Grower Summary

PO BOF 003

Nutrient management for protected ornamentals, bulbs and outdoor flowers

Annual report 2020

Project title:	Nutrient management for protected ornamentals, bulbs and outdoor flowers
Project number:	PO BOF 003
Project leader:	Hilary Papworth, NIAB
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Key staff:	Hilary Papworth Benjamin Tea
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Industry Representative:	-
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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

Low calcium (Ca) in Primula is the likely cause of leaf-edge scorch and can be improved in spring and summer crops by reducing transpiration and not subjecting plants to water stress.

Although overhead irrigation can cause leaching of nutrients from growing media, plants benefit from the added foliar application of nutrients.

Delivery of nitrogen (N) in the form of ammonium (NH_4) up to 30% of total N, should not be detrimental to most bedding species in hard water areas.

Background

The target of this project is to make nutritional recommendations for key crops in the protected ornamental, bulb and outdoor cut flower industry which will form part of the guidance available in RB209. To make nutritional recommendations it is important to understand not only the nutritional requirements of the plants but also how the different variables in the production system will alter the availability of different nutrients.

In the second year of this four-year project the target was to:

- validate the data obtained in year 1 on the interactions between pot size, growing media and irrigation system, by repeating experimental work on Petunia and Pansy.
- To investigate how to avoid excessive EC levels when using capillary matting.
- To expand the work on the impact of pH and environment in Primula by carrying out two trials at different periods of the year, with the aim of reducing the incidence of leaf-edge scorch started in 2019.
- Look at the impact of NH_4 versus nitrate (NO_3) N fertiliser on bedding species, reviewing existing sources of experimental data and carrying out trials to gain first-hand experience of the issues.

The longer-term study on N nutrition in field-grown Narcissus continued this year at the trial sites in Cornwall and Lincolnshire, the aim of which is to review the current advice available in RB209. Application of treatments took place and data collection was underway at the time of writing the reports, findings from this year will be included in the next annual report.

A total of seven experimental trials were carried out in this year.

Summary

To confirm results from 2019 the same bespoke table system was used in the glasshouses at the NIAB trial site in Cambridge and again looked at the impact of using different irrigation systems to delivery liquid feed to Petunia and Pansy plants. The Petunia trial was run during summer of 2020, using F1 hybrid ‘Frenzy Blue Vein’ grown in 13 cm 5 deg pots using three different peat reduced growing media mixes. The mixes were 70:30 peat and perlite mix, 70:30 peat and wood fibre mix and 70:30 peat and coir mix, none had wetter or base feed incorporated. In the autumn Pansy ‘Matrix® White Blotch’ was grown using a 12-cell bedding pack and the same growing media mixes.

In the trial set up we compared irrigation delivered by overhead, ebb and flood and trickle tape onto capillary matting. Each trial had treatments which repeated the same combinations of feed vs irrigation vs growing media, but also included a feed that was reduced nutrient content compared with the previous year for the Petunia. For the Pansy, different strategies for avoiding accumulations of salt on capillary matting were investigated with different rates and feed sources, including a controlled release fertiliser (CRF) alternative.

The results for Petunia fresh weight showed plants grown under the ebb and flow regime with the standard feed product were larger than those in any other treatment, with coir based growing media producing the heaviest plants. The lowest fresh weights were observed in the treatments grown using the capillary irrigation systems or those with wood fibre growing media mixes.

