



Grower Summary

PO 019b

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

Objective 3. To evaluate efficacy and phytotoxicity of a range of plant growth regulators (PGRs), a fungicide, a seaweed based nutrient and Stena (adjuvant) on Poinsettia, and their effect on marketability.

Annual Report

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

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Project number: PO 019b

Project leader: Dr Jill England, ADAS Boxworth

Report: Final Report 31 March 2020

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Date project completed: 31 March 2020

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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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Signature  Date 30 April 2020

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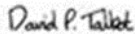
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Grower Summary

Headline

- Bonzi (paclobutrazol, 0.35 ml/L), Terpal (ethephon + mepiquat chloride, 1.67 ml/L) and Stabilan 750 (chlormequat) provided effective growth control of Poinsettia alone and within spray programmes.
- The addition of the adjuvant Stena effectively halved the dose rate required of Stabilan 750 and Terpal to achieve a 'full dose rate' effect on growth.
- Bonzi had a stronger effect when applied in water volumes greater than 300 L/ha.
- Control (seaweed-based nutrient) and Topas (penconazole) are safe to use on Poinsettia (as a nutrient and fungicide respectively), but may impact plant height.

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 British Protected Ornamental Association (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 the efficacy and phytotoxicity of a range of plant growth regulators (PGRs) (either approved in the UK or in other European Countries), a fungicide, a seaweed based nutrient and Stena (adjuvant) on Poinsettia, and their effect on marketability.*

Summary

Whilst growers use a range of cultural methods (e.g. temperature manipulation, deficit irrigation and management of the nutrient supply) to control plant growth where possible, lack of cost effective plant growth regulators (PGRs) approved for use on protected ornamentals would potentially reduce the range of products that can be produced profitably within challenging customer specifications. PGRs are particularly important when used to hold mature crops at specified height during periods of low demand where other physical/cultural methods could lead to unmarketable plants. PGRs, in conjunction with techniques such as graphical tracking, ensure poinsettias meet multiple retailer specifications throughout the production process regardless of environmental growing conditions.

A range of plant growth regulators, a fungicide, a seaweed-based fertiliser and an adjuvant (**Table 1**) were trialled on the Poinsettia variety 'Infinity' (Dummen) at Newey Roundstone Nurseries, Chichester for phytotoxicity and efficacy in controlling height. Rooted cuttings were potted into 13 cm pots (peat and perlite mix; liquid feed using Peters Excel Grower 15:5:15 + 7 CAO + 3 MgO + TE + calcium nitrate applied to an EC of 2.0) in week 30 and pinched in week 33. The trial was set out on 14 open-mesh benches covered with capillary matting and mypex prior to the first treatment. Plants were spaced in weeks 37 (9 September 2019) and 43 (22 October 2019).

Plants were arranged as two trials; the main (fully replicated) trial, treatments 1-13 (**Table 2**) and observation (non-replicated) plots, treatments OBS1-3 (**Table 3**). For the main trial, five treatment applications were made between weeks 39 and 43, followed by an overspray of Bonzi (0.50 ml/L, 300 L/ha water) to all plots except for the water only control in week 44. Graphical tracking was used to confirm if products would be applied, as used in commercial practice. Plant height was measured weekly from the top of the pot to the base of the tallest growing tip. Plant height graphs with graphical tracking are presented in **Appendix 2**. For the observation plots, either a single treatment application (OBS 1 and OBS 3), or six treatment applications (OBS 2) were made. All products were applied under full or EAMU approval (**Table 1**).

Sprays were applied by hand using a backpack and a 1.5 m boom (three 02f110 nozzles) to achieve a fine spray quality, in a water volume of 300 L/ha, except for treatment T10 (Bonzi, 0.35 ml/L) which was applied in 600 L/ha water. All treatments were applied during late afternoon / early evening with shade screens placed over the crop prior to treatment when appropriate. Growing media was moist when treatments were applied, and plants were not watered for 24 hours after treatment.

