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CONTRACT REPORT

New Guinea Impatiens: The potential for extending the growing season, improving plant production and shelf-life properties using cultural and chemical means

Part I (1993)

Effect of Lighting and Shelf-life Chemicals

HDC PC80

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AUTHENTICATION

I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

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Final Report March 1996

HDC PC80

New Guinea Impatiens: The potential for extending the growing season and improving plant production and shelf-life properties using cultural and chemical means

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Co-ordinator: Mr S Morley

Commenced: January 1993

Completed: May 1993

Key words: New Guinea Impatiens, Lighting, Shelf-life

1. RELEVANCE TO GROWERS AND PRACTICAL APPLICATION

1.1 APPLICATION

Four lighting regimes, including an unlit control were studied to quantify their effects on time to marketing, plant habit, flowering and flower and bud retention in shelf-life. Ten cultivars of New Guinea Impatiens were grown under these regimes at a standard temperature of 18°C. At 18°C there appeared to be no benefit of assimilate lighting or any marked crop response to changing photoperiod.

Anti-ethylene compounds were assessed to see if they could improve flower and bud retention and hence prolong flowering throughout shelf-life. However, results were inconclusive in that the plants did not suffer from excessive bud or flower drop.

1.2 SUMMARY

The first experiment in 1993 (PC80) at HRI Efford evaluated methods for improving winter production in terms of plant habit, flowering and shelf-life.

Ten cultivars of New Guinea Impatiens were selected, giving a range of plant habit, foliage type and flower colour.

Cultivar Characteristics

Cultivar	Type*	Flower Colour
Samoa	P	White
Barbados	P	Red
Papete	P	Purple
Tobago	P	Pink
Maui	P	Red-orange
Aruba	P	Magenta
Anaea	C	Dark red
Selenia	C	Red-orange
Delias	C	Pink
Aurore	C	Dark orange

*P = Paradise series
C = Classic types

These were grown under four lighting regimes. An unlit control, assimilate lighting for either 12 or 18 hours per day from 400W SON/T lamps or photoperiodic lighting from GLS tungsten lights for 18 hours.

Prior to marketing the shelf-life chemicals (anti-ethylene flower stickers) STS and Chrysal EVB (non-silver compound) were applied to selected plants.

When grown at 18°C the cultivars tested were not responsive to either assimilate or photoperiodic lighting as measured by the production time. Plant stature was, however, affected with unlit plants and those exposed to tungsten lighting being taller.

There were no consistent effects of lighting on overall plant quality or flower and bud number either at marketing or subsequently in shelf-life.

The application of 'flower stickers' was of little benefit or the cultivars studied did not appear to suffer from excessive bud or flower loss.

1.3 CONCLUSIONS

- The new cultivars have considerable potential as a pot plant, however, careful selection of type has to be made as cultivar response to different cultural regimes can vary.

- The use of either assimilate or photoperiodic lighting appeared to have little effect on the time to marketing.

- Plants lit with 400W SON/T were generally more compact than those unlit, suggesting that lit crops may be able to be grown at higher densities, increasing throughput per unit area.

- The use of 'flower stickers' gave little benefit in terms of bud and flower retention.

- Certain cultivars have a plant habit more suited to production in smaller pots, eg Delias for 10 cm pot production.

2. EXPERIMENTAL SECTION

2.1 INTRODUCTION

New Guinea Impatiens (Impatiens X Hybrida (I. Hawkeri)) production and sales have grown rapidly over the past 5-10 years, and in Europe it is estimated near to 100 million plants are produced annually. With such rapid growth in production it is surprising that little research has been conducted on this crop and in fact very little knowledge exists on the growth and flowering of New Guinea Impatiens in response to their growing environment.

The first introduction of commercial varieties into the UK was around 15 years ago. However, this introduction failed to make a great impact due to their small flower size, long stem internodes and poor branching. The first major advance in their popularity was the development of new cultivars by the breeder/propagator Mikklesens, who introduced the Sunshine series about 10 years ago. Their improved flower size, colour range and habit made New Guinea Impatiens an instant success. From the Sunshine series, the German propagator Ludwig Kientzler continued the improvement with the introduction and release of the Paradise series in 1991. This group was particularly compact, floriferous and early flowering. This was a major breakthrough and the Paradise series continues to dominate the UK market.

The production of New Guinea Impatiens has traditionally been limited to the Summer months since problems of non-uniform flowering, slow establishment and bud abortion meant that the crop could not be grown economically under the poorer Winter light conditions. This constraint on early production was investigated in this study.

