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## Grower Summary

### **PO 019a**

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

PGRs for use on bedding plants post transplanting

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 2.** *To evaluate plant growth regulators for use on bedding and pot plants*

**Project number:** PO 019a

**Project leader:** Dr Jill England, ADAS Boxworth

**Report:** Annual report, 31 March 2019

**Previous report:** None

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**Location of project:** Baginton Nurseries, Coventry, Warwickshire

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

**Date project commenced:** 1 April 2017

**Date project completed (or expected completion date):** 31 March 2019

# Grower Summary

## Headline

- Effective post-transplant plant growth regulator (PGR) treatments were identified for Geranium 'Horizon' red and *Osteospermum* 'Akila' purple.
- Although none of the treatments evaluated gave effective and crop-safe growth control of *Dianthus* 'Festival' violet or Pansy 'Matrix' red blotch, with rate adjustment, some of the products may prove effective.

## 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 2.** To evaluate plant growth regulators for use on bedding and pot plants

## 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. Growers sometimes apply PGRs as drenches, particularly during propagation, 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.

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). Plants were transplanted in week 21 (22 May 2018), 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**. Sprays were applied by hand using a backpack and single nozzle lance, with an 02f110 nozzle, to achieve a fine spray quality, in a water volume of 300 L/ha (note this may be lower than the rate currently used by growers). All treatments were applied during late afternoon with shade screens over the crop prior to treatment. For the drenches, treatments were applied with a watering can at 10% of the pack volume, resulting in 135 ml applied to each pack as the drench.

Treatments were applied as a foliar spray or drench at one week post-transplant, and then after a further 10 days (29 May and 08 June respectively).

**Table 1.** Approval status of PGR products tested in 2018

| Product  | Active ingredient | Approval status                              |
|----------|-------------------|--|
| HDC P005 | -                 | Not approved on protected ornamentals in the |

|                               |                              | UK   |
|-------------------------------|------------------------------|--|
| Moddus<br>(MAPP 15151)        | Trinexapac-ethyl             | EAMU 3062/10 for spray application. One application only permitted per crop          |
| Pirouette<br>(MAPP 17203)     | Paclobutrazol                | On-label approval for spray application. EAMU 1269/17 for drench application         |
| Primo Maxx II<br>(MAPP 17509) | Trinexapac-ethyl             | EAMU 0621/18 for spray application issued 22.03.18                                   |
| Regalis Plus<br>(MAPP 16485)  | Prohexadione                 | EAMU 0181/15 for spray application. Three weeks must be allowed between applications |
| Terpal<br>(MAPP 16436)        | Ethephon + mepiquat chloride | EAMU 0151/18 for 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                | Spray               | N/A              | N/A                   |
| 2       | HDC P005      | -                  | Spray**             | 0.505 L/ha       | 1.68 ml/L (3/4 rate)  |
| 3       | HDC P005      | -                  | Spray**             | 0.675 L/ha       | 2.25 ml/L (full rate) |
| 4       | HDC P005      | -                  | Drench**            | 0.337 L/ha       | 1.12 ml/L (1/2 rate)  |
| 5       | HDC P005      | -                  | Drench**            | 0.505 L/ha       | 1.68 ml/L (3/4 rate)  |
| 6       | Primo Maxx II | Trinexapac-ethyl** | Drench**            | 1.0 L/ha         | 3.33 ml/L (1/2 rate)  |
| 7       | Primo Maxx II | Trinexapac-ethyl** | Drench**            | 1.5 L/ha         | 5 ml/L (3/4 rate)     |
| 8       | Pirouette     | Paclobutrazol      | Spray               | 0.3 L/ha         | 1 ml/L                |
| 9       | Pirouette     | Paclobutrazol      | Drench              | 0.3 L/ha         | 1 ml/L                |