Table 1. PGR product list and approval status

T	Product		Active ingredient	Approval status
1	Terpal (MAPP 16463)	PGR	ethephon and mepiquat (as chloride)	EAMU 0151/18
2	Bonzi (MAPP 17095)	PGR	paclobutrazol	Label approval
3	Stabilan 750 (MAPP 09303)	PGR	chlormequat	EAMU 1416/17
4	Stena (ADJ 0895)	Adjuvant	polyglycerol based adjuvant	Label approval
5	Topas (MAPP 16765)	Fungicide	penconazole	EAMU 0169/19
6	Control	Fertiliser	seaweed based nutrients	n/a

Table 2. Main trial. Treatment list 2019

Treatment	Spray 1	Spray 2	Spray 3	Spray 4	Spray 5	Spray 6**
1	Water	Water	Water	Water	Water	Water
2	Stabilan 750, 0.5 ml/L; 0.15 L/ha	Stabilan 750, 0.5 ml/L; 0.15 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
3	Stabilan 750 + Stena, 0.25 ml/L + 2.5 ml/L; 0.075 L/ha + 0.75 L/ha	Stabilan 750 + Stena, 0.25 ml/L + 2.5 ml/L; 0.075 L/ha + 0.75 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
4	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
5	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
6	Stabilan 750, 0.5 ml/L; 0.15 L/ha	Stabilan 750, 0.5 ml/L; 0.15 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
7	Stabilan 750 + Stena, 0.25 ml/L + 2.5 ml/L; 0.075 L/ha + 0.75 L/ha	Stabilan 750 + Stena, 0.25 ml/L + 2.5 ml/L; 0.075 L/ha + 0.75 L/ha	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Terpal + Stena, 0.83 ml/L + 2.5 ml/L; 0.25 L/ha + 0.75 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
8	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
9	Bonzi, 0.5 ml/L; 0.15 L/ha	Bonzi, 0.5 ml/L; 0.15 L/ha	Bonzi, 0.5 ml/L; 0.15 L/ha	Bonzi, 0.5 ml/L; 0.15 L/ha	Bonzi, 0.5 ml/L; 0.15 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
10*	Bonzi, 0.35 ml/L; 0.21 L/ha	Bonzi, 0.35 ml/L; 0.21 L/ha	Bonzi, 0.35 ml/L; 0.21 L/ha	Bonzi, 0.35 ml/L; 0.21 L/ha	Bonzi, 0.35 ml/L; 0.21 L/ha	Bonzi, 0.35 ml/L; 0.21 L/ha
11	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Terpal, 1.67 ml/L; 0.5 L/ha	Stabilan 750, 0.5 ml/L; 0.15 L/ha	Stabilan 750, 0.5 ml/L; 0.15 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
12	Topas, 1.67 ml/L; 0.5 L/ha	Topas, 1.67 ml/L; 0.5 L/ha	Topas, 1.67 ml/L; 0.5 L/ha	Topas, 1.67 ml/L; 0.5 L/ha	Topas, 1.67 ml/L; 0.5 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha
13	Topas, 0.83 ml/L; 0.25 L/ha	Topas, 0.83 ml/L; 0.25 L/ha	Topas, 0.83 ml/L; 0.25 L/ha	Topas, 0.83 ml/L; 0.25 L/ha	Topas, 0.83 ml/L; 0.25 L/ha	Bonzi, 0.35 ml/L; 0.105 L/ha

*Treatment 10 applied in 600 L/ha water rate. All other treatments applied at 300 L/ha. **Final holding treatment

Table 3. Observational plots. Treatment list 2019

Treatment*	Spray 1	Spray 2	Spray 3	Spray 4	Spray 5	Spray 6
Obs 1	Topas, 3.33 ml/L; 1.0 L/ha	-	-	-	-	-
Obs 2	Control 5.0 ml/L; 1.5 L/ha	Control 5.0 ml/L; 1.5 L/ha	Control 5.0 ml/L; 1.5 L/ha	Control 5.0 ml/L; 1.5 L/ha	Control 5.0 ml/L; 1.5 L/ha	Control 5.0 ml/L; 1.5 L/ha
Obs 3	Control 10.0 ml/L 3.0 L/ha	-	-	-	-	-

*Treatments applied at 300 L/ha

Following the final assessment in week 47, six plants from each of the main trial treatments including the water control, and two plants from each of the observational plots, were sleeved, placed in cardboard boxes which were open at the top, and transferred to ADAS Boxworth, where they were then entered into the shelf life room (20°C). The plants remained boxed for three days (no light). After three days, three plants from each of the main trial treatments and one plant from each of the observational plots, were removed from the boxes and placed onto the benches in a randomised trial design, with a saucer beneath each pot. The lights were turned on, set to 12 hours light/dark, and the sleeves remained on the plants. Plants were irrigated by hand to the saucer as and when required. The sleeves were removed after a further seven days. Plants remained in the shelf life room until 02 January 2020 (week 1).

