Project title:	Bedding and Pot Plant Centre. Management of conventional chemistry on bedding and pot plants					
Project number:	PO 019d					
Project leader:	Dr Jill England, ADAS Boxworth					
Report:	Annual report, 31 March 2022					
Previous report:	The Bedding and Pot Plant Centre – new product opportunities for bedding and pot plant growers (31 March 2021).					
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Date project commenced:	1 April 2020					
Date project completed	31 March 2023					
(or expected completion date):						

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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

- Frupica SC, Karma, Sonata, Sercadis and Luna Privilege are crop safe on 'Begonia' semperflorens Heaven Red, 'Nemesia' Lady Lisa, 'Geranium' Horizon Red, 'Fuchsia' brutus, and 'Calibrachoa' Cabaret Cherry Rose and offer potential new options for Botrytis control in these crops.
- The products trialled contain fungicides with three different FRAC mode of action codes that can be alternated in programmes to minimise the risk of fungicide resistance developing.

Background

- The Bedding and Pot Plant Centre (BPPC) addresses 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.
- The trial being reported here focussed on the diminishing number of key active ingredients by testing fungicides with activity against Botrytis and which have recently obtained extensions of authorisations for minor use (EAMUs) for use in the production of ornamentals. These products were tested on bedding plant species that are susceptible to *Botrytis*.

This is the Bedding and Pot Plant Centre report for:

Objective 1. Management of conventional chemistry.

Summary

Several key active ingredients with activity against *Botrytis* that are known to be crop safe in bedding and pot plant production have recently been withdrawn. The fungicides included within this trial have been selected because they have activity against *Botrytis* and have recently obtained extensions of authorisations for minor use (EAMUs) for use in the production of ornamentals. However, no crop safety data relating to the use of these products was widely available for bedding and pot plant growers. The plant species were selected as they are susceptible to *Botrytis*. This trial expands the fungicide options available for the prevention and control of *Botrytis* within the bedding and pot plant sector.

Three cutting-raised (*'Nemesia'* Lady Lisa, *'Fuchsia' brutus*, and *'Calibrachoa'* Cabaret Cherry Rose) and two seed-raised bedding plant species (*'Begonia' semperflorens* Heaven Red, and *'*Geranium' Horizon Red) were used for this trial. Plugs were transplanted into standard 6-packs (*Begonia* and Geranium) and 1 L pots (*Nemesia, Calibrachoa* and *Fuchsia*) at ADAS

Boxworth on 19th May 2021 (week 20). All species were transplanted into Levington M2 Pot and Bedding Compost. Treatments (**Table 1**) were applied as a foliar spray in either 500 L/ha water (Frupica SC, Karma, Sercadis and Luna Privilege) or 1500 L/ha water (Sonata), twoand four-weeks post-transplant (weeks 22 and 24). Treatment effects were compared with two control treatments. The first control was water only. Then, if PGRs were required on the trial, the second control treatments would also be treated with PGR, to confirm that any treatment effects were attributable to the fungicide application and not the PGR. Plants were not irrigated for 24 hours following treatment.

Trt	Product	No. of	Activo	Rate (L/ha,	Rate (ml/L,	
		applications	Active	Kg/ha)	g/L)	
1	Water control	2	N/A	N/A	N/A	
ን*	Water control (+	2	Ν/Λ	NI/A	Ν/Λ	
2	PGR if required)	2		IN/A		
3*	Frupica SC	2	mepanipyrim	0.9 L/ha	1.8 ml/L	
/*	Karma	2	potassium hydrogen	20 Ka/ba	6 0 <i>a</i> /l	
4	Naima	2	carbonate	5.0 Ny/na	0.0 g/L	
5*	Sonata**	2	Bacillus pumilus	10.01/ha	6 67 ml/l	
0 Conata		L	QST2808	10.0 2/114	0.07 11.2	
6*	Sercadis	2	fluxapyroxad	0.3 L/ha	0.6 ml/L	
7*	Luna Privilege	2	fluopyram	0.225 L/ha	0.45 ml/L	

Table 1. Treatment list. Treatments were applied at 2- and 4-weeks post-transplant (weeks 28 and 39).

