Grower Summary

PO 019a

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

PGRs for use on bedding plant plugs objective 3

Annual report 2019

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Project title:	The Bedding and Pot Plant Centre – new product opportunities for bedding and pot plant growers. ***Objective 3****. To evaluate plant growth regulators for use on bedding plant plugs prior to transplant*
Project number:	PO 019a
Project leader:	Dr Jill England, ADAS Boxworth
Report:	Annual report, 31 March 2019
Previous report:	None
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Grower Summary

Headline

- New recommended plant growth regulator (PGR) drench treatments for use on bedding plant plugs include: Terpal, Dazide Enhance and Pirouette on Geranium 'Horizon'; Pirouette on Pansy 'Matrix'.
- Treatments not recommended due to phytotoxicity at trial rates include: Primo Maxx II on *Dianthus* 'Festival' and Geranium 'Horizon'; HDC P005 on *Dianthus* 'Festival'.
- Pirouette was the most effective drench treatment on Pansy.

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 evaluate plant growth regulators for use on bedding plant plugs prior to transplant.*

Summary

The evaluation of new plant growth regulators (PGRs) for use on bedding and pot plants was prompted by label changes to the plant growth regulator Bonzi (paclobutrazol), including removal of the option for drench application, and the potential restrictions or loss of approval for the use of chlormequat in protected ornamental plant production. Gowers sometimes apply PGRs as drenches and have developed application rates specific to the crops grown under nursery specific growing conditions. The PGRs included in this trial have either been trialled in Denmark with promising results on bedding and pot plants, are new to the market or have recently received CRD approval for use on related crops in the UK. However, any phytotoxic effects and efficacy of these chemicals on bedding and pot plants grown under UK conditions are currently unknown.
This particular piece of work was prompted by trials work carried out in 2017, where sprays and drenches of the PGRs used were applied to a range of species post transplanting into packs, and post potting / transplanting into pots. Many of the drench applications produced

too strong an effect, drench applications are also labour intensive and thus expensive to apply. This, combined with the fact that a number of the plant growth regulators in this trial were not at the time authorised for use on ornamentals, with the potential for restrictions on the amount of active that can be applied per hectare (once approvals were issued), prompted interest in drenching plugs with small doses of active ingredient prior to transplanting. There is also the potential to explore drenching plugs in a closed, tray based system to minimise any potential environmental effects.

A range of plant growth regulators were trialled on four seed-raised bedding plant species (*Dianthus* 'Festival' violet; Geranium 'Horizon' red; Pansy 'Matrix' red blotch and *Osteospermum* 'Akila' purple). Plug plants were treated with PGRs whilst in the plug trays in week 22 (29 May 2018), at a rate of 10% of the tray volume, using the products at a concentration calculated to provide the same quantity of product as if treatments had been applied as a spray at 300 L/ hectare. Plugs were then transplanted two days later (31 May 2018, week 22), at Baginton Nurseries, using standard six-packs for the *Dianthus*, Geranium and Pansy, and jumbo six-packs for the *Osteospermum*.

Products tested are listed in **Table 1**. Due to the relatively small plug cell size, and the number of plugs per treatment (36), plug plants were grouped into treatments within the plug tray and each PGR drench treatment was applied with a syringe over the plants, to ensure the correct amount of active ingredient was applied to each plug plant. *Dianthus* and Geranium were sown into a 288-cell tray, the volume of the 36 cells to be treated was 441 cm^3, meaning a 10% drench would be 44.1 ml per treatment. This equated to 14.7 ml per row of 12 plants. *Osteospermum* and Pansy were sown into 240-cell trays, the volume of the 36 cells to be treated was 544 cm^3, meaning a 10% drench would be 54.4 ml per treatment. This equated to 18 ml per row of 12 plants. Treatment solutions were made up in plastic containers, one for each treatment, which was enough for all species requiring that treatment. Treatments were applied to plants using a syringe, one for each treatment, treating one row at a time.

Plants were then transplanted into packs two days later, and no further PGR treatments were applied.

Table 1. Approval status of PGR products tested in 2018

Product	Active ingredient	Approval status
Dazide Enhance	Daminozide	On-label approval for spray application
HDC P005	-	Not approved on protected ornamentals in the UK
Moddus (MAPP 15151)	Trinexapac-ethyl	EAMU 3062/10 for spray application. One application only permitted per crop

Pirouette (MAPP 17203)	Paclobutrazol	On-label approval for spray application. EAMU 1269/17 for drench application
Primo Maxx II (MAPP 17509)	Trinexapac-ethyl	EAMU 0621/18 for spray application issued 22.03.18
Regalis Plus (MAPP 16485)	Prohexadione	EAMU 0181/15 for spray application. Three weeks must be allowed between applications
Terpal (MAPP 16436)	Ethephon + mepiquat chloride	EAMU 0151/18 for foliar drench application issued 30.01.18

Unauthorised or off-label treatments applied under experimental permit.