Four lighting regimes, including an unlit control were evaluated. The effects of assimilate lighting (400W SON/T) given for either 12 hours or 18 hours per day were compared with possible photoperiodic effects (GLS tungsten) again given for 18 hours per day.

The use of 'flower stickers' was also evaluated throughout an 18 day shelf-life period.

2.2 OBJECTIVES

- To examine a range of lighting treatments, both assimilate and photoperiodic, and quantify their effects on plant habit, flower and bud production and their retention during shelf-life.

- To assess the benefits of applying anti-ethylene compounds or 'flower stickers' prior to marketing on subsequent shelf-life performance.

2.3 MATERIALS AND METHODS

2.3.1 Site

The plants were grown on ebb and flood floors in four compartments of the multifactorial glasshouse "K" Block.

2.3.2 Cultivars

The plants for the trial were brought in from Royal Eveleens as rooted cuttings and potted in week 4.

Paradise Types	**Others**
Samoa	Anaea
Barbados	Selenia
Papete	Delias
Tobago	Aurore
Maui	
Aruba	

2.3.3 Treatments

Lighting Treatments

1. 2500 lux supplementary lighting for 12 hours (SON/T)

2. 2500 lux supplementary lighting for 18 hours (SON/T)

3. GLS incandescent lamps for 18 hours to give long days

4. No lighting (control)

Shelf-life Treatments

All plants were given a simulated market run prior to shelf-life of 21 days.

1. Untreated control

2. Sodium silver thiosulphate (argylene)

3. Chrysal EVB (non-silver ethylene inhibiting)

2.3.4 Experimental Design

4	main lighting treatments
x	
4	shelf-life treatments
16	treatments
x	
10	varieties
160	plots in total

Plot size: 13 plants per plot at pot thick stage
8 plants per plot at full spacing

The trial layout is given in Appendix I, page 15.

2.3.5 Cultural Details

Plants were potted into 12 cm AX optipots (2 tier drainage) using Fisons Levington C1A growing media plus Dolodust at 225 g per 75 l on 29/01/93. Once laid out in the compartments the plants were given a drench of Iprodione (as Rovral 1.0 g/l) as a preventative treatment against *Botrytis*. The concrete floors were drenched with water daily to increase the humidity of the growing environment.

The plants were treated with Benomyl as Benlate (0.5 g/l) on 15/02/93 to control *Botrytis*. Effective sciarid fly control was achieved using a compost drench of Nemasys (*Steinernema Bibionis*) applied on 10/02/93. Weekly introductions of the biological predators *Aphidoletes aphidomyza*, *Encarsia formosa* and *Phytoseiulus persimilis* for the control of aphids (*Aphididae*), glasshouse white fly (*Trialeurodes varporariorum*) and two spotted spider mite (*Tetranychus urticae*). In addition six weekly introductions of *Amblyseius cucumeris* were made for the control of western flower thrips (*Frankliniella occidentalis*).

The plants were given an immediate spacing of 45 plants per m^2 on 03/03/93 (apart from Selenia and Delias which were spaced on 12/03/93). The plants were moved to final spacing of 25 plants per m^2 on 29/03/93.

Liquid feeding commenced at every watering from week 10 using Kristalon Blue 19:6:20 + 3 diluted 1 to 200 to give 95 ppm N, 30 ppm P_2O_5 and 100 ppm K_2O.

An average day/night temperature of 18°C was applied across all treatments with a DROP of 4°C for 2 hours at sunrise being used for growth control. No chemical growth regulation was used.

The shelf-life chemical treatments (flower stickers) were applied to the appropriate plots as follows:

Table 1. Shelf-life Chemical Treatments

Treatment	Dates of Application
Chrysal applied at 5 ml/l	22/03/93, 29/03/93 and 05/04/93
Argylene applied at 1 g/l	15/03/93 and 05/04/93

These anti-ethylene compounds were applied as per label recommendations.

2.3.6 Assessments

Throughout the course of the trial, notes were made on plant development including plant habit, bud and flower development. The time to 50% flowering was recorded.

Plant Growth Assessments at Marketing

At the point of marketing, when at least half of the plants in a varietal block had four to five open flowers, the following assessments were made:

Plant height score (1-5; short-tall)
Plant spread score (1-5; narrow-broad)
Plant quality score (1-3; unmarketable-best)
Bud and flower count

Shelf-life

Six plants from each plot were sleeved, boxed and transported to Birmingham and back to simulate a market run. On their return the plants were retained in packhouse conditions for three days. The sleeves were then removed and the plants assessed for:

Number of buds fallen
Number of flowers fallen

The plants were then placed in shelf-life conditions of 20°C and 1000 lux for a 12 hour day. The above assessments were made on two further occasions after nine and 18 days.