*If PGR was required, this was applied to all plants within treatments 2-7. **Sonata applied in 1500 L/ha water; all other treatments applied in 500 L/ha water

None of the fungicides (Frupica SC, Karma, Sonata, Sercadis or Luna Privilege) assessed in this crop safety trial resulted in any detrimental effects on the five plant species ('*Begonia' semperflorens* Heaven Red, '*Nemesia*' Lady Lisa, 'Geranium' Horizon Red, '*Fuchsia'* brutus, and '*Calibrachoa*' Cabaret Cherry Rose). No major symptoms of phytotoxicity were observed, and there was no effect on plant quality or height by the final assessment. No delays in flowering were associated with the use of any of the fungicides assessed on the five species tested therefore it can be concluded that Frupica SC, Karma, Sonata, Sercadis or Luna Privilege are crop safe on *Begonia, Nemesia*, Geranium, *Fuchsia* and *Calibrachoa*.

Fungicide modes of action (MOA) are classified by the Fungicide Resistance Action Committee (FRAC), who use different numbers and letter combinations to distinguish fungicide MOA groups. Using fungicides with different FRAC codes prevents the development of fungicide resistance. These trials have identified fungicides with three different FRAC codes (**Table 2**) that are safe to use in the prevention and control of *Botrytis* by bedding and pot plant

growers as part of a planned fungicide resistance prevention strategy; Karma is not classified (nc) by FRAC. Previous trial work carried out in this project highlighted that many of the fungicides included within this trial also have activity against powdery mildew. The crop safety of four of these fungicides on a range of species prone to powdery mildew has previously been demonstrated within this programme of work.

Financial benefits

Fungicides are an essential crop protection input in the production of bedding and pot plants. Without access to fungicides for the prevention and control of *Botrytis*, losses caused by this pathogen are conservatively estimated at 1% of production value resulting in a potential loss of \pounds 4.3 million to the sector.

This evaluation of fungicides approved in the UK under EAMUs for use on bedding and pot plants will expand the range of active ingredients available to growers' for controlling *Botrytis*. Whilst growers do use cultural methods (e.g., fans, ventilation and controlling the timing of irrigation) to aid the prevention of foliar disease where possible, however a lack of cost-effective fungicides approved for use on protected ornamentals would reduce the range of plants that can be produced profitably within client specifications. The cost per litre of spray solution to apply the products included in this trial at the specified rates ranges from 0.08p to 5.55p (**Table 2**) and provides greater opportunity to increase profit through reduced input costs.

Product	Application rate	FRAC code	Cost of active (p)	Cost / L of spray (p)
Frupica SC	0.9 L/ha	9	0.145 / ml	0.26
Karma	3.0 Kg/ha	NC	0.0138 / g	0.08
Sonata*	10.0 L/ha	BM02	0.83 / ml	5.55
Sercadis*	0.3 L/ha	7	0.1410 / ml	0.08
Luna Privilege	0.225 L/ha	7	0.215 / ml	0.10

Table 2. Fungicide costs (non-discounted, excluding VAT and labour costs for application) and FRAC codes

* Sercadis and Luna Privilege have the same FRAC code. NC = not classified.

Action points

- Sonata, Sercadis and Frupica SC are protectant fungicides and will be most effective when used in fungicide programmes to prevent *Botrytis*.
- Karma has eradicant properties so is most effective when *Botrytis* is present within crops.

- A limited number of species have been tested within this trial and growers are advised to test spray new or unfamiliar fungicides on a small number of untested plant varieties or cultivars prior to large scale use on commercial crops.
- Growers should familiarise themselves with and adhere to product labels, approvals, and Extensions of Approval for Minor Use (EAMUs) prior to use.
- EAMUs recommend the alternation of fungicides with different modes of action to prevent fungicide resistance becoming a problem.
- These trials have shown the potential of fungicides with three different FRAC codes which can be utilised for use in the control and prevention of *Botrytis* in spray programmes as part of an anti-fungicide resistance strategy. The mode of action of Karma is 'not classified'.
- Luna Privilege and Sercadis have the same FRAC code so only one of these products should be used in fungicide programmes to minimise the risk of fungicide resistance developing.
- Growers should note that the water volume used for Sercadis, Frupica SC, Karma and Luna Privilege in these trials (500 litres water per hectare) may be lower than the rate they currently use and as such application rates or volumes may need to be adjusted to maintain the same application rate of active ingredient.