None of the treatments included in this trial had a significant adverse effect on the number of heads per plant or cyathia quality, and no phytotoxicity was recorded for any treatment. The target height specification was 22 – 28 cm.

- **Stabilan 750** (0.5 ml/L) is the standard commercial treatment for Poinsettia and it was effective as expected (Treatment 2). In this treatment it was followed by applications of Bonzi (0.35 ml/L) as use of Stabilan 750 is now restricted to two applications per crop (EAMU 1416/17). When applied at the lower rate of 0.25 ml/L and combined with the adjuvant **Stena** (2.5 ml/L), height control was comparable to applying Stabilan 750 alone at the higher rate (0.5 ml/L), and bract size was slightly larger. Plants in both treatments scored well in shelf life.
- **Terpal** again proved to be an effective PGR on Poinsettia, producing plants within the height specification with no phytotoxicity (Treatment 4, 1.67 ml/l). This treatment achieved the same bract quality score as Stabilan 750 (/ Bonzi), overcoming issues with small bract size recorded in previous trials. These results indicate that 1.67 ml/L is an appropriate rate for use on Poinsettia. When Terpal was applied at the lower rate of 0.83 ml/L and combined with the adjuvant **Stena** (2.5 ml/L), height control was comparable to applying Terpal alone

at the higher rate (1.67 ml/L), and bract size was slightly larger. Plants in both treatments scored well in shelf life.

- **Bonzi** achieved growth control at all rates and water volumes used, without causing phytotoxicity or affecting bract, cyathia or head development compared with the water control. Three Bonzi treatments were evaluated, two dose rates (0.35 ml/L and 0.5 ml/L), with the 0.35 ml/L rate applied in 300 and 600 L/ha water. The two water rates were included as growers using Ripa sprayers need a higher water rate to propel pesticides to the furthest reaches of the crop. However, using the higher water rate also increases the volume of active ingredient intercepted by each plant. All three treatments controlled Poinsettia growth below 28 cm, with a greater effect at the higher dose rate than the lower dose rate (300 L/ha water); and at the higher water volume (600 L/ha water) than the lower volume (300 L/ha water). When translating the recommendations from this trial, growers will need to reduce dose rates when applying in higher volumes of water. Growers should always trial new products and rates on a small number of plants prior to wide scale use.
- **Spray programmes.** Three spray programmes were included in this trial; these were combinations of Stabilan 750 Terpal and Stena and were designed to identify any benefit of early or later applications of Terpal and Stabilan 750 compared with other treatments. The spray programmes were: Stabilan 750 followed by Terpal (Treatment 6), Stabilan 750 + Stena followed by Terpal + Stena (Treatment 7), and Terpal followed by Stabilan 750 (Treatment 11). All of these treatments produced Poinsettias that were within the height specification, with no phytotoxicity, and with comparable cyathia scores and average number of heads per plant. However, bract size was larger in treatments where Stabilan 750 applications (with and without Stena, Treatments 6 and 7) were followed by Terpal; bract size in these treatments was also larger than when Stabilan 750 was followed by Bonzi (Treatment 2).
- **Topas** (fungicide), produced no phytotoxic effects on Poinsettia at any of the dose rates used in this trial. However, when applied at the two higher rates (Treatments 12 and OBS1), it did have an effect growth, producing shorter plants than the water control. At the higher rate (OBS1), the effect on growth was due to a single application at double the EAMU rate. Growers will therefore need to take into account when applying Topas to control powdery mildew, that although it is safe to use on Poinsettia, it may reduce plant height at higher rates.
- The seaweed-based fertiliser **Control** applied at label rate (6 applications, 5.0 ml/L) and at double the rate (1 application, 10.0 ml/L) did not cause phytotoxicity and treated Poinsettia achieved comparable quality and cyathia scores. However, plants were shorter at both dose rates. Slightly fewer heads were produced per plant in at the higher dose rate

(OBS3, 10.0 ml/L, average 3.6 heads per plant) compared with the lower dose rate treatment (OBS2, 5.0 ml/L, average 4.2 heads per plant) and the water control (average 4.7 heads per plant).

