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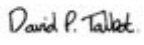
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AUTHENTICATION

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

- Five out of six varieties of *Salvia* marketable in flower (for summer sales from week 25 and 27 respectively) from week 16 and week 19 transplant
- *Salvia greggii* 'Joy' and *Salvia microphylla* 'Hot Lips' marketable within five and four weeks of week 16 and week 19 transplant respectively
- *Salvia* 'Big Blue' shy to flower in 1 L pots; larger pot size would be more appropriate
- Plant growth regulators (PGRs) were used to produce more compact 'pot plant' product : Dazide Enhance (4 g/L) and Bonzi (1 ml/L), applied in 300 L/ha water
- Temperature sensitive subjects such as *Salvia* 'Amistad' and *S.* 'Rockin Deep Purple' may be more suited to production under heated glass.

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.

Breeders, seed houses and plant producers continually develop new breeding lines and growers select those with visual appeal for consumers, precocious flowering lines, attractive colour ranges, and intrinsic branching habits; plants with genetics that impart resistance to pests and diseases, but also compact plants that require no or minimal application of plant growth regulators, that are easily scheduled whilst being suitable for a range of markets, enabling premium quality plants to be produced with minimum inputs.

This trial compares the production of herbaceous *Salvia* transplanted into 1 L pots on two transplant dates, with and without PGR applications.

This is the Bedding and Pot Plant Centre report for:

Objective 3. Programming herbaceous *Salvia* for production as impact bedding plants

Summary

Six *Salvia* varieties (*Salvia* 'Amistad', *Salvia* 'Big Blue', *Salvia greggii* 'Joy', *Salvia microphylla* 'Hot Lips', *Salvia* 'Rockin Deep Purple' and *Salvia* 'Wendy's Wish') were transplanted into 1 L pots at Bryant's Nurseries, Bovingdon, Hemel Hempstead in week 16, and week 19, 2021, and grown on under polytunnels (**Figure 1**). While some cultivars had been pinched by the supplier, 'Wendy's Wish', 'Amistad' and 'Big Blue' (week 16 trial), and 'Rockin Deep Purple' (week 19 trial) were pinched at Bryant's Nurseries. The replicated trial was set out with each plant species having a 'PGR applied' and a 'non-PGR' treatment. PGRs were applied only if

necessary and on the advice of the grower. Plant growth regulators (PGRs) were applied by the grower to PGR plots only: Dazide Enhance (4 g/L) and Bonzi (1 ml/L), applied in 300 L/ha water. Plants were monitored for pests and disease throughout the trial.

A drench of Subdue (metalaxyl-M; 18.75 ml/100 m²) was applied to *S. g.* 'Joy' to control root rot.



Figure 1. Week 16 (left) and week 19 (right) trials at set-up

Main outcomes:

***Salvia* 'Amistad'** proved sensitive to the cold conditions early in the trial (**Figure 2**), causing leaf chlorosis, and could benefit from production under heated glass. While some plants appeared to grow through this, damage continued to be evident for others. The plug plants for the week 16 trial had particularly long internodes, requiring an early PGR application which somewhat improved plant form.



Figure 2 Cold damage on *Salvia* 'Amistad' (left). Lower leaf speckling on *S.* 'Big Blue' (right)

***Salvia* 'Big Blue'** plants were attractive, with large blue-green leaves. However, they were slow to establish and did not flower before the end of either trial in 1 L pots. They may be better suited to production under warmer conditions and in larger pots. 'Big Blue' quality was slightly affected by lower leaf speckling (**Figure 2**).

***Salvia greggii* ‘Joy’** flowered early, with plants marketable by five and four weeks post-transplant (week 16 and week 19 trial respectively). However, *S. g.* ‘Joy’ was susceptible to stem base / root disease which caused plant losses, leaving remaining plants often brittle and easily damaged. Care should be taken to provide unfavourable conditions for these pathogens by letting the growing media dry out before irrigating, particularly in a cool spring when it can take longer for growing media to dry back. This variety may also benefit from cutting back to help produce a strong plant base.

***Salvia microphylla* ‘Hot Lips’** flowered early, similar to *S.g.* ‘Joy’ with plants marketable by five and four weeks post-transplant (week 16 and week 19 trial respectively). The flowers have a white upper lip and red lower lips but petal colour is influenced by temperature and can be predominately red in cool, moist conditions and white in hot, dry conditions.

***Salvia* ‘Rockin Deep Purple’** was sensitive to cold conditions, which caused leaf chlorosis, but was less affected than *Salvia* ‘Amistad’.

***Salvia* ‘Wendy’s Wish’** plugs (week 16 trial) had long internodes on delivery, similar to *S.* Amistad, requiring an early PGR application which improved plant form.