Science Section

Introduction

The Bedding and Pot Plant Centre (BPPC) was 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 1.

Background

Several fungicides (and actives) with uses and activity against *Botrytis* in the production of protected ornamentals have been withdrawn in recent years including Bravo 500 (chlorothalonil), Bumper 250 EC (propiconazole), Systhane 20 EW (myclobutanil) and Octave (prochloraz). Therefore, crop safe alternatives are essential to maintain the competitiveness of the UK bedding and pot plant sector. The fungicides included within this trial have been selected because they have activity against *Botrytis* and have recently obtained extensions of authorisations for minor use (EAMUs) for use in the production of ornamentals. However, no crop safety data relating to the use of these products was widely available for bedding and pot plant species were selected as they are susceptible to *Botrytis*. This trial expands the fungicide options available for the prevention and control of *Botrytis* within the bedding and pot plant sector.

Project objectives

Objective 1: To evaluate the crop safety of up to five EAMUs recently authorised for use in the production of protected ornamentals per year.

Objective 2: To provide industry updates on crop safe control options for key bedding and pot plant pests and diseases, including product selection and spray programme maintenance to prevent the build-up of resistance.

Methods and materials

Site and crop production details

Five seed-raised bedding plant species (*Begonia semperflorens* 'Heaven Red', *Nemesia* 'Lady Lisa', Geranium 'Horizon Red', *Fuchsia* 'Brutus' and *Calibrachoa* 'Cabaret Cherry Rose') supplied by Ball Colegrave in 360 cell trays) were used for this trial. Plugs were transplanted into standard 6-packs (*Begonia* and Geranium) and 1 L pots (*Nemesia, Fuchsia* and *Calibrachoa*) in week 20 at ADAS Boxworth. All species were transplanted into Levington M2 Pot and Bedding Compost. Plants were stood down on Mypex within a polythene tunnel (**Figure 1**).

Treatments (**Table 3**) were applied as a foliar spray two and four weeks post-transplant (weeks 22 and 24), using a backpack and single nozzle lance, with an 02f110 nozzle, to achieve a medium spray quality, in a water volume of 500 L/ha for all treatments except for T5 (Sonata) which was applied in a water volume of 1500 L/ha. Five fungicides were tested in the trial, with two water controls. If PGRs were required on the trial, one of the water control treatments was to be treated with PGR, to ensure that any treatment effects could be attributed to the fungicide application and not the PGR. All treatments were applied in the morning and spray boards were used to prevent any overspray of treatment onto neighbouring plots. Plants were not irrigated for 24 hours following treatment. All products used in the trial have recently been authorised for use on ornamentals through the Extension of Authorisation for Minor Use (EAMU) programme, and therefore no experimental permits were required.



Figure 1. Phytotoxicity trials set up within a polythene tunnel at ADAS Boxworth, 28 May 2021, Oneweek post-transplant.

Table 3.	Treatment	list used in	n the phy	/totoxicity	trials.	Treatments	were	applied	two-	and	four-w	eeks
post-tran	splant. The	same trea	tment lis	t was use	ed for a	ll species.						

Tet	Product	No. of	Activo	Rate (L/ha,	Rate (ml/L,
m	Floduct	applications	Active	Kg/ha)	g/L)
1	Water control	2	N/A	N/A	N/A
2*	Water control (+ PGR if required)	2	N/A	N/A	N/A
3*	Frupica SC	2	mepanipyrim	0.9 L/ha	1.8 ml/L
4*	Karma	2	potassium hydrogen carbonate	3.0 Kg/ha	6.0 g/L
5*	Sonata	2	<i>Bacillus pumilus</i> QST2808	10.0 L/ha	6.67 ml/L
6*	Sercadis	2	fluxapyroxad	0.3 L/ha	0.6 ml/L
7*	Luna Privilege	2	fluopyram	0.225 L/ha	0.45 ml/L

*If PGR was required, this was applied to all plants within treatments 2-7

PGR was determined not to be required during the trial, therefore Treatments 1 and 2 were both classed as a standard water control.