2.3.7 Statistical Analysis

Due to the absence of full replicates within this experiment the resultant data were not subjected to formal statistical analysis.

3. RESULTS

3.1 ASSESSMENTS AT MARKETING

The results of these assessments can be found in Appendix II, pages 16 to 18.

Plant height at marketing was generally reduced where plants had been lit at 2500 lux from SON/T lamps for either 12 or 18 hours. The tungsten lit crop, giving photoperiod control only, and the unlit crop were similar and taller in height.

The width of plants at marketing was largely unaffected by the lighting treatments, and appeared largely a factor of plant spacing and varietal habit.

Overall plant quality at marketing was largely cultivar dependent with no constant response to lighting being recorded. The cultivars Selenia and Barbados responded positively to SON/T lighting. In contrast the cultivars Papete and Anaea produced poorer quality plants when lit.

There were again no consistent trends with respect to flower number and lighting. When lit with SON/T lamps for 18 hours the cultivars Papete and Tobago produced slightly more flowers but not when lit for 12 hours.

3.2 SHELF-LIFE

Results of the shelf-life assessments are given in Appendix III, page 19. As there were no effects of lighting on shelf-life results for the 'flower stickers' are averaged across lighting treatments.

At both sleeve removal and 18 days later the principal response was one of cultivar. There was no clear evidence within this experiment that the use of either STS or EVB improved bud or flower retention. On the contrary, the cultivar Aurore retained far fewer buds and flowers where EVB was applied.

4. DISCUSSION

In recent years a large number of new cultivars have become available to the UK grower expanding the range of colours, leaf types and plant habits. These cultivars, particularly the more compact 'Paradise' series, have shown characteristics favourable for the indoor pot plant market.

The production of New Guinea Impatiens, however, has traditionally been limited to the summer months as problems of non-uniform flowering, slow establishment and bud abortion meant that the crop could not be grown economically under the poorer winter light conditions. This perceived constraint on production was the subject of the present study.

Four lighting regimes, including an unlit control, were evaluated. The effects of assimilate lighting (400W SON/T) given for either 12 hours or 18 hours per day were compared with possible photoperiodic effects (GLS tungsten). The use of 'flower stickers' was also evaluated throughout a 21 day shelf-life period.

Growth Control

Plant height at marketing was generally greater where plants were unlit or lit for 18 hours with tungsten lights. In the case of the former the stretching could be attributed to the generally poor winter light conditions, and may suggest that if grown unlit then a lower density would be desirable. The stretching effect of tungsten lighting is well documented and is a function of the enhanced far red component of the light incident on the crop. Although there were no clear benefits to lighting in terms of early production, lighting may be used to sustain higher plant populations whilst preventing stretching and may also therefore negate the need for chemical plant growth regulators.

Flower and bud retention did also not appear to be affected by the use of assimilate or photoperiodic lighting throughout this experiment where plants were grown at 18°C. However, work by Erwin at Minnesota University suggests a more complex response is possible whereby the photoperiodic effect is only evident at higher production temperatures of up to 25°C.

Shelf-life

Within the context of this experiment the principal factor influencing bud and flower retention was cultivar. Neither the lighting treatments or the use of 'flower stickers' had a consistent effect on shelf-life. Given the perceived problem with 'winter' production this result is somewhat surprising and the reason for it is not immediately apparent. However, the variable

response of plants to anti-ethylene compounds is well documented and it is therefore possible that applications made at higher rates would elicit a greater response. Much more detailed studies are required in this area.

5. CONCLUSIONS

- The new cultivars have considerable potential as a pot plant, however, careful selection of type has to be made as cultivar response to different cultural regimes can vary.

- The use of either assimilate or photoperiodic lighting appeared to have little effect on the time to marketing.

- Plants lit with 400W SON/T were generally more compact than those unlit, suggesting that lit crops may be able to be grown at higher densities, increasing throughput per unit area.

- The use of 'flower stickers' gave little benefit in terms of bud and flower retention.

- Certain cultivars have a plant habit more suited to production in smaller pots, eg Delias for 10 cm pot production.

6. RECOMMENDATIONS FOR FUTURE WORK ON NEW GUINEA IMPATIENS

The next experiment in this project (PC80) will focus on the effect of temperature throughout production and interactions with plant density.

