Grower Summary

PO 019

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

Annual 2016

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Project number:	PO 019
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Report:	Annual report, March 2016
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Date project commenced:	July 2014
Date project completed (or expected completion date):	March 2017

GROWER SUMMARY

Headline

- Seed-raised varieties of *Begonia boliviensis* and *Calibrachoa* perform well relative to vegetative varieties.
- FlowersOnTime predicted time to flower within ± 7 days tolerance levels for some species (*Salvia splendens* Vista and French marigold Durango), but not all that were tested under UK conditions.
- Spectral filters were demonstrated to be useful aids to achieve plant growth control (Lumisol and Luminance) and crop scheduling (SunSmart Blue), although the effects are species dependent.

Background

Objective 1: Seed vs cutting varieties of Begonia boliviensis and Calibrachoa

Recent breeding programs have produced new seed grown varieties of *Begonia boliviensis* and *Calibrachoa* that provide growers with the opportunity to take advantage of potentially less expensive plant material. As consistent plant quality is an industry requirement, and seed produced varieties are potentially more variable than vegetative varieties, a comparison of seed vs vegetative production in terms of inputs, quality and costs was carried out.

Objective 2: Temperature effect on days to flowering

With energy costs constantly increasing, growers are having to produce high quality products with lower inputs whilst maintaining production schedules. Researchers in the USA, the Floriculture Research Alliance, have developed an Excel spreadsheet based decision making tool (FlowersOnTime), to help growers explore the influence of average daily temperature on flowering time for their crops. The guide is based on data collected for over 60 crops, and uses the grower's standard crop production time and temperature to predict the effect of changing air temperature on time to flowering, assuming that all other conditions (e.g. photoperiod and daily light integral) remain unchanged. The model created has tolerance levels of ± 7 days, depending on location due to variation in factors such as light level. It was considered that this tool may be useful to growers during cool seasons to predict flowering, so that growers could achieve marketing with minimum additional heat input. This would be of most benefit to those growers with a specific marketing date as opposed to providing plants ready for marketing throughout the season. An alternative may be to use the tool to calculate transplant dates, for example if growing at a set temperature suitable for the crop, or if growing early season plants over a longer period when space is not at a premium.

Objective 3: Demonstration of spectral filters (film)

Growers are keen to reduce their reliance on chemical inputs through adoption of cultural and non-chemical means, and this can include the use of spectral filters (films). A range of spectral filters (films) is available to growers, capable of manipulating the light spectra afforded to the crop beneath, influencing plant growth and quality, and incidence of some pests and diseases.

Diffusing filters can influence plant quality through deeper penetration of light into the crop. SunSmart Blue is promoted as reducing plant height and is used by growers to hold plants back until marketing. Demonstration of the potential benefits and drawbacks of the various spectral filters on the market will help to inform grower decision making.

Summary

Objective 1: Seed vs cutting varieties of Begonia boliviensis and Calibrachoa

Work was carried out between March and June 2015. Plugs of seed (s) and vegetatively (v) propagated varieties of *Begonia boliviensis*: Bossa Nova (s), La Paz (s), Santa Cruz Sunset (s) and Million Kisses Armour (v) and *Calibrachoa*: Kabloom (s), Crave (s), Aloha Kona (v), Cabaret (v) and Callie (v) sourced from a range of breeders / suppliers were transplanted into both pots (10.5 cm and 9 cm respectively) and 6-packs in weeks 11 and 13, using a peat (60%) / woodfibre (40%) growing medium. Three weeks post-transplant (week 14 and week 16), a sub-sample of three healthy plants representative of each variety was transplanted into 30 cm rattan baskets and grown on under glass before being moved outdoors in week 21; plants were treated with common crop protection strategies.

***Begonia boliviensis*.** All *Begonia* varieties produced good quality plants from both transplant weeks, with the exception of *B*. Santa Cruz Sunset, which was slower to establish than the other varieties, and more fragile with some breakages occurring during transplanting. The *B.* Santa Cruz Sunset also flowered unevenly, with week 11 transplants coming into flower later than the week 13 transplants. For all varieties the quality score was greater for those transplanted in both week 13 than week 11 (**Figure 1**) when assessed two and three weeks after transplant (WAT). For *B*. Bossa Nova and *B*. Million Kisses Amour, the high quality scores were maintained through to the final assessment, 9 and 7 WAT (for week 11 and 13 transplants respectively)

B. Million Kisses Amour, the sole vegetative *Begonia* included in this trial, achieved high quality scores and was favoured by growers. However, there were also promising seed-raised varieties. *B.* Bossa Nova in particular scored well for quality – particularly for the later transplant date, and there was also less difference in plant height across the two transplant dates, suggesting it may be less responsive to variation in the environment than other varieties.