Plants were monitored for pests and diseases throughout the trial. *Aphidius colemani* was introduced on a fortnightly basis for aphid control.

Two species of plants (*Nemesia* and *Calibrachoa*) had already begun to flower by the time of the first treatment application on 02 June, week 22. As these flowers appeared to be normal and were considered unlikely to show any effects from the fungicide application, the decision was made to pinch off any open flowers on these species on 04 June, week 22.

Temperature and humidity were monitored throughout the trial using two Tinytag data loggers.

Trial design and statistical analysis

Each plant species was set out as a distinct trial, arranged in a randomised plot design with seven treatments. Plots consisted of four 6-packs (24 plants) for *Begonia* and Geranium, and 12 x 1 L pots (12 plants) for *Nemesia, Fuchsia* and *Calibrachoa*. Within each trial there were three replicate blocks, with an overall total of 1,764 plants.

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

Assessments

Prior to transplant, plug root development (**Table 4**), plant quality (**Table 5**), and height were assessed. Further assessments on plant height, plant quality and percentage of plants in flower were made throughout the trials. Phytotoxicity was assessed from the first treatment application onwards (**Table 6**). For plant height, the same plants in each plot were assessed at each assessment. Inspections and assessments are summarised in **Table 7** and below.

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

Table 4. Root development scores

Table 5. 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 6. Phytotoxicity scores

Score	Definition
0	Comparable with control
1	Commercially acceptable – barely affected
2	Very slightly damaged but still commercially acceptable
3	Very slightly damaged / slight yellowing
4	Slightly damaged / stunting
5	Damaged / reduced growth
6	Damaged / reduced growth / some discolouration
7	Severely damaged / reduced growth / lots of discolouration

8	Nearly dead	
9	Dead	

Date	Week	Action	Plant species	Assessment	
Butt	no.	Addon		Assessment	
		Pre-transplant			
		assessment	Begonia, Nemesia,	Poot dovelopment plant	
19 May	20	completed. Plants	Geranium <i>, Fuchsia</i>	quality plant height (cm)	
		transplanted and	and Calibrachoa	quality, plant neight (cm)	
		trials set out			
		Treatment	Begonia, Nemesia,	Plant height (cm) plant	
02 June	22	application #1 and	Geranium <i>, Fuchsia</i>	riant neight (chi), plant	
		assessment	and Calibrachoa	quanty	
04 Juno	22	22	Elowers Dinched	Nemesia and	N1/A
04 June		Flowers Plinched	Calibrachoa	N/A	
		Treatment	Begonia, Nemesia,	Plant height (cm), plant	
16 June	24	application #2 and	Geranium <i>, Fuchsia</i>	quality, phytotoxicity, no. of	
		assessment	and Calibrachoa	plants in flower & bud	
			Begonia, Nemesia,	Plant height (cm), plant	
30 June	26	Assessment	Geranium <i>, Fuchsia</i>	quality, phytotoxicity, no. of	
			and Calibrachoa	plants in flower & bud	
14 July				Plant height (cm), plant	
	28	3 Assessment	Geranium and Fuchsia	quality, phytotoxicity, no. of	
				plants in flower & bud	

 Table 7. Summary of bedding and pot plant trial inspections and assessments, 2021

Results

The effect of each treatment on height, quality, phytotoxicity and flowering of the five plant species included in the trial was compared with the water control (**T1**). Results are tabulated for phytotoxicity (**Table 8** and **Appendix 1**), plant quality (**Table 9** and **Appendix 2**), plant height (**Table 10** and **Appendix 3**) and flowering (**Table 11** and **Appendix 4**). Images of plants from all treatments at the end of the trial can be found in **Appendix 5**.

All plants obtained for the trial, except for the *Begonias*, were of good quality prior to transplant and the pre-transplant assessment confirmed 75-100% rooting in all plugs for *Nemesia*, Geranium, *Fuchsia* and *Calibrachoa*. *Begonia* plants obtained for the trial arrived in poor condition, with 0-50% rooting in plugs, however this was consistent across all *Begonia* plants used in the trial. Sufficient plug plants were supplied to enable healthy plants to be selected for the trial.