Treatments applied in this trial were developed using the 2017 trial results as a guide, therefore the treatment list for each species was different (**Table 2** - **Table 5**). For *Osteospermum*, where there were no trials in 2017, products were applied at full label rate.

Table 2. PGR product and treatment list 2018 – *Dianthus*

Trt No.	Product	Active ingredient	Application method*	Dose rate (L/ha)**	Dose rate (ml/L)
1	Water control	N/A	Drench	N/A	N/A
2	HDC P005	-	Drench***	0.337 L/ha	1.12 ml/L (1/2 rate)
3	HDC P005	-	Drench***	0.505 L/ha	1.68 ml/L (3/4 rate)
4	Primo Maxx II	Trinexapac-ethyl	Drench***	1.0 L/ha	3.33 ml/L (1/2 rate)
5	Primo Maxx II	Trinexapac-ethyl	Drench***	1.5 L/ha	5.0 ml/L (3/4 rate)
6	Pirouette	Paclobutrazol	Drench	0.3 L/ha	1.0 ml/L

*Drenches were applied by hand with a syringe, at 10% of the tray volume. **Products used at a concentration calculated to provide the same quantity of product as if treatments had been applied as a spray at 300 L/ hectare. ***Treatments applied under experimental permit.

Table 3. PGR product and treatment list 2018 – Geranium

Trt No.	Product	Active ingredient	Application method*	Dose rate (L/ha)**	Dose rate (ml/L)
1	Water control	N/A	Drench	N/A	N/A
2	HDC P005	-	Drench***	0.169 L/ha	0.56 ml/L (1/4 rate)
3	HDC P005	-	Drench***	0.337 L/ha	1.12 ml/L (1/2 rate)
4	Terpal	Ethephon + mepiquat chloride	Drench	0.5 L/ha	1.67 ml/L (1/4 rate)
5	Terpal	Ethephon + mepiquat chloride	Drench	1.0 L/ha	3.33 ml/L (1/2 rate)
6	Regalis Plus	Prohexadione	Drench***	0.31 L/ha	1.03 g/L (1/4 rate)
7	Regalis Plus	Prohexadione	Drench***	0.62 L/ha	2.08 g/L (1/2 rate)
8	Dazide Enhance	Daminozide	Drench***	0.45 L/ha	1.5 g/L (1/4 rate)
9	Dazide	Daminozide	Drench***	0.9 L/ha	3.0 g/L (1/2 rate))

	Enhance				
10	Primo Maxx II	Trinexapac-ethyl	Drench***	0.5 L/ha	1.67 ml/L (1/4 rate)
11	Primo Maxx II	Trinexapac-ethyl	Drench***	1.0 L/ha	3.33 ml/L (1/2 rate)
12	Moddus	Trinexapac-ethyl	Drench***	0.15 L/ha	0.5 ml/L (1/4 rate)
13	Moddus	Trinexapac-ethyl	Drench***	0.3 L/ha	1.0 ml/L (1/2 rate)
14	Pirouette	Paclobutrazol	Drench	0.3 L/ha	1.0 ml/L

* Drenches were applied by hand with a syringe, at 10% of the tray volume. **Products used at a concentration calculated to provide the same quantity of product as if treatments had been applied as a spray at 300 L/ hectare. ***Treatments applied under experimental permit.

Table 4. PGR product and treatment list 2018 – Pansy

Trt No.	Product	Active ingredient	Application method*	Dose rate (L/ha)**	Dose rate (ml/L)
1	Water control	N/A	Drench	N/A	N/A
2	HDC P005	-	Drench***	0.337 L/ha	1.12 ml/L (1/2 rate)
3	HDC P005	-	Drench***	0.505 L/ha	1.68 ml/L (3/4 rate)
4	Pirouette	Paclobutrazol	Drench	0.3 L/ha	1.0 ml/L

* Drenches were applied by hand with a syringe, at 10% of the tray volume. **Products used at a concentration calculated to provide the same quantity of product as if treatments had been applied as a spray at 300 L/ hectare. ***Treatments applied under experimental permit.

Table 5. PGR product and treatment list 2018 – *Osteospermum*

Trt No.	Product	Active ingredient	Application method*	Dose rate (L/ha)**	Dose rate (ml/L)
1	Water control	N/A	Drench	N/A	N/A
2	HDC P005	-	Drench***	0.675 L/ha	2.25 ml/L (full rate)
3	Terpal	Ethephon + mepiquat chloride	Drench	2.0 L/ha	6.67 ml/L (full rate)
4	Regalis Plus	Prohexadione	Drench***	1.25 L/ha	4.17 ml/L (full rate)
5	Dazide Enhance	Daminozide	Drench***	1.8 L/ha	6.0 g/L (full rate)
6	Primo Maxx II	Trinexapac-ethyl	Drench***	2.0 L/ha	6.67 ml/L (full rate)
7	Moddus	Trinexapac-ethyl	Drench***	0.6 L/ha	2.0 ml/ L (full rate)
8	Pirouette	Paclobutrazol	Drench	0.3 L/ha	1.0 ml/L

* Drenches were applied by hand with a syringe, at 10% of the tray volume. **Products used at a concentration calculated to provide the same quantity of product as if treatments had been applied as a spray at 300 L/ hectare. ***Treatments applied under experimental permit.