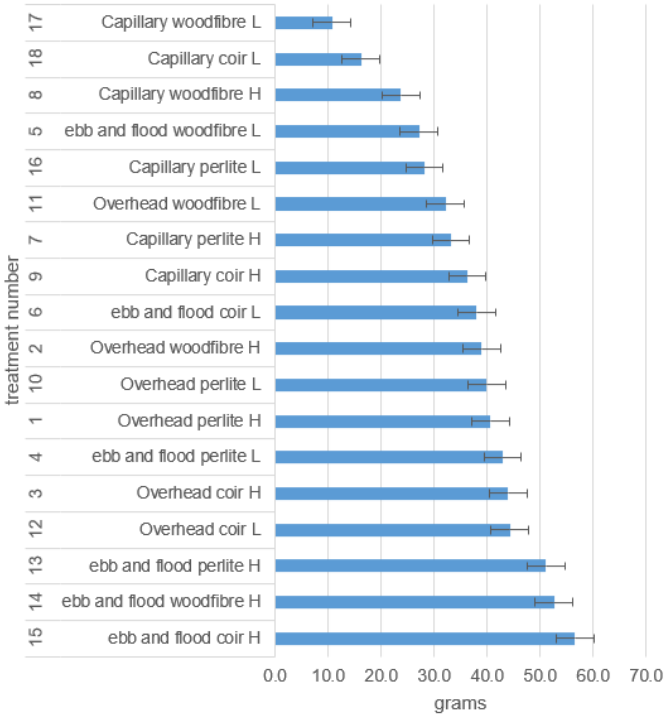


Figure 1. Average fresh weight for Petunia treatments ranked, observed 19/08/2020. H= high and L= low feed levels

The results indicate that with overhead irrigation with a perlite or coir mix growing media there is no impact from the reduction in nutrients between the feed regimes. This is not the case for the wood fibre mix; it has a significantly lower fresh weight with the tailored feed. It may be possible to adopt a lower feed regime and still achieve the same growth, but it is dependent on overhead irrigation and constituent parts of the growing media mix.

The results from the leaf tissue analysis for N show that N levels are linked to the irrigation method, with capillary matting delivering the lowest levels of N regardless of the feed regime. There appears to be a link between the irrigation system and the ratio of NH_4 to NO_3 in the leaf tissue which does not appear impacted by the type of growing media.

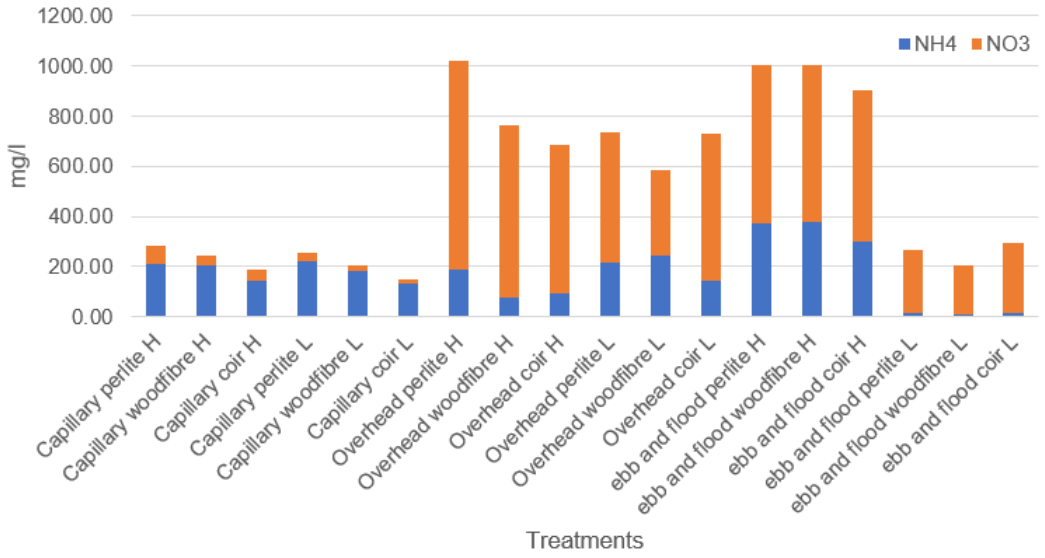


Figure 2. Results of leaf tissue analysis for total N content, samples 19/08/2020. H= high and L=low feed.

The Pansy trial shows the same link between overhead irrigation and greater efficiency of nutrient uptake. Use of a CRF in this trial was intended to disconnect the link between water application and nutrition, the results showed that this was successful under autumn growing conditions. These treatments had the highest plant fresh weight and most flowers in the trial,but increasing the feed/water ratio had a similar effect on plants, making it another successful strategy.