None of the fungicides (Frupica SC, Karma, Sonata, Sercadis or Luna Privilege) assessed in this crop safety trial resulted in any detrimental effects on the five bedding and pot plant species (*Begonia, Nemesia,* Geranium, *Fuchsia* and *Calibrachoa*) that they were tested on. No symptoms of phytotoxicity were observed on these species. There were no statistical differences in plant quality, and plant height, and no delays in flowering were associated with the use of any of the fungicides assessed on the five species tested (*Begonia, Nemesia, Geranium, Fuchsia* and *Calibrachoa*).

Plant phytotoxicity scores

Phytotoxicity was recorded on *Fuchsia* two weeks after the first treatment application, where slight effects were associated with Frupica SC, Sercadis and Luna Privilege (**Table 8**, **Appendix 1**). Crop damage was not recorded in any other plant / treatment combination.

Table 8. Average plant phytotoxicity scores for bedding species two weeks after treatment one, week24, 16 June 2021. (*NS = no significant differences*)

Species	Water	Water	Frupica	Karma	Sonata	Sercadis	Luna	р	L.S.D.
	control	control +	SC				Privilege	value	
		Bonzi if							
		required							
Begonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Nemesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Geranium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Fuchsia	0.0	0.0	0.0	1.0	0.0	0.3	0.3	(NS)	-

Calibrachoa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	

Plant quality scores

No statistically significant differences in plant quality were recorded in any species / treatment combinations (**Table 9**, **Appendix 2**).

Table 9. Average plant quality score for bedding species, two weeks after treatment one, week 24, 16June 2021. (NS = no significant differences)

Species	Water	Water control +	Frupica	Karma	Sonata	Sercadis	Luna	р	L.S.D.
	control	PGR if required	SC				Privilege	value	
Begonia	3.0	3.7	3.7	3.7	3.3	3.3	4.3	(NS)	I
Nemesia	4.0	4.3	4.0	4.0	3.7	4.0	4.3	(NS)	I
Geranium	4.0	3.7	3.7	3.7	4	4	4	(NS)	-
Fuchsia	4.0	3.7	3.3	3.3	3.7	4.3	3.3	(NS)	I
Calibrachoa	3.7	3.7	3.7	3.7	3.7	3.7	3.7	(NS)	-

Plant height

No statistically significant differences in plant height were recorded in any of the species / treatment combinations two, four and six weeks after the first fungicide application (**Table 10**, **Appendix 3**).

Table 10. Average height in cm for bedding species, two weeks after treatment one, week 24, 16 June 2021. (*NS* = *no significant differences*)

Species	Water	Water control	Frupica	Karma	Sonata	Sercadis	Luna	р	L.S.D.
	control	+ PGR if	SC				Privilege	value	
		required							
Begonia	35.3	39.2	37.5	37.4	43.7	33.7	41.2	(NS)	-
Nemesia	147.2	151.0	153.3	145.7	149.9	138.1	150.6	(NS)	-
Geranium	64.3	57.7	65.8	64.0	62.6	63.5	61.4	(NS)	-
Fuchsia	157.1	157.1	149.6	161.7	159.5	157.1	140.0	(NS)	-
Calibrachoa	145.4	154.2	143.2	142.1	154.2	153.8	148.8	(NS)	-

Flowering

There were no statistically significant differences in the percentage of plants in flower for any species / treatment combinations by two, four and six weeks after the first fungicide application (**Table 11, Appendix 4**). None of the Geranium plants flowered during the trial, so no flowering data was obtained for this species.

