



Grower Summary

PO 019a

The Bedding and Pot Plant Centre – new product opportunities for bedding and pot plant growers.

Objective 3: *To investigate plant nutrition, water quality and environment as possible causes of necrotic spotting and associated symptoms in susceptible Verbena varieties.*

Annual 2018

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AHDB Horticulture is a Division of the Agriculture and Horticulture Development Board.

Project title: The Bedding and Pot Plant Centre – new product opportunities for bedding and pot plant growers.

Objective 3: *To investigate plant nutrition, water quality and environment as possible causes of necrotic spotting and associated symptoms in susceptible Verbena varieties.*

Project number: PO 019a

Project leader: Dr Jill England, ADAS Boxworth

Report: Annual report, 31 March 2018

Previous report: None

Key staff: Dr Jill England (ADAS), Senior Horticulture Consultant
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Location of project: Woodlands Nursery, Stapleton, Leicestershire

Industry Representative: Caroline Shove, Bryants Nurseries Ltd, Water Lane, Bovingdon, Hemel Hempstead, Hertfordshire, HP3 0NA

Date project commenced: 1 April 2017

Date project completed 31 March 2019

(or expected completion date):

Grower Summary

Headline

- The incidence of necrotic leaf spot and chlorosis is greater in plants grown in 'wet' growing media and 'ambient' environment conditions (higher VPD).
- Root quality poorer under 'wet', humid conditions.
- Water quality and growing media pH had no effect on symptom development.

Background

The Bedding and Pot Plant Centre (BPPC) has been established to address the needs of the industry via a programme of work to trial and demonstrate new product opportunities and practical solutions to problems encountered on nurseries. Knowledge transfer events including trial open days and study tours are also included in the programme.

The work programme is guided by a grower-led Management Group that includes members of the BPOA Technical Committee, and representatives from Baginton Nurseries, Coventry the host nursery for the BPPC, and growers representing both the bedding and pot plant sectors.

This is the Bedding and Pot Plant Centre report for:

Objective 3: *To investigate plant nutrition, water quality and environment as possible causes of necrotic spotting and associated symptoms in susceptible Verbena varieties.*

Summary

Leaf problems have been encountered with *Verbena* at various nurseries, including chlorotic leaf margins and necrotic spotting (**Figure 1**). No pathogen has been associated with the symptoms. Although two trials were carried out in 2016 to evaluate the influence of watering regime (dry, standard, wet), pH (4.5, 5.8 and 6.5) and trace element delivery (fritted and unfritted) on symptom development in *Verbena* 'Quartz Blue', *V.* 'Obsession Scarlet' and *V.* 'Temari Blue', none of the *Verbena* varieties developed symptoms and the cause of the spotting and chlorosis remains unknown.



Figure 1. *Verbena* with marginal chlorosis (left) and leaf spot (right) symptoms
Plug plants of *Verbena* 'Quartz Blue' (PanAmerican, seed raised) were delivered to Woodland Nursery, Stapleton, Leicestershire and transplanted into six packs (black plastic) containing growing media, pre-adjusted to pH 4.5 and 6.5 (supplied by Bulrush Horticulture Ltd.) in week 19 (10 May, 2017). The plants were grown under glass for one week before additional treatments were applied, and during this phase of the trial, plants were irrigated using a 50:50 blend of rainwater and borehole water. Treatments (**Table 1**), set up on 17

May 2017, were: 1) three water quality treatments were applied: rainwater, borehole water and a 50:50 mix of rainwater and borehole water. For the 50:50 treatment, a quantity of water was prepared at the start of the trial and used throughout, and 2) two water management regimes, which were achieved by managing the irrigation frequency; the dry treatment plants were watered as necessary to prevent the plants from wilting. The wet treatment was watered more frequently to maintain a wet regime. Both were determined by grower knowledge and were watered by a nominated person throughout the trial, and 3) two environment treatments; for the humid environment treatment, plants were sited under 'tents' of milky white propagation plastic (**Figure 2**).



Figure 2. Trial at set up (left) and environment monitoring equipment (right).

