck and tissue analysis

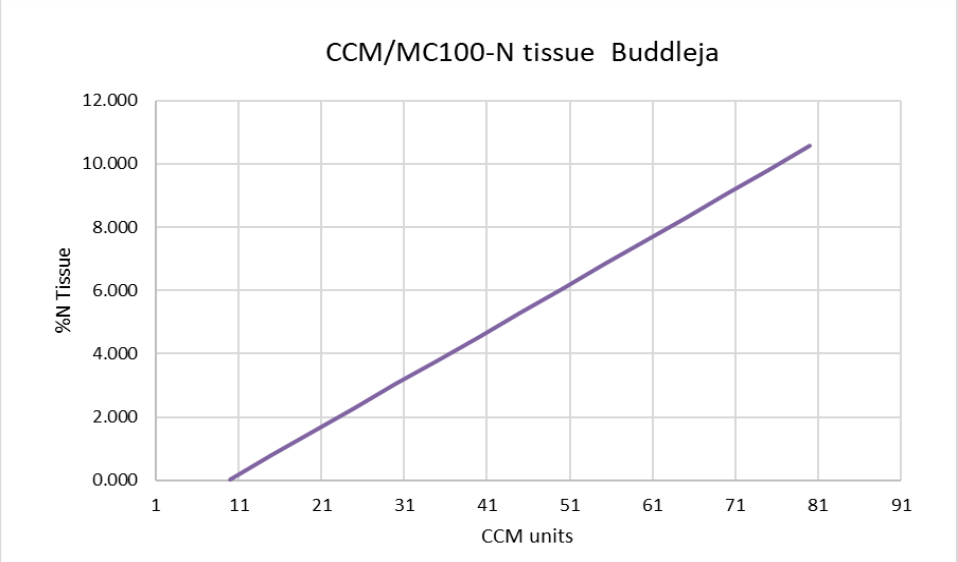

Figure 2 shows the relationship between the CCM/MC100 and tissue analysis

Tradescanthia

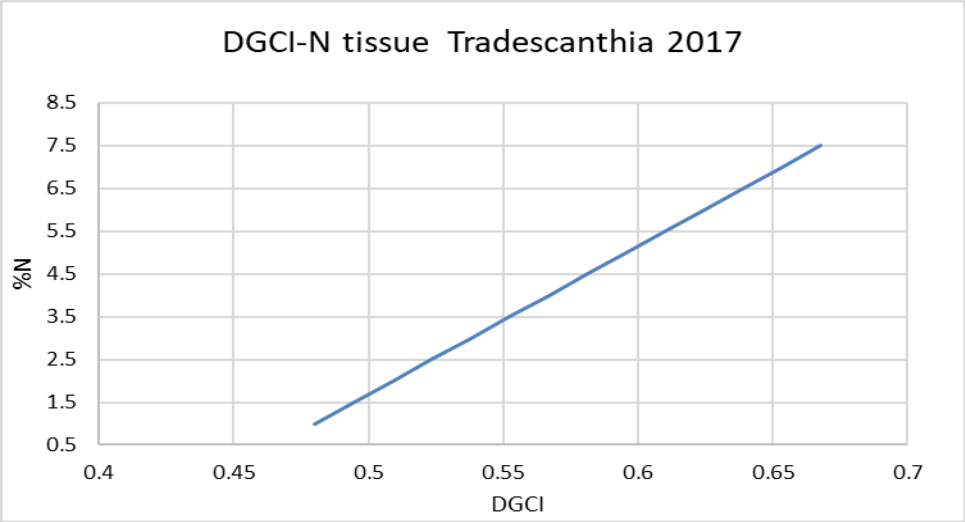

Figure 3 shows the relationship between the Green Index App and tissue analysis

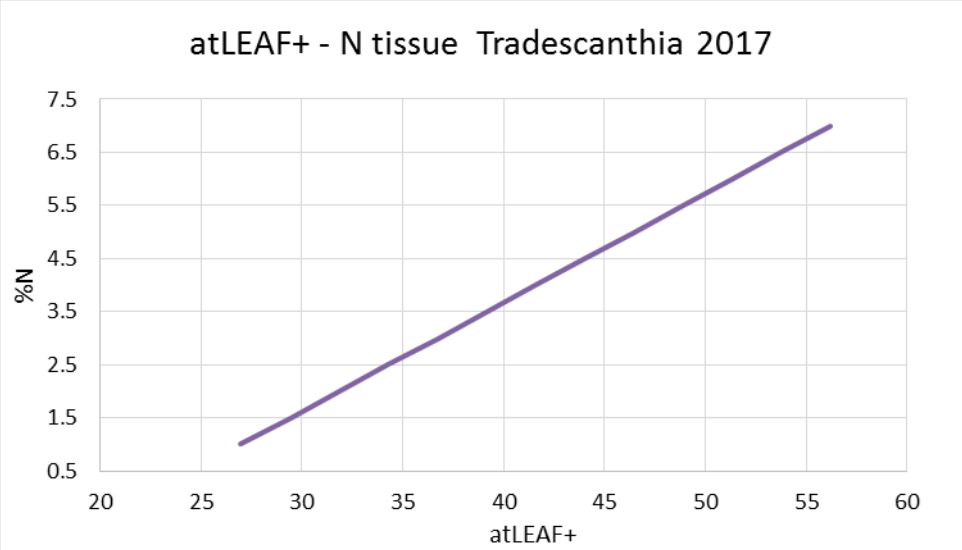

Figure 4 shows the relationship between the atLEAF+ and tissue analysis

Financial Benefits

For many growers there can be losses of plants of between 5-10% due to disease, pest or nutritional effects. If it is accepted that on average the return per ha for Hardy Nursery Stock (HNS) is £750,000, then a loss of 7.5% would equate to £56,250. If we then assume that nutritional losses are 2-3% of the 7.5% overall loss, then this would equate to a loss of between £15,000 – £22,500 directly relating to poor nutrient management. Additionally this figure does not account for the cost to the environment due to leaching losses.

The new atLEAF+ chlorophyll meter priced at £350 or the Procheck EC meter at £750 both have the ability to ensure that the marketing specifications of high value crops are met. Grower responses to this work indicate that costs of up to £2000 for hand-held monitoring equipment would easily pay for itself within a year of the monitoring being started. Considering the value of crops being monitored, the capital expenditure is quite low.

The table below (Table 1) shows the cost of nutrients added to and leached from the 6 pots contained in the Pour-thru units at PCS on *Viburnum*. The unit price of nitrogen was costed at £600/tonne. Note that the value of any mineralised N from the substrate would be included in the leachate data but no value is available for that part of the analysis results.