 Table 11. Average number of plants in flower for bedding species, 2 weeks after the first fungicide application, week 24, 16 June 2021. (NS = no significant differences)

Species	Water	Water control	Frupica	Karma	Sonata	Sercadis	Luna	р	L.S.D.
	control	+ PGR if	SC				Privilege	value	
		required							
Begonia	18.3	20.0	12.7	14.3	15.0	6.3	16.0	(NS)	-
Nemesia	12.0	12.0	11.3	12.0	11.7	11.7	12.0	(NS)	-
Geranium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	-
Fuchsia	0.7	0.7	0.3	0.0	0.3	0.7	0.3	(NS)	-
Calibrachoa	12.0	12.0	12.0	12.0	12.0	12.0	12.0	(NS)	-

Discussion

All the fungicides assessed have activity against *Botrytis* and are authorised for use in ornamental plant production under extensions of authorisations for minor use. Growers should note that Sonata, Sercadis and Frupica SC are protectant fungicides and will be most effective when used in spray programmes to prevent *Botrytis*. Karma has eradicant properties and so is best used when *Botrytis* is present within crops.

The water volume used in these trials (500 litres water per hectare) may be lower than the rate currently used by growers and as such application rates or volumes may need to be adjusted for different water volumes.

Fungicide modes of action (MOA) are classified by the Fungicide Resistance Action Committee (FRAC), who use different numbers and letter combinations to distinguish fungicide MOA groups. Using fungicides with different FRAC codes prevents the development of fungicide resistance. These trials have identified fungicides with three different FRAC codes (**Table 2**) that are safe to use in the prevention and control of *Botrytis* by bedding and pot plant growers as part of a planned fungicide resistance prevention strategy; Karma is not classified (nc) by FRAC.

Conclusions

The results obtained in this trial have identified five fungicides (Frupica, Karma, Sonata, Sercadis, and Luna Privilege) with relatively new EAMUs for use in ornamental plant production that have proven to be crop safe on the five plant species tested (*Begonia semperflorens* 'Heaven Red', *Nemesia* 'Lady Lisa', Geranium 'Horizon Red', *Fuchsia* 'Brutus', *and Calibrachoa* 'Cabaret Cherry Rose'). These results should give growers the confidence to start to integrate these fungicides into their spray programmes for the prevention and control of *Botrytis*.

A limited number of plant species have been tested within this trial and growers are advised to test spray new or unfamiliar fungicides on a small number of untested plant varieties or cultivars prior to large scale use on commercial crops.

Sonata and Sercadis have the same FRAC code so only one of these products should be used in fungicide programmes to minimise the risk of fungicide resistance developing.

Acknowledgements

Our thanks to:

- Bordon Hill Nurseries, Adama Agricultural Solutions UK Ltd, Certis, BASF, Syngenta UK Limited for the provision of plants and materials.
- The Scientific Support team at ADAS.
- The Management Group and Chris Need for steering the project.

Phytotoxicity scores

Species	Water	Water control + Bonzi if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Nemesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Geranium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Fuchsia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	-
Calibrachoa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	

Table 1. Average plant phytotoxicity score for Fuchsia, four weeks after treatment one, week 26, 30 July 2021. (*NS = no significant differences*)

Table 2	. Average p	lant phytotoxicity	score for Fuchsia,	six weeks after	treatment one, w	veek 28, 1	14 July 2021.	(NS = no	significant differences)
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Species	Water	Water control + Bonzi if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Nemesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Geranium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	
Fuchsia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	-
Calibrachoa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(NS)	

Plant quality scores

Species	Water	Water control + PGR if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	4.7	5.0	4.0	4.3	5.0	4.0	5.0	(NS)	-
Nemesia	4.7	4.3	4.7	4.7	4.3	4.7	4.7	(NS)	-
Geranium	5.0	4.7	5.0	5.0	5.0	5.0	5.0	(NS)	-
Fuchsia	4.7	4.7	5.0	4.7	5.0	4.7	4.7	(NS)	-
Calibrachoa	4.7	4.7	4.3	4.7	4.7	4.7	4.3	(NS)	-

Table 1. Average plant quality score for bedding species, four weeks after treatment one, week 26, 30 June 2021. (NS = no significant differences)

Table 2. Average plant quality score for bedding species, six weeks after treatment or	ne, week 28, 14 July 2021. (NS = no significant differences)
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Species	Water	Water control + PGR if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(NS)	-
Nemesia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(NS)	-
Geranium	5.0	4.3	4.7	5.0	5.0	5.0	5.0	(NS)	-
Fuchsia	5.0	5.0	5.0	5.0	5.0	4.7	5.0	(NS)	-
Calibrachoa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(NS)	-