\*Foliar sprays applied in 300 L water/ha. Drenches were applied by hand with a watering can with a rose head fitting, at 10% of the pack volume. \*\* 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                          | Spray               | 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 | Spray**             | 1.0 L/ha         | 3.33 ml/L (1/2 rate) |

|    |                                     |                              |          |           |                      |
|----|-------------------------------------|------------------------------|----------|-----------|----------------------|
| 5  | Terpal                              | Ethephon + mepiquat chloride | Spray**  | 1.5 L/ha  | 5 ml/L (3/4 rate)    |
| 6  | Terpal                              | Ethephon + mepiquat chloride | Drench   | 0.5 L/ha  | 1.67 ml/L (1/4 rate) |
| 7  | Terpal                              | Ethephon + mepiquat chloride | Drench   | 1.0 L/ha  | 3.33 ml/L (1/2 rate) |
| 8  | Regalis Plus -<br><b>1 app only</b> | Prohexadione                 | Drench** | 0.31 L/ha | 1.03 g/L (1/4 rate)  |
| 9  | Regalis Plus -<br><b>1 app only</b> | Prohexadione                 | Drench** | 0.62 L/ha | 2.08 g/L (1/2 rate)  |
| 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 - <b>1 app only</b>          | Trinexapac-ethyl             | Drench** | 0.15 L/ha | 0.5 ml/L (1/4 rate)  |
| 13 | Moddus - <b>1 app only</b>          | Trinexapac-ethyl             | Drench** | 0.3 L/ha  | 1 ml/L (1/2 rate)    |
| 14 | Pirouette                           | Paclobutrazol                | Spray    | 0.3 L/ha  | 1 ml/L               |
| 15 | Pirouette                           | Paclobutrazol                | Drench   | 0.3 L/ha  | 1 ml/L               |

\*Foliar sprays applied in 300 L water/ha. Drenches were applied by hand with a watering can with a rose head fitting, at 10% of the pack volume. \*\* 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                          | Spray               | N/A              | N/A                   |
| 2       | HDC P005      | -                            | Spray**             | 0.505 L/ha       | 1.68 ml/L (3/4 rate)  |
| 3       | HDC P005      | -                            | Spray**             | 0.675 L/ha       | 2.25 ml/L (full rate) |
| 4       | HDC P005      | -                            | Drench**            | 0.337 L/ha       | 1.12 ml/L (1/2 rate)  |
| 5       | HDC P005      | -                            | Drench**            | 0.505 L/ha       | 1.68 ml/L (3/4 rate)  |
| 6       | Terpal        | Ethephon + mepiquat chloride | Spray**             | 1.0 L/ha         | 3.33 ml/L (1/2 rate)  |
| 7       | Terpal        | Ethephon + mepiquat chloride | Spray**             | 1.5 L/ha         | 5 ml/L (3/4 rate)     |
| 8       | Pirouette     | Paclobutrazol                | Spray               | 0.3 L/ha         | 1 ml/L                |
| 9       | Pirouette     | Paclobutrazol                | Drench              | 0.3 L/ha         | 1 ml/L                |

\*Foliar sprays applied in 300 L water/ha. Drenches were applied by hand with a watering can with a rose head fitting, at 10% of the pack volume. \*\* 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               | Spray               | N/A              | N/A                   |
| 2       | HDC P005      | -                 | Spray**             | 0.675 L/ha       | 2.25 ml/L (full rate) |

|   |                                  |                              |         |           |                       |
|---|----------------------------------|------------------------------|---------|-----------|-----------------------|
| 3 | Terpal                           | Ethephon + mepiquat chloride | Spray** | 2.0 L/ha  | 6.67 ml/L (full rate) |
| 4 | Regalis Plus - <b>1 app only</b> | Prohexadione                 | Spray   | 1.25 L/ha | 4.17 ml/L (full rate) |
| 5 | Primo Maxx II                    | Trinexapac-ethyl             | Spray   | 2.0 L/ha  | 6.67 ml/L (full rate) |
| 6 | Moddus - <b>1 app only</b>       | Trinexapac-ethyl             | Spray   | 0.6 L/ha  | 2 ml/ L (full rate)   |
| 7 | Pirouette                        | Paclobutrazol                | Spray   | 0.3 L/ha  | 1 ml/L                |

\*Foliar sprays applied in 300 L water/ha. Drenches were applied by hand with a watering can with a rose head fitting, at 10% of the pack volume. \*\* Treatments applied under experimental permit. Of the products included in this trial, those containing chlormequat or mepiquat chloride (Terpal and HDC P005) were expected to have a similar effect on plant growth as Stablan 750; those containing prohexadione calcium (Regalis Plus, HDC P005) 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).