Further work will be needed to investigate the trigger for flower development with the specific aim of achieving more uniform flowering and scheduling of both early and main season crops.

Additional cultural factors such as nutrition should be evaluated both in production and as a means of manipulating shelf-life.

Trialling of new cultivars should be continued along with an assessment of plant variability dependent on source of the start material.

APPENDICES

APPENDIX I

Trial Layout

Treatment	Glasshouse compartment
2500 lux 12 h SON/T	K4
2500 lux 18 h SON/T	K10
GLS incandescent 18 h	K15
Unlit control	K5

APPENDIX II

Results at Marketing

Table 1. Height score (1-5; short-tall)

Cultivar	Cultural Treatments SON/T 12 h 2500 lux	SON/T 18 h 2500 lux	GLS 18 h photoperiodic	Unlit control
Samoa	2.5	2.5	3.0	3.0
Barbados	2.5	2.2	3.0	2.9
Papete	2.6	2.0	3.0	2.9
Tobago	3.0	3.4	3.2	3.0
Maui	2.2	2.0	3.0	2.0
Aruba	2.6	2.6	2.8	3.2
Anaea	2.2	2.0	3.0	3.2
Selenia	2.9	3.0	3.0	3.1
Delias	2.0	2.1	2.8	2.2
Aurore	2.7	2.1	3.0	3.9
Mean	2.5	2.4	3.0	2.9

Table 2. Breadth score (1-5; narrow-broad)

Cultivar	Cultural Treatments SON/T 12 h 2500 lux	SON/T 18 h 2500 lux	GLS 18 h photoperiodic	Unlit control
Samoa	3.2	3.4	3.9	4.0
Barbados	3.8	4.1	4.0	4.2
Papete	4.1	4.0	4.2	4.5
Tobago	4.9	4.9	5.0	5.0
Maui	4.5	4.5	4.9	4.8
Aruba	4.5	4.8	4.9	5.0
Anaea	4.9	4.2	4.9	5.0
Selenia	4.9	4.9	4.8	4.9
Delias	4.0	4.0	3.0	3.9
Aurore	4.7	4.1	4.9	4.9
Mean	4.3	4.3	4.4	4.6

APPENDIX II

Results at Marketing

Table 3. Quality score (1-3; unmarketable-best)

Cultivar	Cultural Treatments SON/T 12 h 2500 lux	SON/T 18 h 2500 lux	GLS 18 h photoperiodic	Unlit control
Samoa	2.0	1.9	1.8	2.0
Barbados	2.0	2.2	1.2	1.4
Papete	2.1	2.6	2.6	2.4
Tobago	2.9	2.8	2.6	2.5
Maui	2.4	2.5	2.7	2.8
Aruba	2.2	2.4	2.6	2.7
Anaea	2.9	2.1	2.2	2.1
Selenia	2.9	2.8	2.2	1.9
Delias	2.0	1.9	1.7	1.6
Aurore	2.1	2.4	2.1	2.1
Mean	2.3	2.4	1.9	2.1

Table 4. Number of buds

Cultivar	Cultural Treatments SON/T 12 h 2500 lux	SON/T 18 h 2500 lux	GLS 18 h photoperiodic	Unlit control
Samoa	2.1	1.9	2.9	3.0
Barbados	5.1	7.0	5.1	6.8
Papete	5.4	7.8	6.7	5.0
Tobago	36.0	40.1	17.7	21.6
Maui	5.2	6.6	6.1	4.8
Aruba	14.0	5.9	6.2	15.2
Anaea	19.0	4.2	8.9	13.2
Selenia	15.5	13.5	5.9	9.9
Delias	1.7	4.2	1.7	2.1
Aurore	15.4	5.4	10.3	13.1
Mean	11.9	9.7	7.1	9.5

APPENDIX II

Results at Marketing

Table 5. Number of flowers

Cultivar	Cultural Treatments SON/T 12 h 2500 lux	SON/T 18 h 2500 lux	GLS 18 h photoperiodic	Unlit control
Samoa	1.1	0.9	0.7	0.9
Barbados	0.9	1.5	1.2	1.7
Papete	1.6	3.7	1.6	1.7
Tobago	2.2	3.2	1.6	1.6
Maui	1.6	1.0	1.7	1.4
Aruba	1.1	1.0	0.9	1.2
Anaea	1.8	1.5	1.0	2.7
Selenia	2.6	1.9	0.7	0.8
Delias	0.8	1.2	0.9	0.7
Aurore	1.1	1.0	1.5	2.5
Mean	1.5	1.7	1.2	1.5