Plant height

Species	Water	Water control + PGR if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	67.1	76.7	77.1	80.0	86.2	73.3	89.8	(NS)	-
Nemesia	192.9	195.0	197.9	187.5	192.1	174.6	197.1	(NS)	-
Geranium	87.9	82.9	97.5	88.8	92.9	99.2	86.2	(NS)	-
Fuchsia	220.0	224.6	213.8	222.1	222.5	218.3	192.5	(NS)	-
Calibrachoa	170.0	183.3	165.0	176.7	177.1	179.2	171.2	(NS)	-

Table 1. Average height (cm) for bedding species, four weeks after treatment one, week 26, 30 June 2021. (NS = no significant differences)

 Table 2.
 Average height (cm) for bedding species, six weeks after treatment one, week 28, 14 July 2021. (NS = no significant differences)

Species	Water	Water control + PGR if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(NS)	-
Nemesia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(NS)	-
Geranium	116.7	108.3	135.8	116.7	133.8	137.5	120.8	(NS)	-
Fuchsia	278.3	282.9	292.9	281.7	294.6	272.1	253.3	(NS)	-
Calibrachoa	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(NS)	-

Number of plants in flower

Table 1. Average number of plants in flower for bedding species, four weeks after the first fungicide application, week 26, 30 June 2021. (*NS* = no significant differences)

Species	Water	Water control + PGR if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	24.00	23.67	21.67	23.33	24.00	22.67	24.00	(NS)	-
Nemesia	12.00	12.00	11.33	12.00	11.67	11.67	12.00	(NS)	-
Geranium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(NS)	-
Fuchsia	0.67	0.67	0.33	0.00	0.33	0.67	0.33	(NS)	-
Calibrachoa	12.00	12.00	12.00	12.00	12.00	12.00	12.00	(NS)	-

Table 2. Average number of plants in flower for bedding species, six weeks after treatment one, week 28, 14 July 2021. (NS = no significant differences)

Species	Water	Water control + PGR if	Frupica SC	Karma	Sonata	Sercadis	Luna	p value	L.S.D.
	control	required					Privilege		
Begonia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(NS)	-
Nemesia	12.00	12.00	12.00	12.00	11.67	12.00	12.00	(NS)	-
Geranium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(NS)	-
Fuchsia	6.67	6.67	4.33	4.67	4.67	5.00	1.33	(NS)	-
Calibrachoa	11.67	11.33	11.67	11.00	11.33	12.00	12.00	(NS)	-

a. Begonia semperflorens 'Heaven Red', 14 July 2021.



Water control (left) vs water + PGR (right)



Water control (left) vs Frupica (right)



Water control (left) vs Sonata (right)



Water control (left) vs Karma (right)



Water control (left) vs Luna Privilege (right)

Water control (left) vs Sercadis (right)

b. *Nemesia* 'Lady Lisa', 14 July 2021.



Water control (left) vs water + PGR (right)



Water control (left) vs Frupica (right)



Water control (left) vs Karma (right)



Water control (left) vs Sonata (right)



Water control (left) vs Sercadis (right)



Water control (left) vs Luna Privilege (right)

c. Geranium' 'Horizon Red', 14 July 2021.



Water control (left) vs Frupica (right)



Water control (left) vs water + PGR (right)



Water control (left) vs Karma (right)





Water control (left) vs Sercadis (right)



Water control (left) vs Luna Privilege (right)

d. Fuchsia 'Brutus', 14 July 2021.



Water control (left) vs water + PGR (right)



Water control (left) vs Frupica (right)



Water control (left) vs Karma (right)



Water control (left) vs Sonata (right)



Water control (left) vs Sercadis (right)



Water control (left) vs Luna Privilege (right)

e. Calibrachoa 'Cabaret Cherry Rose', 14 July 2021.



Water control (left) vs water + PGR (right)



Water control (left) vs Frupica (right)



Water control (left) vs Karma (right)



Water control (left) vs Sonata (right)



Water control (left) vs Sercadis (right)



Water control (left) vs Luna Privilege (right)