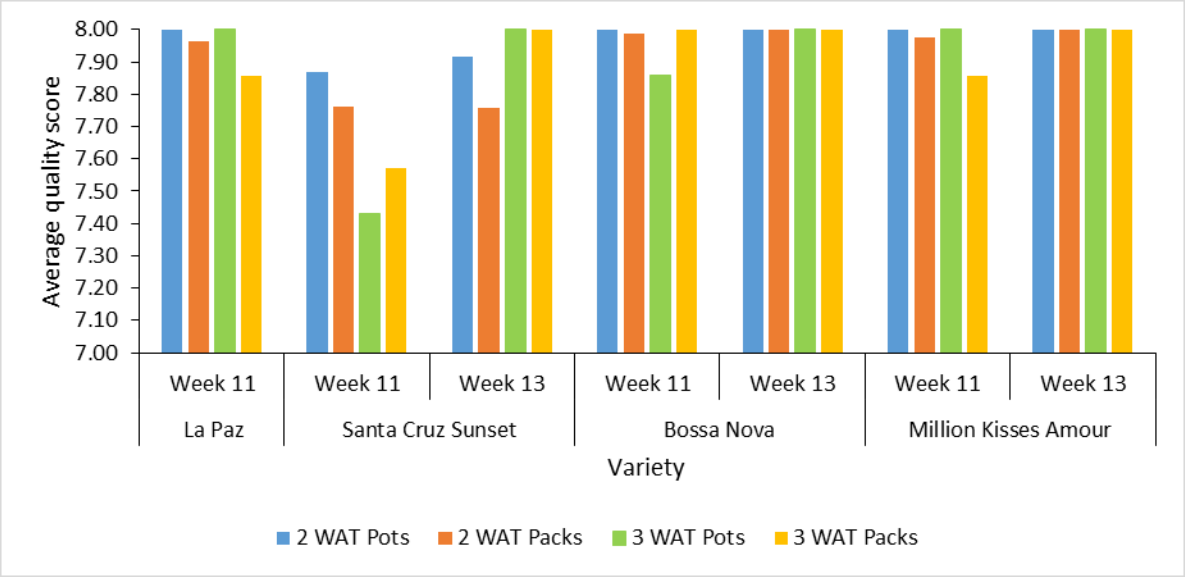

Figure 1. *Begonia boliviensis* average quality scores assessed 2 WAT (26 March and 2 April respectively) and 3 WAT (9 April and 16 April respectively) Scoring: 1 = poor, 9 = exceptional. Scoring based on number of flowers, flower colour, foliage colour, plant habit and consistency.

Calibrachoa. Quality scores for the *Calibrachoa* were more varied than for the *Begonia.* However, *C.* Kabloom, *C.* Cabaret and *C.* Callie all scored well for quality when assessed two and three WAT (**Figure 2**). *C.* Aloha Kona and *C.* Cabaret generally achieved good scores, including the highest grower scores for week 11 and 13 transplants respectively. *C.* Kabloom (seed-raised) scored consistently well for quality, showed less variation in height (2 and 3 WAT), and was scored favourably by growers.