- The adjuvant **Stena** (previously coded as HDC P006) again proved effective in reducing the PGR dose rate require to achieve comparable height control when used at the label rate (2.5 ml/L) in combination with Stabilan 750 and Terpal.

In summary, all PGR treatments were effective in controlling Poinsettia growth to achieve the height specification, with no phytotoxicity. The adjuvant Stena can be applied at the label rate with Terpal and Stabilan 750, but the dose rate of the PGR needs to be reduced by 50% to achieve the height specification. The order of Terpal and Stabilan 750 in spray programmes has minimal effect on Poinsettia growth, but bract size was slightly smaller when Terpal was followed by Stabilan 750. Bonzi provided effective growth control, but has a stronger effect when applied in water volumes greater than 300 L/ha. Control (nutrient) and Topas (fungicide) are safe to use on Poinsettia but may affect plant height.

Financial benefits

Although water deficit irrigation is currently being examined as a means of controlling growth in Poinsettia, it is yet to be fully adopted by the majority of industry and short term alternatives are still required to ensure compliance with retailer height specifications.

The evaluation of plant growth regulators (PGRs) either approved in the UK or in other European Countries for use on Poinsettia, followed by appropriate AHDB EAMU applications will expand the range of active ingredients available to growers for controlling plant growth.

The cost per litre of PGR spray solution of the products included in this trial at the specified rates ranges 0.2p from to 3.3p (**Table 4**).

Table 4. Product costs (non-discounted, excluding VAT and labour costs for application)

Product	Cost of active (p/ml)	Cost /L of spray (p)
Terpal (1.67 ml/L)	1.7	2.8
Bonzi (0.35 ml/L)	9.5	3.3
Stabilan 750 (0.5 ml/L)	0.3	0.2
Stena (2.5 ml/L)	2.0	5.0
Topas (1.67 ml/L)	7.7	12.8

Control	2.7	13.4
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Due to the fact that chlormequat based products are used in cereal production to control growth and minimise stem lodging, Stabilan 750 is an inexpensive PGR to purchase due to the market size. Other PGR products, which are not aimed at broad acre crops, tend to be more expensive as a result, and Terpal is around 14x the cost per litre of spray solution in comparison. Relative to Bonzi, it is slightly less expensive per litre of spray solution.

The adjuvant Stena proved successful, allowing a reduction in the rates of both Terpal and Stabilan 750 applied, but its cost per litre of spray solution in relation to any PGR cost savings may limit its uptake by industry based on a purely financial basis.

Action points

- Terpal is already approved for use as a plant growth regulator in ornamental plant production (EAMU 0151/18), so can be commercially adopted. It has potential for use as a PGR with low risk of phytotoxicity on Poinsettia at a rate of 1.67 ml/L. (There may be a risk of the ethephon used in the formulation promoting unwanted side branches and/or cyathia abortion, but this has not been seen in the three years of trials completed in the 2017/18, 2018/19 and 2019-20 seasons).
- The combination of Terpal and Stabilan 750 with the adjuvant Stena at the recommended rate (2.5 ml/L) enables a reduction of dose rate of these PGRs, but a comparative costing (with and without Stena) should be undertaken as part of any adoption process.
- To avoid any potential reductions in bract size Terpal should be applied after Stabilan 750 within spray programmes.
- Bonzi has long been used on Poinsettia without crop damage, but care should be used when determining dose rates. The rates used in this trial (0.35 ml/L and 0.50 ml/L in 300 L/ha water; and 0.35 ml/L in 600 L/ha water) did not cause excessive height control under the growing conditions experienced in the 2019-20 Poinsettia season.
- 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. Applications made under EAMU authorisations are at the grower's own risk