Plant height. While significant effects on plant height due to the PGR applications were not recorded, plants treated with PGRs were consistently shorter than their untreated counterparts by the final assessment (week 27) in the week 19 trial. PGRs are more effective in warm conditions than cold, as plants are more active.

Temperature impacted on plant growth, with low temperatures causing damage to susceptible plants, while others may benefit from being moved outside as the polytunnel temperature rises to help control growth. There is a balance to be struck in respect of temperature – avoiding damaging low / fluctuating temperatures for susceptible plants, but moving other plants outside in cooler conditions to help control growth potentially, reducing the need for PGRs.

Financial benefits

The popularity of herbaceous *Salvias* has continued to increase, predominately in 2 L pots; few appear to be available in 1 L pots.. Retail prices in March 2023 range between £7.50 and £7.99 for a 2L pot; or a collection of three plants for an average £16.50. There appears to be little variation in price between different species.

Herbaceous *Salvias* continue flowering into the autumn, however there may be gains to be made on returns through early production, with early marketing of species that are quick to

flower, such as *S. 'Hot Lips'* and *S. g. 'Joy'*. However, this will require careful selection of species: Focus on selecting disease resistant and cold tolerant species

Action points

- Consider pot size, and carefully match variety to an appropriate pot size to achieve the greatest impact. While *Salvia greggii* and *S. microphylla* varieties may be suitable for production in 1 L pots, larger pot sizes, potentially with multiple plants per pot, maybe more suitable for larger varieties, for example *Salvia 'Big Blue'*
- Produce temperature sensitive varieties under glass, heated as appropriate to the prevailing conditions to avoid physiological damage. This would apply to 'Amistad' and 'Rockin Deep Purple' and related varieties.
- Specify compact plug plants from suppliers of more vigorous varieties and pinch if this hasn't been done by the propagator. *S. g. 'Joy'* would likely benefit from cutting back to produce a stronger plant, although this would delay flowering. Use PGRs, applied before internode extension, to control growth of the more vigorous varieties.
- Take care to allow the growing media to dry back before irrigating susceptible species such as *S. g 'Joy'*, to provide unfavourable conditions for pathogens.

Science Section

Introduction

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

This is the Bedding and Pot Plant Centre report for: Objective 3. Programming herbaceous Salvia for production as impact bedding plants

Background

Breeders, seed houses and plant producers continually develop new breeding lines and from these growers select those with visual appeal for consumers, precocious flowering lines, attractive colour ranges, and intrinsic branching habits. Of key interest to growers are genetics that impart resistance to pests and diseases, but also compact plants that require no or minimal application of plant growth regulators, that are easily scheduled whilst being suitable for a range of markets, enabling premium quality plants to be produced with minimum inputs.

The genus *Salvia* includes a diverse range of species, from annuals to half-hardy perennials (in the UK) to hardy herbaceous perennials and shrubs. *Salvia* produced for the bedding plant market are often compact tender or half hardy (in the UK) perennials grown as annuals, generally from seed. These include the traditional *Salvia splendens*, but also *S. farinacea*, *S. roemeriana* and *S. coccinea*. Woody based varieties include *S. microphylla*, *S. greggii* and *S. x jamenesis*. Hardy herbaceous perennials encompass clump forming (including *S. nemorosa*, *S. x superba*, *S. x sylvestris* and *S. virgata*) and rosette forming (including *S. argentia*, *S. pratensis*, *S. verbenaca*) species. Half-hardy herbaceous perennials include *S. guarantica*, *S. uliginosa*, *S. discolour* and *S. elegans* (Sutton,1999).

The results of breeding programmes are seen in the large number of new cultivars of woody based species coming through, particularly *S. greggii* and *S. microphylla* (e.g. *S. m.* 'Hot Lips'), which tend to achieve heights of around 0.5 to 1.0 meters, and which are likely to require plant growth regulator (PGR) applications for production in jumbo 6-packs or 1 L pots, some of which may be too vigorous for these formats.

Other impactful plants currently at the forefront of marketing are *S. nemorosa* 'Marvel Sky Blue' (available from BallColegrave), *Salvia* 'Rockin Deep Purple' (available from Kernock

Park Plants), *S. guarantica* 'Black and Blue' (Kernock Park Plants) or *S. g.* 'Amante', *Salvia* 'Big Blue' (BallColegrave) and *S.* 'Wendy's Wish' (available from Earley Ornamentals), among others, that would be suitable for larger containers, ranging from 2-6 L, with larger cultivars suitable for up to 6 L containers. These larger plants may be suitable for marketing in 1 L pots with appropriate growth regulator treatments. The jumbo 6-pack format typically retails between £7.99 and £12.99 per pack. They do not generally appear to be marketed in 1 L pots, but *S.* 'Wendy's Wish' is currently retailing at £8.99 per 1.5 L pot in one outlet.