Three crops with different nutritional requirements were selected to illustrate the way species react to the NH_4 to NO_3 balance in feeds, these were Pansy 'Matrix® Blue Blotch', Geranium zonal 'Designer Scarlet Bright', Cyclamen F1 'Metis® White'.

Three feed treatments were applied to the trial each with NH_4 and NO_3 in the ratios 0:100, 20:80 and 30:70. However, all treatments provided 100 ppm N (NH_4/NO_3), 45 ppm phosphate (P),125 ppm potassium (K), 8 ppm magnesium (Mg) and trace elements.

Feeding was started one week after potting and then on a weekly basis. At each feeding event 10 ml of the diluted solutions were applied to individual pots.

The pH of the growing media initially declined, followed by a general increase. The highest pH values were observed in Pansy, followed by Geranium and lowest in Cyclamen, with no overlap in values for the species. Within each species there is no consistent trend linking the pH value to the N-form ratio, so final pH does not appear to be increasingly lower with increasing or decreasing amounts of NH_4 in the feed.

Table 1. Observation on growing media pH over duration of the trial for all treatments.

	Crop	Cyclamen			Geranium			Pansy		
	N form ratio NH_4:NO_3	0/100	20/80	30/70	0/100	20/80	30/70	0/100	20/80	30/70
Date	10/06/2020	6.14	6.16	6.05	6.43	6.43	6.29	6.25	6.28	6.25
	17/06/2020	6.15	6.11	6.04	6.18	6.17	6.17	6.12	6.14	6.17
	24/06/2020*	6.01	5.91	5.02	6.03	6.01	6.03	5.57	5.71	5.93
	01/07/2020	5.23	5.14	5.15	5.23	5.24	5.22	5.52	5.42	5.33
	08/07/2020	5.75	5.77	5.78	5.78	5.77	5.78	5.77	5.79	5.78
	15/07/2020	5.78	5.75	5.76	5.75	5.76	5.74	5.78	5.76	5.75
	23/07/2020	6.33	6.36	6.33	6.81	6.87	6.72	6.83	6.87	6.83
	30/07/2020	6.97	6.99	6.98	6.86	6.74	6.85	6.52	6.52	6.5
	05/08/2020	No observation in this week								
	13/08/2020*	6.31	6.36	6.13	7.12	6.86	7.34	7.48	7.37	7.55

*outdoor daytime temperature in excess of 30 ^{0}C during these weeks

There was little change in pH over the 9 weeks despite using different N-form ratios. Where changes occurred, the trend was the same in all treatments, and in all cases the growing media pH was higher at the end of the trial than at the start. From monitoring growing media pH in other trials, it appears likely that the upward trend in pH is from the use of overhead irrigation and the water, which is high in bicarbonate. It is also possible that the ratios are not high enough in NH_4 to cause a significant decline in pH under these conditions.

Previous work on Primula indicated a strong link between leaf-edge scorch, Ca, and environmental conditions. A trial was run during summer to see if the tissue death (necrosis) seen under high humidity conditions in spring were repeated, and to investigate if low growing media moisture content was a contributing factor in this problem.