Of the products included in this trial, those containing chlormequat or mepiquat chloride (Terpal) were expected to have a similar effect on plant growth as Stabilan 750; those

containing prohexadione calcium (Regalis Plus) or trinexapac-ethyl (Primo Maxx II and Moddus) were expected to have a similar effect to the more familiar daminozide products (e.g. B-nine, Dazide Enhance).

Summary of results by plant species

Dianthus 'Festival' violet

- HDC P005 (0.337 L/ha) did not provide effective growth control, and caused slight petal bleach. Growth was controlled at higher rate (0.505 L/ha), but with more severe petal bleach.
- Primo Maxx II (1.0 L/ha and 1.5 L/ha) did control growth but caused phytotoxicity.
- Pirouette did not cause phytotoxicity but the plants were too compact, and flowers were not sufficiently high above the pack as the dose rate / or volume applied was too high.
- None of the treatments were particularly suitable as drenches prior to transplant. Other than Pirouette, those that did provide growth control also caused phytotoxicity (foliar and petal bleach).

Geranium 'Horizon' red

- Although HDC P005 and Regalis Plus did not cause phytotoxicity at the rates tested, they did not provide adequate growth control.
- Primo Maxx caused phytotoxicity including petal bleach.
- Terpal gave good growth control with no phytotoxicity, although flowering was delayed.
- Dazide Enhance (0.45 L/ha) showed potential, with good growth control and no phytotoxicity.
- Moddus at 0.15 L/ha has potential; the higher rate (0.3 L/ha) caused phytotoxicity.
- Pirouette 0.3 L/ha has potential, producing compact plants with a good flower colour.

Pansy 'Matrix' red blotch

- HDC P005 did not cause phytotoxicity at the rates tested, but neither did it provide adequate growth control.
- Pirouette did not cause any phytotoxicity, and has potential as a treatment on Pansy.

Osteospermum 'Akila' purple

- HDC P005 and Regalis Plus showed promise, with good growth control, and no phytotoxicity.
- Primo Maxx II and Moddus did not show signs of phytotoxicity by week 30, but plants were perhaps too compact.
- Pirouette did not show signs of phytotoxicity, but did not control growth adequately.

- Dazide Enhance did not provide growth control, the plants were taller than the water only control.
- Terpal caused distortion to the foliage early on, which the plants did not grow away from, and flowering was also delayed.

Financial benefits

The evaluation of plant growth regulators (PGRs) either approved in the UK or in other European Countries for use on bedding plants (spray and drench application), followed by appropriate AHDB EAMU applications will expand the range of active ingredients available to growers for controlling plant growth. Whilst growers do use cultural methods (e.g. temperature, diff/drop, controlling irrigation and nutrient supply) to control plant growth where possible, species specific responses and a lack of cost effective PGRs approved for use on protected ornamentals would reduce the range of plants that can be produced profitably within client specifications. PGRs are particularly important when used to hold mature crops at specified height during periods of low demand where other methods would lead to unacceptable effects e.g. leaf yellowing. The cost per litre of spray solution applied in this trial at the specified rates ranged from 88.2p to 0.09p (**Table 6**) and provides greater opportunity to increase profit through reduced input cost. The ability to apply PGRs to plants in the plug tray prior to transplant would not only reduce costs by reducing the amount of product needed, but would also save on labour in terms of application time per plant.

Table 6. PGR costs (non-discounted, excluding VAT and labour costs for application)

Product and rate	Cost of active (p)	Cost / L of spray (p)
Bonzi	9.5 / ml	11.9
Dazide Enhance (1.5; 3.0; 6.0 g/L)	14.7 / g	22.1; 44.1; 88.2
HDC P005 (0.56; 1.12; 1.68; 2.25 g/L)	2.2 /g	1.2; 2.5; 3.7; 5.0
Moddus (0.5; 1.0; 2.0 ml/L)	3.9 / ml	2.0; 3.9; 7.8
Pirouette (1.0 ml/L)	0.09 / ml	0.09
Primo Maxx II (1.67; 3.33; 5.0; 6.67 ml/L)	5.0 / ml	8.4; 16.7; 25; 33.4
Regalis Plus (1.03; 2.08; 4.17 g/L)	12.3 / g	12.7; 25.6; 51.3
Terpal (1.67; 3.33; 6.67 ml/L)	1.7 / ml	2.8; 5.7; 11.3

Action points

- Useful growth regulator effects were achieved with treatments of Pirouette 0.3 L/ha and Terpal 0.5 L/ha and may be worth further evaluation on a range of other crops on nurseries.
- Growers should test new or unfamiliar products on a small number of plants before large scale use.
- Growers should familiarise themselves with and adhere to product labels, approvals and Extensions of Approval for Minor Use (EAMUs) prior to use. Note that a number

of the treatments included in this trial have been carried out under experimental permit and are not currently authorised for nursery use in the UK.