This trial compares the production of herbaceous *Salvia* transplanted into 1 L pots on two transplant dates, with and without PGR applications, where PGRs were applied only if necessary and on the advice of the grower.

New product development is critical to growers within the bedding and pot plant sector.

Project objectives

Objective 1: To evaluate the effect of transplant date on flowering of six herbaceous *Salvia* species/cultivars.

Objective 2: To evaluate the need for plant growth regulator application to two sequential batches of six herbaceous *Salvia* species / cultivars.

Objective 3: To provide growers with advice on the cultivation of promising *Salvia* species / cultivars included in the trial.

Methods and materials

Site and crop production details

Six *Salvia* varieties (*Salvia* 'Amistad', *Salvia* 'Big Blue', *Salvia greggii* 'Joy', *Salvia microphylla* 'Hot Lip's, *Salvia* 'Rockin Deep Purple' and *Salvia* 'Wendy's Wish') were transplanted into 1 L pots at Bryant's Nurseries, Bovingdon, Hemel Hempstead in week 16, and week 19. The plants were grown on under polytunnels (Figure 3).

While some cultivars had been pinched by the supplier, 'Wendy's Wish', 'Amistad' and 'Big Blue' (week 16 trial), and 'Rockin Deep Purple' (week 19 trial) were pinched at Bryant's Nurseries (**Table 3** and **Table 4**).



Figure 3. Week 16 (left) and week 19 (right) trials at set-up

Trial design and statistical analysis

The trial was set out with each plant species as a distinct treatment; each species having a 'PGR applied' and a 'non-PGR' treatment, providing twelve treatments in total. Plots consisted of 24 plants, with 3 plants per plot marked with a label for later assessments. Within each trial there were four replicate blocks, with an overall total of 2,304 plants across the two trials, with each trial containing 1,152 plants.

Results were examined by ANOVA with use of Duncan's multiple range test to separate treatments.

Pesticide and PGR applications

Plants were monitored for pests and disease throughout the trial. A drench of Subdue (metalaxyl-M; 18.75 ml/100 m²) was applied to *S. g.* 'Joy' to control root disease.

Plant growth regulators (PGRs) were applied by the grower to PGR plots only (**Table 3** and **Table 4**): Dazide Enhance (4 g/L) and Bonzi (1 ml/L), applied in 300 L/ha water.

Assessments

Plug root development (**Table 1**), plant quality (**Table 2**), and plant height (cm) were assessed at transplant. Further assessments on plant height, plant quality and the percentage of plants in flower were made throughout the trials. For plant height, the same three plants per plot were measured at each assessment and the average height calculated. Inspections and assessments are summarised in **Table 3** and **Table 4** below.

Table 1. Root quality scores

Score	Definition
0	No root development
1	Rooting in up to 25% of the pot
2	Rooting in 26-50% of the pot
3	Rooting in 51-75% of the pot
4	Rooting in 76-100% of the pot

Table 2. Plant quality scores

Score	Definition
0	Dead
1	Very poor quality
2	Poor quality
3	Good quality, some damage visible
4	Good quality, very little damage
5	Excellent quality, no damage visible

Table 3. Summary of week 16 trial inspections and assessments, 2021

Date	Week no.	Action	Assessment
20 April	16	Pre-transplant assessment completed. Plants transplanted and trials set out. Tips pinched on 'Wendy's Wish' and 'Amistad'	Root development, plant quality, plant height (cm)
08 May	18	PGR applied to 'Amistad' and 'Wendy's Wish' by grower (PGR plots only)	n/a
11 May	19	Tips pinched on 'Big Blue'	n/a
26 May	21	'Joy' samples sent for testing at ADAS Boxworth (lower stem rot)	n/a
28 May	21	PGR applied to all cultivars by grower (PGR plots only). Subdue applied to 'Joy'	n/a

11 June	23	Inspection	Plant height (cm), plant quality, root quality, no. of plants in flower
18 June	24	PGR applied to all cultivars by grower (PGR plots only)	n/a
23 June	25	Assessment 2	Plant height (cm), plant quality, root quality, no. of plants in flower
06 July	27	Assessment 3	Plants not assessed. Not appropriate as the plants were beyond marketing

Table 4. Summary of week 19 trial inspections and assessments, 2021

Date	Week no.	Action	Assessment
11 May	19	Pre-transplant assessment completed. Plants transplanted and trials set out. Tips pinched on 'Rockin Deep Purple'	Root development, plant quality, plant height (cm)
26 May	21	'Joy' samples sent for testing at ADAS Boxworth (lower stem rot)	n/a
28 May	21	PGR applied to all cultivars by grower (PGR plots only). Subdue applied to Joy.	n/a
11 June	23	Assessment 1	No. of plants in flower only, capturing early flowering plants
18 June	24	PGR applied to all cultivars by grower (PGR plots only)	n/a
23 June	25	Assessment 2	Plant height (cm), plant quality, root quality, no. of plants in flower
06 July	27	Assessment 3	Plant height (cm), plant quality, root quality, no. of plants in flower