Table 1. *Verbena* leaf spot and chlorosis trial treatment list

| T | Irrigation regime | Water quality | Environment | pH | |
|----|-------------------|---------------|---------------------------------------|------------|------------|
| 1 | Wet | Borehole | Humid | Low (4.5) | |
| 2 | | | | High (6.5) | |
| 3 | | | Ambient | Low (4.5) | |
| 4 | | | | High (6.5) | |
| 5 | | Rainwater | Humid | Low (4.5) | |
| 6 | | | | High (6.5) | |
| 7 | | | Ambient | Low (4.5) | |
| 8 | | | | High (6.5) | |
| 9 | | | 50/50 blend of borehole and rainwater | Humid | Low (4.5) |
| 10 | | | | | High (6.5) |
| 11 | | Ambient | | Low (4.5) | |
| 12 | | | | High (6.5) | |
| 13 | Dry | Borehole | Humid | Low (4.5) | |
| 14 | | | | High (6.5) | |
| 15 | | | Ambient | Low (4.5) | |
| 16 | | | | High (6.5) | |
| 17 | | Rainwater | Humid | Low (4.5) | |
| 18 | | | | High (6.5) | |
| 19 | | | Ambient | Low (4.5) | |
| 20 | | | | High (6.5) | |
| 21 | | | 50/50 blend of borehole and rainwater | Humid | Low (4.5) |
| 22 | | | | | High (6.5) |
| 23 | | Ambient | | Low (4.5) | |
| 24 | | | | High (6.5) | |

T = Treatment

Summary of results

Environmental conditions had the strongest influence with more symptoms developing in plants grown under ambient conditions.

A closer look at the environmental conditions indicated that VPD (vapour pressure deficit) was generally below 0.5 kPa in the humid environment, and approaching or above 1.0 kPa in the ambient treatments. VPD between 0.4 kPa and 1.2 kPa is generally considered a target range for bedding plant production, with lower values more appropriate to plants during propagation or early growth, and higher values for late vegetative growth onwards. High VPD (>1 kPa) imparts a strong drying effect on plants, while at 0.0 kPa VPD the air is fully saturated. Plant stress can be moderated through ensuring that plants are not produced under high VPD conditions; the appropriate VPD range varying according to plant species. For the plants in this trial, fewer symptoms developed in plants grown under generally low VPD conditions.

Irrigation regime also had a strong influence on symptom development in this trial, with more symptoms developing in plants grown under the wet regime.

Water quality did not have a clear influence on symptom development in this trial. It had been expected that more symptoms would develop in plants irrigated with the high EC borehole water. However, the proportion of plant cover with symptoms was greater in plants irrigated with the 50:50 blend water than either borehole water or rainwater. The number of plants per plot with symptoms was similar for all water quality treatments.

Growing media pH did not influence symptom development in this trial.

Irrigation regime and environment were the strongest influences; with greater symptom development, in wet, ambient conditions. The 'ideal' environment appears to be somewhere between the two growing environments that were tested; 'Ambient' was too dry for *Verbena* and some wetting of paths would help to reduce symptoms. Consideration of VPD may enable growers to determine a range within which symptoms do not develop, striking a balance where plants are sufficiently active (i.e. transpiring sufficiently to take up adequate nutrients and water, and to regulate plant temperature) to maintain quality without symptoms developing.

Growing media moisture influences root development, with fewer roots and root hairs present in plants grown under wet conditions, limiting the ability of plants to respond during stress conditions such as high light, temperature and VPD. Growing media should not remain wet for long periods of time and should be allowed to dry sufficiently before watering. Good root development will produce plants with more resilience against sharp increases in VPD and temperature.

Action points

- Take care when irrigating crops. Allow growing media to dry back before watering, and ensure that it does not remain wet for long periods as this will have a negative impact on root structure, plant growth and quality.
- Weighing containers to give an indication of growing media moisture content before and after irrigation may be useful to set irrigation guidelines and as a basis for staff training.
- Consider monitoring VPD and determine a range within which fewer symptoms appear, and plant quality is improved.

Financial benefits

The incidence of marginal leaf chlorosis and necrotic spotting symptoms vary from year to year, ranging from one or two varieties up to 60% of varieties in some years; the problem can affect 100% of the crop. While the exact value of *Verbena* to the bedding plant sector is not known, grower feedback suggests that 5-6% of spring bedding sales can be affected. To put this into context, many nurseries consider 3% waste as the upper acceptable limit and

above this would stop producing a particular crop or variety. Symptoms have been reported on many nurseries across the sector.

As an example, the turnover associated with a batch of 10,000 *Verbena* double six packs (12 plants) is estimated at £22,000 to the grower. Where 60% of the crop is affected, the value of this wastage is estimated at £13,200.