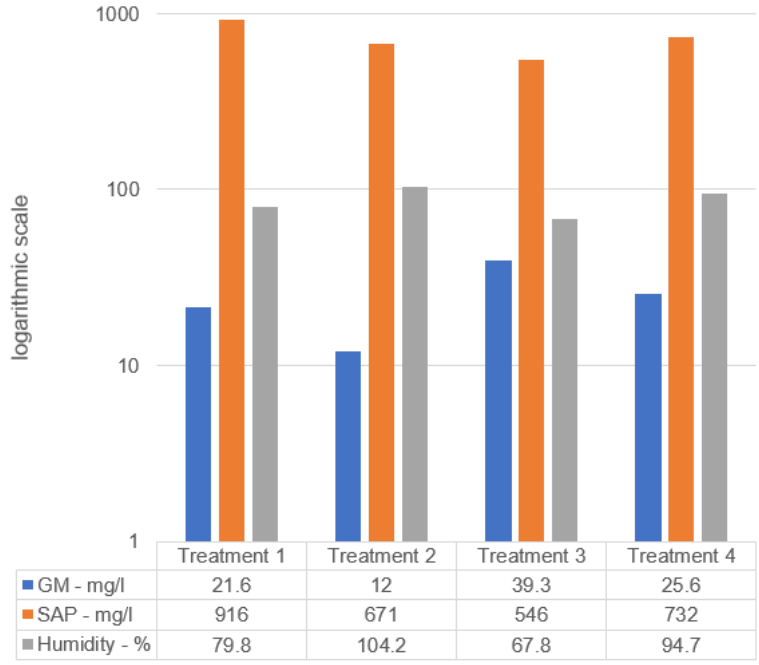
The investigation was untaken between May and August of 2020 using Primula ‘Cresendo® Bright Red’ and variation in plant spacing and watering levels were used to create four different treatments (Table 2).

Table 2. Treatment list for summer Primula trial.

Treatment code	1	2	3	4
Water rate	High	High	Low	Low
Humidity level	low	high	low	High

Plants were arranged in seven rows in a staggered arrangement, either at a spacing of around 10 cm between pot centres to create a lower humidity environment, or spaced pot-thick to increase the humidity. Watering was either applied as frequently as needed or limited to create a water deficit.

The results obtained for leaf tissue Ca show that the levels are highest in well-watered plants grown in lower humidity conditions. Increasing humidity or reducing irrigation levels were observed to reduce Ca in the leaf tissue by 20-40%.



	Treatment 1	Treatment 2	Treatment 3	Treatment 4
GM - mg/l	21.6	12	39.3	25.6
SAP - mg/l	916	671	546	732
Humidity - %	79.8	104.2	67.8	94.7

Figure 3. Results of growing media (GM) Calcium content, Leaf tissue (SAP) and average humidity at crop height from Blue Maestro™ disc monitors, figures are considered relative rather than exact as monitors do not have the high level of accuracy compared with glasshouse control systems but are accurate relative to one another.

In later stages of the trial, dying areas on the leaf margins were observed and these symptoms are recognisable as leaf-edge scorch. These were observed in treatments 2, 3 and 4 (see Table 2 for treatments), however the incidence in treatment 2 appeared most frequent.

Figure 4. Leaf edge scorch symptoms observed in the trial on treatments 2, 3 and 4, images dated 11/08/2020.

Results of growing media analysis show that sufficient Ca was present to avoid deficiency and the pH levels were suitable for its absorption.

Reducing humidity and improving the Ca in the leaf tissue, and apparently reducing the symptoms of leaf edge scorch, seemed to produce smaller plants over the same growing period.

The second investigation was done between September 2020 and January 2021 to see if the response to humidity and watering was the same during the autumn/winter growing period, and to see if applications of calcium nitrate ($Ca(NO_3)_2$) as a foliar feed can improve Ca nutrition under these conditions. Results are yet to be obtained for this trial.

Financial Benefits

In terms of fertiliser cost only, changing from a liquid feed regime to only using CRF could reduce costs, potentially to the point of being cost neutral. The level of cost depends on the efficiency of the irrigation system, and therefore the amount of liquid feed wasted. Using precision irrigation may reduce waste, making the use of liquid feed cheaper while achieving the same quality plants. However, CRF tends to have lower equipment costs and time input.

Action Points

- Regularly monitor the growing media EC to identify both inadequate and excessive levels, particularly in low water use periods, as trial results demonstrate that growing media EC can double in a week.
- Use CRF or increase the feed/water ratio for winter crops where irrigation can be low in response to weather conditions.
- In spring and summer Primula crops, reduce humidity in the glasshouse to improve Ca content in plants. This should reduce scorch symptoms.