Results

The effect of transplant date on the height, quality and flowering of each *Salvia* cultivar was compared across the two trials and across PGR and non-PGR treated plots. Temperature and humidity were monitored throughout the trial (**Appendix 1**). Plant heights are tabulated in **Table 5** and **Appendix 2**; plant quality scores in **Table 6** and **Appendix 3**; and root quality scores in **Table 7** and **Appendix 4**. Average number of plants in flower is tabulated in **Table 8** and **Appendix 5**. Images of plants from all treatments at the start of the trial can be found in **Appendix 6**, with comparative images of plants with and without PGR application in **Appendix 7**. Trial commentary can be found in **Appendix 8**.

All plants obtained for the trial were of good quality prior to transplant and the pre-transplant assessment confirmed 75-100% rooting in all plugs. Insufficient trays of 'Rockin Deep Purple' variety were delivered, so only 16 plants were used per plot for this variety only, and only in the week 19 trial.

Plant height

An early plant growth regulator (PGRs) application was made to 'Wendy's Wish' and 'Amistad' (week 16 trial) as they presented with large internodes on arrival (**Figure 4**); two further applications were made to all plants in PGR plots in both trials on 28 May 2021 and 18 June 2021 (week 24) (**Table 5** and **Appendix 2**).

'Amistad' and 'Hot Lips' (week 16 trial) do appear to have responded to the PGR application, with shorter plants in the PGR treated plots by the week 25 assessment, but the differences in plant height were not statistically significant. For the remaining species, plants in the PGR plots were the same height or taller than the untreated plants (**Table 5**).



Figure 4. Week 16 trial. Long internodes on *Salvia* 'Amistad' (left) and *Salvia* 'Wendy's Wish' (right) at the start of the trial

For the week 19 trial, all species appeared responsive to the PGRs both at the week 25 assessment (**Table 5**) and the week 27 assessment (**Appendix 2**), although differences were not statistically significant. ‘Big Blue’ was slow to establish and increase in height (both trials), and would likely benefit from a warmer environment.

Table 5. Average plant height. Week 16 trial, nine weeks post-transplant (week 25, 23 June 2021) and week 19 trial, six weeks post-transplant (week 25, 23 June 2021). Week 16 trial: PGRs were applied to Amistad and Wendy’s Wish only, two weeks post-transplant (8 May 2021). Week 16 and week 19 trial: Two further PGR applications were made to all plants in PGR plots on 28 May 2021 (week 21) and 18 June 2021 (week 25). ns = no significant differences

Species	Week 16 trial		Week 19 trial	
	PGR applied (cm)	No PGR applied (cm)	PGR applied (cm)	No PGR applied (cm)
Amistad	56.2	58.1	48.8	55.7
Joy	46.1	45.8	41.2	46.0
Hot Lips	57.3	59.7	53.4	57.9
Big Blue	16.5	16.0	11.1	12.3
Wendy’s Wish	62.0	61.0	48.3	53.5
Rockin Deep Purple	43.5	43.5	33.4	38.1
F pr	0.515 ns		0.645 ns	
I.s.d	5.417		4.557	
s.e.d	2.656		2.240	

Plant quality

No statistically significant differences in plant quality were recorded in any species / treatment combination (**Table 6** and **Appendix 3**). All cultivars in both trials were marketable, with an average score greater than 3.

Plant quality was poorer in the week 16 trial than the week 19 trial for all species. Low minimum temperatures were recorded within the polytunnel, dipping below 5.0°C (**Appendix 1**), which caused cold damage to ‘Amistad’ (**Error! Reference source not found.**, **Figure 2, Appendix 7**) and ‘Rockin Deep Purple’, presenting as chlorosis (**Appendix 7**), plants in the week 16 trial were more affected than week 19; and the ‘Amistad was more affected than the ‘Rockin Deep Purple’. The plants did grow through the chlorosis to some degree, but some slight yellowing of leaves did remain on some plants.



Figure 5 Cold damage on *Salvia* 'Amistad' (left). Lower leaf speckling on *S.* 'Big Blue' (right)

'Hot Lips' came into flower very early. The flowers have a white upper lip and red lower lips, but this is temperature dependent. Flowers can be predominately red in cooler, moister conditions and white in hot, dry conditions.

'Joy' was affected by stem base *Botrytis* and root disease, which caused weak stem bases and brittle plants, which affected quality scores. The quality scores for 'Big Blue' were affected by some speckling on lower leaves (**Figure 5**).