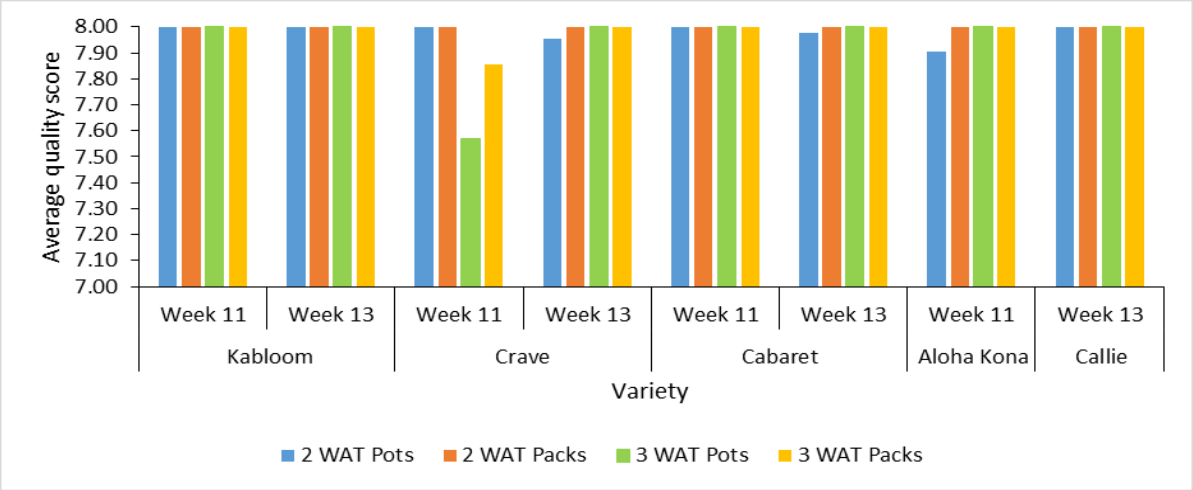

Figure 2. *Calibrachoa* average quality scores assessed 2 WAT (26 March and 2 April respectively) and 3 WAT (9 April and 16 April respectively) Scoring: 1 = poor, 9 = exceptional. Scoring based on number of flowers, flower colour, foliage colour, plant habit and consistency.

For this trial, it was necessary to provide the same inputs, for example water volume, to all varieties to allow for comparisons, and this is likely to have affected quality in some varieties that may favour a different regime. Whilst the *C.* Kabloom and *C.* Aloha Kona produced in this trial were compact and well branched, other varieties (e.g. *C.* Crave or *C.* Callie) may require more pinching, particularly if the production time is protracted through transplanting into larger containers or hanging baskets. Growers will need to select varieties and fine tune inputs to suit their own site and production regime. This

trial suggests that the new seed-raised varieties of both *Begonia boliviensis* and *Calibrachoa* should compete well against vegetative varieties.

Table 1. Seed vs cutting varieties of *Begonia boliviensis* and *Calibrachoa* production cost comparison. ∗Exclusive of royalties. †Inclusive of delivery costs. S = seed; v = vegetative.

Variety	Tray size	Cost (p/plug)*	Royalty (p/plug)	Total (p/plug)
Begonia Bossa Nova (s)	84	36.50	0	36.50
Begonia Santa Cruz Sunset (s)	84	53.95†	0	53.95†
Begonia La Paz (s)	180	36.00	0	36.00
Begonia Million Kisses Amour (v)	66	52.11†	6.2	58.31†
Calibrachoa Kabloom (s)	84	32.13†	0	32.13†
Calibrachoa Crave (s)	84	32.13†	0	32.13†
Calibrachoa Cabaret (v)	84	32.13†	4.1	36.23†
Calibrachoa Aloha Kona (v)	128	20.50	4.1	24.60
Calibrachoa Callie (v)	128	30.00	3.7	33.70

Costs

An assessment of inputs identified that in this trial, for both the *Begonia* and *Calibrachoa* there was no difference between varieties; for example fungicides and growth regulators were applied to all varieties of *Calibrachoa* and similarly, fungicides were applied to all varieties of *Begonia* (**Table 1**). Costs were also influenced by the variety, tray / plug size, and delivery costs. Some suppliers included the delivery cost in the price per plug and were unable to provide price net of delivery. Royalties are not payable on seed-raised varieties which suggests that overall they ought to be cheaper than vegetative varieties. Whilst this was borne out for the *Calibrachoa*, it was less clear for the *Begonia* as the plug price was inclusive of delivery. Smaller plugs (more plugs per tray) were less costly but the plants achieved a similar plant size as those from larger plugs within the timeframe of this trial, although they may have taken longer to achieve pot cover. The plants for this trial were produced from plugs, but production may prove more profitable through on-site propagation from seed (or cuttings), subject to the availability of appropriate expertise and facilities (e.g. early season heat).

Objective 2: Temperature effect on days to flowering

Work was carried out between March and May 2015. Plugs of five plant species (*Dianthus* Festival mixed, *Petunia* Frenzy Select mixed, *Verbena* Quartz XP mixed, French marigold Durango red and *Salvia Splendens* Vista mixed) were transplanted as plugs into black 6-packs. They were grown on under glass, in three different temperatures; 16°C (T1), 18°C (T2) and 19°C (T3).

For most of the species, there was a notable difference in flowering time between the three treatment areas (**Table 2**), particularly with *Petunia* where plants grown at 19°C came into flowering 15 days earlier than those grown at 16°C. This was also the case

for *Salvia*, with plants growing at both 18°C and 19°C coming into flower earlier than those grown at 16°C. For *Dianthus*, there was no difference in flowering time between 18°C and 19°C, and for French marigold, plants grown at both 16°C and 18°C came into flower at the same time. For the *Verbena*, there was no difference in flowering time between any of the treatments. For all species tested, flower number increased with temperature under these conditions.