Table 1 shows a table showing applied nutrient costings and leaching losses

Kgs CRF/m^3	2kg/m^3	4kg/m^3	6kg/m^3	8kg/m^3
Cost of N added(CRF + PG mix + Urea)/ha	£150.40	£247.44	£344.47	£441.51
Cost of N in leachate/ha	£10.02	£54.75	£102.85	£219.22
% loss of added N/ha	6.6%	22.1%	29.8%	49.6%

Using the monitoring equipment that detects nutrient content prior to visual detection enables a greater reactive approach to crop nutrition, which can result in both environmental and financial gains.

Action Points

If growers are going to monitor crops on nurseries, then:

a) Dedicate one person to the job and give them the skills for accurate sampling across the selected crops.

b) Use selected marker crops on the nursery, potted into a substrate used widely across the nursery for sampling. Avoid crops with hairy leaves for chlorophyll readings.

c) During the first year of monitoring, laboratory analysis will be needed as well to establish the benchmark of nutritional values for specific crops.

d) Equipment readings are specific to a nursery site and cannot be compared to other sites.

e) Even if a crop has CRF added be prepared to liquid feed to maintain targeted growth.

f) Liquid feed plug and liner crops two or three weeks before potting with a high Phosphate liquid feed to stimulate root growth and ensure rapid pot establishment. This will reduce initial higher leaching.

g) Categorise crops into three feeding types, Low, Medium and High feed requirements.

h) Consider buying substrate without CRF and install “Dibbling” equipment on potting machines to easily change CRF incorporation rates. This would allow longer storage times of bulk substrate and give greater flexibility to add specific levels of CRF to meet the crop demands.