Table 6. Average plant quality scores. Week 16 trial, nine weeks post-transplant (week 25, 23 June 2021) and week 19 trial, six weeks post-transplant (week 25, 23 June 2021). Scale of 0-5 (0 = dead plants; 3 = good quality, some damage visible; 5 = excellent quality, no damage visible). ns = no significant differences

Species	Week 16 trial		Week 19 trial	
	PGR applied	No PGR applied	PGR applied	No PGR applied
Amistad	3.8	3.8	4.4	4.4
Joy	3.8	4.3	4.0	4.6
Hot Lips	4.8	4.6	4.9	5.0
Big Blue	3.8	4.2	4.7	5.0
Wendy's Wish	4.2	4.3	4.4	4.5
Rockin Deep Purple	4.8	4.9	5.0	5.0
F pr	0.209 ns		0.553 ns	
I.s.d	0.802		0.5259	
s.e.d	0.3453		0.2585	

Root quality

Root quality was generally excellent, scoring 4 (rooting in 76-100% of pot) on 23 June (week 25), **Table 7**) for all cultivars in both trials except for 'Joy' (both week 16 and 19 trials) however these differences were not statistically different. Other exceptions were 'Amistad' and 'Hot Lips' (week 16 trial, week 23, 11 June, plots with no PGR applied). Root quality recorded for 'Joy' (week 19 trial, 6 July 2021, plots with no PGR applied) was significantly poorer than all other cultivars ($P=0.024$) (**Appendix 4**). 'Joy' had been affected by stem base *Botrytis* and root disease which although treated caused some plant losses, loss of vigour and root damage.

Table 7. Average root quality scores. Week 16 trial, nine weeks post-transplant (week 25, 23 June 2021) and week 19 trial, six weeks post-transplant (week 25, 23 June 2021). Scale of 0-4 (0 = no root development; 2 = rooting in up to 25% of the pot; 4 = rooting in 76-100% of pot). sig = significant differences; ns = no significant differences

Species	Week 16 trial		Week 19 trial	
	PGR applied	No PGR applied	PGR applied	No PGR applied
Amistad	4.0	4.0	4.0	4.0
Joy	3.5	4.0	3.3	3.5
Hot Lips	4.0	4.0	4.0	4.0
Big Blue	4.0	4.0	4.0	4.0
Wendy's Wish	4.0	4.0	4.0	4.0
Rockin Deep Purple	4.0	4.0	4.0	4.0
F pr	0.056 ns		0.988 ns	
I.s.d	0.2658		0.4054	
s.e.d	0.1303		0.1993	

Number of plants in flower

There were no significant differences in the number of plants in flower, and no significant effect of the PGRs on flowering time (**Table 8, Appendix 5**).

'Joy' and 'Hot Lips' came into flower and were marketable within five and four weeks of transplant (week 16 and week 19 transplants respectively). Buds were present on 'Wendy's Wish' (week 16 trial) by five weeks after transplant (week 21, 26 May 2021), with flowers present after seven weeks (week 23, 11 June 2021). 'Amistad' and 'Rockin Deep Purple' were slower to flower, while 'Big Blue' did not produce any flowers during the trial.

Table 8. Average number of plants in flower. Week 16 trial, nine weeks post-transplant (week 25, 23 June 2021) and week 19 trial, six weeks post-transplant (week 25, 23 June 2021). ns = no significant differences

Species	Week 16 trial		Week 19 trial	
	PGR applied	No PGR applied	PGR applied	No PGR applied
Amistad	24.0	24.0	24.0	24.0
Joy	21.7	21.3	21.8	23.3
Hot Lips	24.0	24.0	24.0	24.0
Big Blue	0.0	0.0	0.0	0.0
Wendy's Wish	23.8	24.0	24.0	24.0
Rockin Deep Purple	23.5	23.0	16.50	15.00
F pr	0.854 ns		0.711 ns	
I.s.d	1.543		2.522	
s.e.d	0.754		1.240	

Discussion and Conclusion

'Wendy's Wish' and 'Amistad' (week 16 trial) plugs presented with large internodes. An early PGR was applied to control internode extension, and this did improve plant shape although the effect was still evident, if to a lesser degree, at the end of the trial. The week 19 plants were less affected.

While significant effects on plant height due to the PGR applications were not recorded, plants treated with PGRs were consistently shorter than their untreated counterparts by the final assessment (week 27) in the week 19 trial. PGRs are more effective in warm conditions than cold, as plants are more active.

'Joy' and 'Hot Lips' both flowered early, with plants marketable by five and four weeks post-transplant (week 16 and week 19 trial respectively). However, 'Joy' was susceptible to stem base / root disease which caused plant losses, leaving remaining plants often brittle and easily damaged.

'Amistad' and 'Rockin Deep Purple' both suffered from physiological damage (leaf chlorosis) as the temperature fluctuated between below 5°C and above 20°C during production. Plants in the week 16 trial were more affected but they did generally growth through the damage to produce marketable plants. The cold damage appeared to be more evident in 'Amistad' later

in the trial. 'Big Blue' did not exhibit symptoms of cold damage, but was slow to establish. These varieties would benefit from production under glass, adequately heated in cold conditions.