### **Results by plant species**

#### Dianthus 'Festival' violet

- Height was significantly controlled by all treatments (apart from the Pirouette spray, 0.3 L/ha), but the effect was too strong and the plants were too compact. Reducing the dose rate, or the drench volume should provide acceptable height control.
- While Pirouette applied as a spray at 0.3 L/ha did not control growth, it is likely to prove effective with an adjustment to the dose rate. Pirouette did not cause phytotoxicity.
- There were more plants in flower in the Pirouette spray treatment compared to the untreated control by week 25; all other treatments had fewer plants in flower.
- All rates of HDC P005 and Primo Maxx II, as sprays or drenches, caused phytotoxicity, with foliage and / or petal bleach.

#### Geranium 'Horizon' red

- Spray treatments of Terpal at both rates tested were effective in controlling growth compared with the untreated control; Pirouette applied as a spray was less effective at the dose rates used.
- Drench treatments of Terpal, Regalis Plus, Primo Maxx II (high rate), Moddus (high rate) and Pirouette were all too strong; the plants were too compact.
- Sprays of Terpal and Pirouette did not cause phytotoxicity. All other treatments caused foliar and petal bleach. The high rate drenches of Terpal and Regalis Plus caused some plant death.

- Flowering was delayed in the Terpal spray treatments only.

#### Pansy 'Matrix' red blotch

- Although plants treated with Terpal (both spray dose rates) were shorter than the control, and did not cause phytotoxicity, they did not appear to provide sufficient growth control in this trial. However, with an adjustment to spray rates, Terpal may provide effective treatments.
- Similarly, HDC P005 (0.505 L/ha) applied as a spray may prove effective with an adjustment to dose rates, but it should be noted HDC P005 applied as a spray caused petal bleach on the early flowers; later flowers were not affected.
- The Pirouette spray rates were too low to control growth, while the drench treatment 0.3 L/ha was too strong.
- The HDC P005 (0.505 L/ha) drench caused severe phytotoxicity with petal bleach, while the lower dose rate drench 0.337 L/ha was not effective, but also caused phytotoxicity
- None of the treatments significantly reduced flowering compared with the untreated control.

#### Osteospermum 'Akila' purple

- The majority of treatments provided some growth control compared with the untreated control, most notably HDC P005 and Regalis Plus.
- The Moddus spray did not control height.
- None of the treatments caused phytotoxicity, and did not adversely affect either flowering time or the number of plants in flower.

#### **Summary**

- The most promising product on *Dianthus* was Pirouette, however further work is needed to determine the most effective spray rate for this species.
- Terpal applied as a spray was the most promising PGR on Geranium and has potential for use at rates between 1.0 – 1.5 L/ha.
- Terpal, Pirouette and HDC P005 applied as sprays had some potential on Pansy, however further work may be required to find the most appropriate rates. Given the fact that HDC P005 can cause petal bleach on Pansy, Terpal is likely to be a safer option.
- All of the new products produced too strong an effect when applied as drenches at the rates tested. Pirouette (paclobutrazol) was also too strong when applied as a drench, highlighting the importance of not applying high rates when using PGRs as drenches.



## 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, they often induce 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 as part of the trial, at the specified rates, range from 51.3p to 0.09p (**Table 6**) and provide greater opportunity to increase profit through reduced input cost.

**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                  |
| 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; 5.0; 6.67 ml/L )       | 1.7 / ml           | 2.8; 5.7; 8.5; 11.3   |

Regalis Plus and Moddus received a single treatment; all other products received two treatments due to label requirements.

## Action points

- Growers should examine the potential of spray treatments of Terpal on Pansy and Geranium, and Pirouette on *Dianthus* to achieve growth control, but dose rates may need to be adjusted.
- Growers should also explore drench treatments of Terpal on Geranium at low rates, and at higher rates on Pansy.
- 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.

- Growers should note that that the spray rate used in the trials (300 litres per hectare) may be lower than the rate currently use and as such application rates or volumes may need to be adjusted to maintain the same application rate of active ingredient.