Achieved production time of French marigold and *Salvia splendens*, was predicted within the tolerance level of ±7 days of the FlowersOnTime tool (**Table 2** and **Figure 3**), even though the temperatures used for this trial were at the top end of the range used to construct the model.

Table 2. Number of days from transplant to first flower. Values in brackets are number of days to first flower predicted by the FlowersOnTime tool. *This temperature was outside the range of the FlowersOnTime tool.

Variety	T1: 16°C	T2: 18°C	T3: 19°C*
Dianthus 'Festival'	40 (26)	32 (23)	32 (n/a)
French marigold	25 (26)	25 (23)	19 (n/a)
Petunia 'Frenzy'	40 (24)	32 (20)	25 (n/a)
Salvia splendens 'Vista'	40 (31)	25 (25)	25 (n/a)
Verbena 'Quartz XP'	40 (26)	40 (23)	40 (n/a)

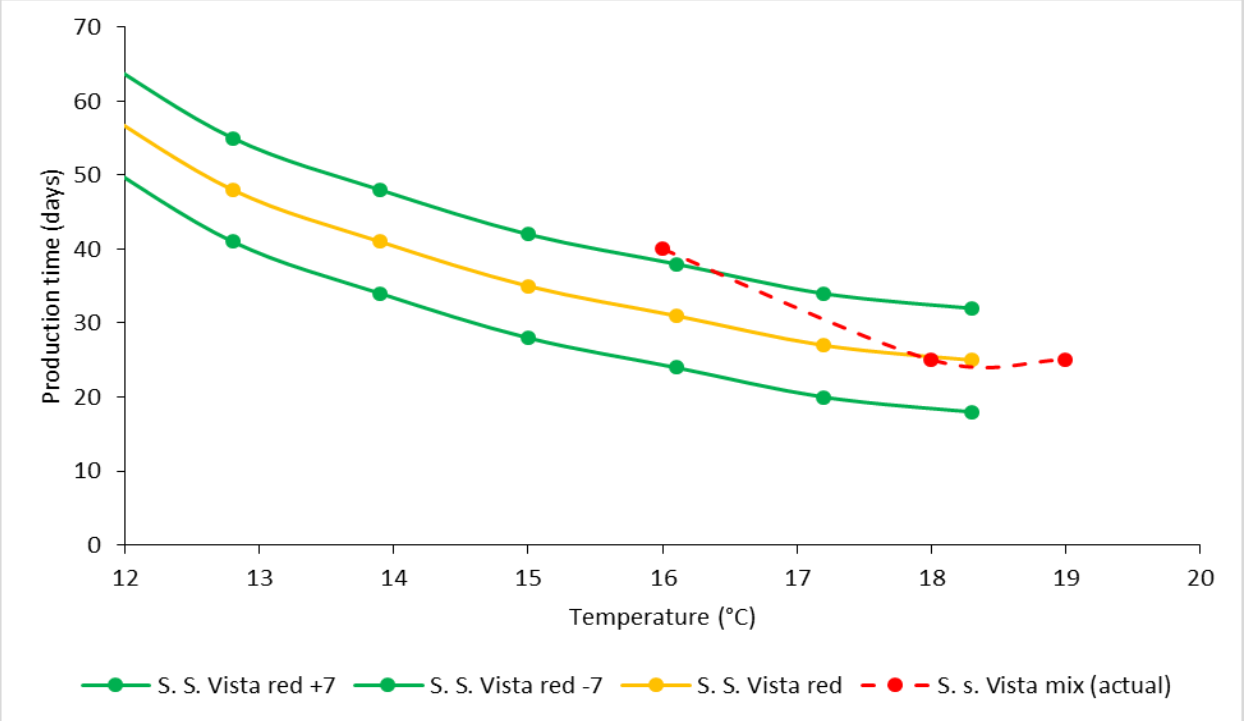

Figure 3. FlowersOnTime prediction vs actual flowering time – *Salvia splendens* Vista mix

Objective 3: Demonstration of spectral filters (film)

Four separate polytunnels with SunSmart Blue (new and old to test potential degradation), Lumisol and Luminance coverings, with a glasshouse 'control' were assessed between April and June 2015. 10 plant species (*Ageratum* 'Champion Blue', *Lobelia* 'Regatta' mix,

Antirrhinum 'Liberty' mix, *Pansy* 'Matrix' spring select mix, *Dianthus* 'Festival' mix, *Petunia* 'Frenzy' mix, French marigold 'Durango' mix, *Salvia* 'Vista' red, Geranium 'Horizon' mix and *Viola* 'Sorbet XP' spring select mix) potted into 6-packs (black plastic) using a peat (60%) / woodfibre (40%) growing medi were grown under the different tunnels to demonstrate impact on production.