'Big Blue' didn't flower by the time of the final assessment; this variety would be better suited and more impactful in larger pots, perhaps with multiple plants per pot. By 11 June (week 25), Wendy's Wish was flowering in the week 16 trial (five weeks post-transplant), while buds but no flowers were present in the week 16 trial (seven weeks post-transplant).

Conclusion

Temperature played a major part in this trial, with low temperatures causing damage to susceptible plants, while others may benefit from being moved outside as the polytunnel temperature rises to help control growth and reduce reliance on PGRs. There is a balance to be struck in respect of temperature – avoiding damaging low temperatures for susceptible plants, but moving other plants outside in cooler conditions to help control growth.

Salvia greggii 'Joy' proved susceptible to root and stem base (*Botrytis*) diseases. Care should be taken to let the growing media dry out before irrigating, particularly in a cool spring when it takes longer for growing media to dry back. This variety may also benefit from cutting back to help produce a stronger plant.

References

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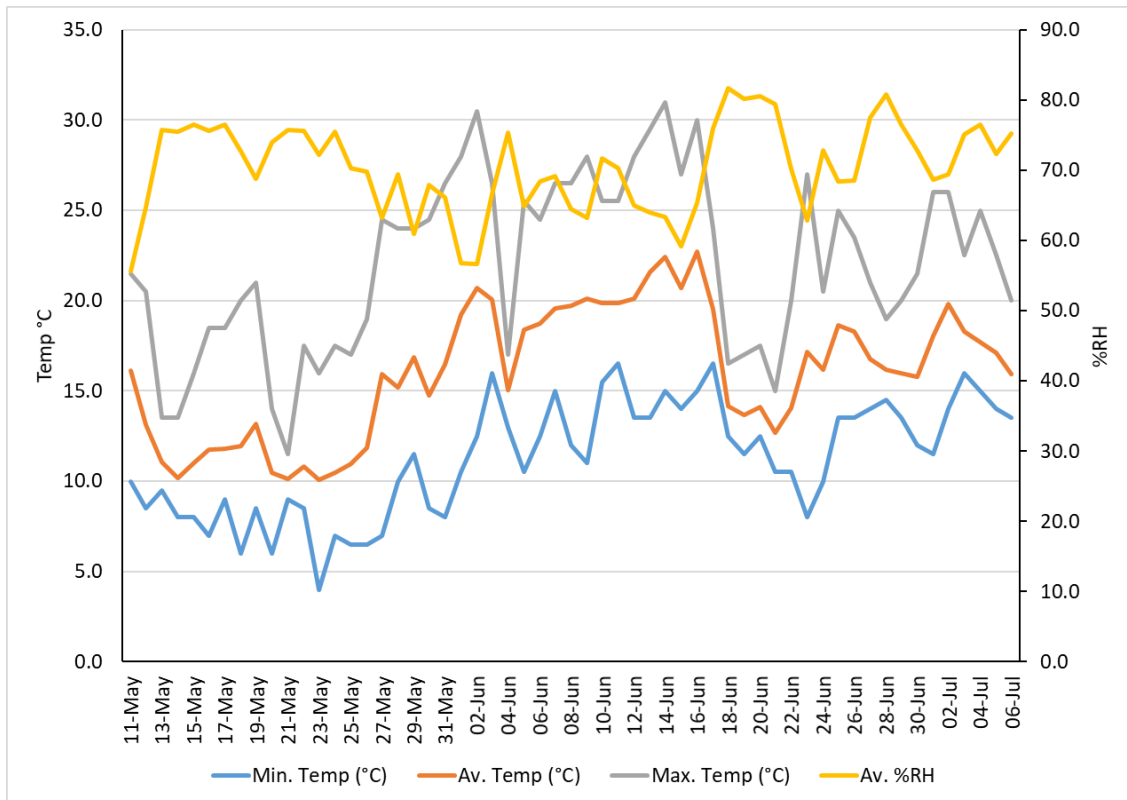
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Appendix 1

Polytunnel temperature and humidity during the *Salvia* trial



Appendix 2

Average plant height (cm).