Of the light diffusing spectral filters (Lumisol and Luminance), Luminance generally produced more compact plants than those produced under glass, although with some variation between species. Plant quality was also generally commercially acceptable; diffused light affects plant quality by providing a more even temperature at plant level, reducing the potential for 'hot spots' of light on foliage, and the scattered light reaches deeper into the crop reducing shading of lower leaves. The light spectrum under the two plastics was similar in the longer wavelengths e.g. far red. Luminance transmitted more light than lumisol in the red and green (3%), blue (4%) and UVA (9%) regions of the spectrum.

SunSmart Blue can delay flowering and hold plants back, however in this trial the Lumisol treatment limited growth more successfully. There were slight differences in the light spectra and light transmission afforded by the two SunSmart Blue tunnels due to slight sun damage to the older tunnel cover. However, these plastics transmitted apporoximately 40% of available PAR light, with proportionally greater transmission in blue (~65%) than green (51%), red (21%) or UVA (21%) region of the spectrum. Within this trial, generally, flowering was delayed, plant quality was higher and growth greater under the new SunSmart Blue tunnel, suggesting that growers will need to monitor the effects of these tunnel covers over time and replace them should any deterioration affect plant quality or scheduling. However, as there was no replication of structures, the statistical significance of these results cannot be established. It is clear from these results that different plant species respond differently to the changes to the environment afforded by the spectral filters and growers need to be aware of these effects when planning their use within a production programme.

Financial Benefits

- For the *Begonia boliviensis* and *Calibrachoa* the cost benefits were influenced by variety, tray / plug size and delivery costs. Seed-raised varieties did not incur royalties, (3.7 – 6.2p/plug). Smaller plugs (more plugs per tray) were less costly but the plants achieved a similar plant size as those from larger plugs within the timeframe of this trial. Further financial benefits may be gained through on-site production from seed or cuttings.

- Confident prediction of days to flower under the variable conditions UK growers experience would help to reduce waste and contain costs by applying the minimum amount of heat necessary to meet target marketing dates. For the French marigold, the number of days to flowering was increased by 15 days when the temperature was reduced by 2˚C (from 18˚C to 16˚C). Using a published scenario (Adams et al. 2009), a reduction of 1˚C (from 14˚C to 13˚C) provided a 13% reduction in energy use (42 kWh/m2/annum in the model used) in a low-input ornamental crop (vent 16˚C, no humidity control, no minimum pipe

temperature and no thermal screen). At an average 10p/kWh (www.businesselectricityprices.org.uk), this equates to 420p/m2/annum, and a 1.15p/m2/day saving in energy cost and can be considered against an estimated crop value of £29.6/m2 (double 6-packs, 0.082/m2) to the grower. These estimates would vary depending on the nursery infrastructure, energy costs, and heating system used. Consideration would also need to be given to the potential increase in crop protection costs at lower temperatures.

- Spectral filters can help to reduce inputs e.g. plant growth regulators, and reduce waste by holding plants back to meet marketing schedules. As an example, the value associated with a standard single span polytunnel (4 m x 20 m) of mixed bedding in standard double 6-packs (dimensions 0.082 m2) that would otherwise be wasted is estimated at £2,341, assuming all plants are marketed. The cost to cover the polytunnel with SunSmart Blue film (£0.88 /m2) is estimated at £209, excluding labour and fittings. Although plant growth regulators were not used in this trial, the cost of a single application of Bonzi (as paclobutrazol, 1.25 ml/L) to hold the plants back for dispatch would be £1.90 + VAT (20 ml Bonzi) plus the cost of the labour and equipment to apply it. This would need to be applied to each crop the tunnel is used for, while the tunnel cover is marketed with a life expectancy of 7-8 years.

Action Points

- Seed raised *Begonia boliviensis* and *Calibrachoa* compete well with vegetative varieties, and growers should consider trialling plants on their own sites to further investigate the the best varieties to grow for quality and economics.
- Spectral filters (films) demonstrated features beneficial to growers:
    - SunSmart Blue can be used to hold batches of plants back to meet specific marketing dates. This appears to be achieved through the cooler environment and lower light transmission.
    - Light diffusing films, e.g. Luminance produce good quality, compact plants, provide a more even temperature at plant level and a cooler working environment.
    - As there variation in plant response to the various products available, close monitoring will determine the most appropriate varieties for each situation.