Week 16 trial. Five weeks post-transplant (week 23, 11 June 2021), with and without PGR. Note: PGRs were applied to 'Amistad' and 'Wendy's Wish' only, two weeks post-transplant (8 May 2021). 'two PGR applications were made to all plants in PGR plots on 28 May 2021 (week 21) and 18 June 2021 (week 25). ns = no significant differences

Species	PGR	No PGR
Amistad	44.92	43.88
Joy	38.63	40.38
Hot Lips	52.00	46.50
Big Blue	12.96	12.42
Wendy's Wish	48.88	48.58
Rockin Deep Purple	31.21	28.00
F pr	0.467 ns	
I.s.d	5.287	
s.e.d	2.593	

Week 19 trial. Eight-weeks post-transplant (week 27, 6 July 2021), with and without PGR. Note: two PGR applications were made to all plants in PGR plots on 28 May 2021 (week 21) and 18 June 2021 (week 25). ns = no significant differences

Species	PGR	No PGR
Amistad	75.0	83.5
Joy	46.7	53.1
Hot Lips	59.9	64.1
Big Blue	16.3	25.9
Wendy's Wish	70.7	74.5
Rockin Deep Purple	49.3	55.9
F pr	0.753 ns	
I.s.d	6.450	
s.e.d	3.170	

Appendix 3.

Average plant quality scores.

Week 16 trial. Five weeks post-transplant (week 23, 11 June 2021), with and without PGR. Scale of 0-5 (0 = dead plants; 3 = good quality, some damage visible; 5 = excellent quality, no damage visible). ns = no significant differences

Species	PGR	No PGR
Amistad	3.7	3.6
Joy	3.7	3.7
Hot Lips	5.0	4.9
Big Blue	4.8	4.5
Wendy's Wish	4.6	4.5
Rockin Deep Purple	4.7	4.6
F pr	0.996 ns	
I.s.d	0.7996	
s.e.d	0.3925	

Week 19 trial. Eight-weeks post-transplant (week 27, 6 July 2021), with and without PGR. Scale of 0-5 (0 = dead plants; 3 = good quality, some damage visible; 5 = excellent quality, no damage visible). ns = no significant differences

Species	PGR	No PGR
Amistad	4.8	4.6
Joy	4.9	5.0
Hot Lips	5.0	4.9
Big Blue	4.9	5.0
Wendy's Wish	4.8	4.9
Rockin Deep Purple	5.0	5.0
F pr	0.524 ns	
I.s.d	0.2324	
s.e.d	0.1142	

Appendix 4

Average root quality scores.

Week 16 trial. Five weeks post-transplant (week 23, 11 June 2021), with and without PGR. Scale of 0-4 (0 = no root development; 2 = rooting in up to 25% of the pot; 4 = rooting in 76-100% of pot). sig = significant differences; *ns* = no significant differences

Species	PGR	No PGR
Amistad	4.0	3.9
Joy	3.9	4.0
Hot Lips	4.0	3.9
Big Blue	4.0	4.0
Wendy's Wish	4.0	4.0
Rockin Deep Purple	4.0	4.0
F pr	0.345 ns	
I.s.d	0.1632	
s.e.d	0.0802	

Average root quality scores. Week 19 trial. Eight-weeks post-transplant (week 27, 6 July 2021), with and without PGR. Scale of 0-4 (0 = no root development; 2 = rooting in up to 25% of the pot; 4 = rooting in 76-100% of pot). sig = significant differences; *ns* = no significant differences

Species	PGR	No PGR
Amistad	4.0	4.0
Joy	4.0	3.8
Hot Lips	4.0	4.0
Big Blue	4.0	4.0
Wendy's Wish	4.0	4.0
Rockin Deep Purple	4.0	4.0
F pr	0.024 sig	
I.s.d	0.07992	
s.e.d	0.03928	

Appendix 5

Average number of plants per plot in flower.

Week 19 trial. Average number of plants in flower per plot, four- and eight-weeks post-transplant (week 23, 11 June 2021; week 27, 6 July 2021), with and without PGR. ns = no significant differences

Species	Four weeks post-transplant		Eight weeks post-transplant	
	PGR	No PGR	PGR	No PGR
Amistad	0.0	0.5	24.0	24.0
Joy	21.0	22.0	21.8	23.3
Hot Lips	7.3	6.8	24.0	24.0
Big Blue	0.0	0.0	0.0	0.0
Wendy's Wish	0.0	0.0	24.0	24.0
Rockin Deep Purple	0.0	0.0	20.0	18.0
F pr	0.748 ns		0.566 ns	
I.s.d	1.541		2.554	
s.e.d	0.748		1.255	







Week 16 trial, seven weeks post-transplant (week 23, 11 June 2021), with and without PGR. NS = no significant differences between treatments

Species	PGR	No PGR
Amistad	0.3	0.3
Joy	18.8	18.0
Hot Lips	20.8	24.0
Big Blue	0.0	0.0
Wendy's Wish	8.0	6.8
Rockin Deep Purple	0.0	0.0
F pr	0.940 ns	
I.s.d	6.280	
s.e.d	3.034	







Appendix 6

Trial set up

Week 16 plants, 20 April 2022







	
'Amistad'	'Big Blue'
	
'Joy'	'Wendy's Wish'
	
'Hot Lips'	'Rockin Deep Purple'

Week 19 trial, 11 May 2022.







	
'Amistad'	'Big Blue'
	
'Joy'	'Wendy's Wish'
	
'Hot Lips'	'Rockin Deep Purple'

Appendix 7

Week 16 trial. Comparative images trial final assessment. Week 25, 23 June 2022



	
<p align="center">'Amistad' With PGR (left), no PGR (right)</p>	<p align="center">'Big Blue' With PGR (left), no PGR (right)</p>
	
<p align="center">'Joy' With PGR (left), no PGR (right)</p>	<p align="center">'Wendy's Wish' With PGR (left), no PGR (right)</p>
	
<p align="center">'Hot Lips' With PGR (left), no PGR (right)</p>	<p align="center">'Rockin Deep Purple' Both with PGR</p>




Week 19 trial. Comparative images trial final assessment. Week 27, 6 July 2021


	
<p>'Amistad' With PGR (left), no PGR (right)</p>	<p>'Big Blue' With PGR (left), no PGR (right)</p>
	
<p>'Joy' With PGR (left), no PGR (right)</p>	<p>'Wendy's Wish' With PGR (left), no PGR (right)</p>
	
<p>'Hot Lips' With PGR (left), no PGR (right)</p>	<p>'Rockin Deep Purple' With PGR (left), no PGR (right)</p>

Appendix 8

Salvia trial commentary, weeks 16 and 19

	Week 16	Week 19	
'Amistad'	<p>The plugs for the week 16 trial arrived on site with particularly long internodes. Application of an early PGR improved plant form somewhat: Dazide Enhance (4 g/L) and Bonzi (1 ml/L), applied in 300 L/ha water.</p> <p>Plants were affected by the cold, causing chlorosis. Most plants grew through this by 11 June, but others suffered permanent cold damage. This cultivar may be better produced in warmer conditions under glass.</p>	<p>Internodes were shorter than seen in plants supplied for the week 16 trial. An early PGR was not applied to plants in this batch.</p> <p>Plants were affected by the cold, causing chlorosis. Some plants continued to exhibit some slight chlorosis by 11 June assessment.</p>	
'Big Blue'	<p>Plants were slow to establish and grow away, and could benefit from warmer growing conditions than an unheated tunnel, particularly for early transplant dates in cold seasons.</p> <p>None of the 'Big Blue' plants flowered during the trial (in 1 L pots). They may be more suitable for larger pot sizes, potentially with multiple plants per pot.</p> <p>Slightly reduced quality scores because of slight speckling on lower leaves.</p>	<p>Similar to the comments for the week 16 trial. Plants small and slow to establish with no sign of flowers or buds.</p>	

'Joy'	<p>Joy was in flower and marketable by 5 weeks after transplant.</p> <p>'Joy' was susceptible to stem base (<i>Botrytis</i>) / root disease which caused plant losses, often leaving remaining plants brittle and easily damaged. All 'Joy' plants were treated with Subdue. Some of the remaining plants had brittle / weak stem bases. A stronger or second cut back could produce a stronger plant.</p>	<p>Plant quality better than week 16 plants. Less affected by stem base and root disease. Surviving plants were in flower and marketable by week 23, 4 weeks post-transplant.</p>	
'Hot Lips'	<p>Flowers appeared very early and were in flower and marketable by week 21, 5 weeks post-transplant.</p> <p>Flowers were all red with no white lip. This effect is temperature dependent, with more white seen in hot, dry conditions.</p>	<p>Plants were in flower and marketable by week 23, 4 weeks post-transplant.</p> <p>Some white lips appearing in flowers in some plots. Flowers present on plants in all trays.</p>	
'Rockin' Deep Purple'	<p>The plugs for the week 16 trial arrived on site with particularly long internodes. Application of an early PGR somewhat improved plant form: Dazide Enhance (4 g/L) and Bonzi (1 ml/L), applied in 300 L/ha water.</p> <p>Cold damage similar to 'Amistad' but generally less affected with the effect less permanent and plants looking healthier. Larger leaves than 'Amistad'. This cultivar may be better produced in warmer conditions under glass.</p>	<p>Some slight yellowing because of cold damage remained evident.</p>	

<p>Wendy's Wishes'</p>	<p>The plugs for the week 16 trial arrived on site with particularly long internodes. Large internodes still present, but less obvious by the end of the trial. Application of an early PGR improved plant form somewhat: Dazide Enhance (4 g/L) and Bonzi (1 ml/L), applied in 300 L/ha water.</p> <p>Great combination of flower colour and buds. Some leaf yellowing (lower and mid plant) over time.</p> <p>Flowers present by the 11 June 2021.</p>	<p>Internodes were shorter than seen in plants supplied for the week 16 trial. An early PGR was not applied to plants in this batch. Buds present but no flowers by 11 June 2021. Very attractive</p>	
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