APPENDIX III

Shelf-life: Unlit Plants

Table 1. Assessment at sleeve removal

Cultivar	Cultural Treatments: Control Buds	Control Flowers*	STS Buds	STS Flowers	EVB Buds	EVB Flowers
Samoa	17	3/2	14	3/2	13	3/2
Barbados	10	3/1	6	4/1	9	2/1
Papete	4	5/1	6	5/0	20	3/1
Tobago	25	3/1	32	7/0	17	5/0
Maui	7	5/1	7	4/2	5	3/1
Aruba	22	2/1	20	2/0	12	3/1
Anaea	4	2/0	5	6/1	4	2/1
Selenia	13	4/1	19	14/3	12	4/1
Delias	4	2/0	4	2/2	7	2/1
Aurore	15	4/0	15	7/0	6	2/1

* Figures denote (a) the number of flowers present and (b) the number of fallen flowers; a/b

Table 2. Assessment following 18 days shelf-life

Cultivar	Cultural Treatments: Control Buds	Control Flowers	STS Buds	STS Flowers	EVB Buds	EVB Flowers
Samoa	18	2/0	17	4/1	13	3/1
Barbados	10	5/2	6	5/2	7	5/1
Papete	7	4/1	7	7/3	14	5/2
Tobago	21	31/14	22	33/16	15	21/9
Maui	6	5/2	8	5/1	4	4/2
Aruba	12	20/4	9	23/4	7	10/1
Anaea	6	2/1	6	2/1	3	0/0
Selenia	10	27/10	3	30/14	5	12/4
Delias	4	4/1	4	2/0	7	2/0
Aurore	15	33/16	14	29/15	3	4/2

APPENDIX IV

Trial layout showing cultivar blocks

Contract between HRI and ADAS (hereinafter called the "Contractor") and the Horticultural Development Council (hereinafter called the "Council") for research/development project.

PROPOSAL

1. TITLE OF PROJECT **Contract No: PC/80**

NEW GUINEA IMPATIENS: THE POTENTIAL FOR EXTENDING THE GROWING SEASON AND IMPROVING PLANT PRODUCTION AND SHELF LIFE PROPERTIES USING CULTURAL AND CHEMICAL MEANS

2. BACKGROUND AND COMMERCIAL OBJECTIVE

The production of New Guinea Impatiens is generally limited to the summer months relying on natural light conditions. To allow the crop to be fully exploited many aspects of its culture need to be examined and schedules produced for plant growth at different times of the year. In particular the potential for the use of supplementary lighting for winter production needs to be assessed.

The crop must be carried through to assess treatment effects on the shelf life properties of the plants. Bud drop during this period is a problem with New Guinea Impatiens and potential treatments to reduce this need to be evaluated.

The varietal response to the chemical and cultural conditions would also need to be examined.

3. POTENTIAL FINANCIAL BENEFIT TO THE INDUSTRY

* Improved quality of final plant.
* Extension of the season for plant production into the winter months.
* Improved shelf life giving quality plants for the retailing and home environment.
* Economic assessments would be made to compare treatments/schedules.
* The treatments improving shelf life may be able to be extrapolated for use on other crops.

4. SCIENTIFIC/TECHNICAL TARGET OF THE WORK

This trial aims to assess the response of a range of varieties to cultural and chemical treatments in successive crops of New Guinea Impatiens. From this comparison treatments with the potential to extend the production season of New Guinea Impatiens, with improved shelf life, may be identified.

5. RELATED WORK

Observations at Lee Valley EHS showed Alar might have potential for use with New Guinea Impatiens in controlling size (Farthing 1984). A small observation trial at Efford carried out by Elaine Sapsed (1990) showed that effects of Alar and Bonzi on New Guinea Impatiens appeared to vary with cultivar.

The results of cultivar trials from Kiel, Germany will soon be available.

6. DESCRIPTION OF THE WORK

Trial 1. To start January 1993.

Lighting treatments

i. 2500 lux supplementary lighting for 12 hours.
ii. 2500 lux supplementary lighting for 18 hours.
iii. GLS incandescent lamps to give long days for 18 hours.
iv. No lighting (control)

Shelf life treatments *

All plants given a simulated market run prior to shelf life of 3 weeks.

i. Untreated control.
ii. Sodium silver thiosulphate.
iii.+iv. Two further treatments with non-silver ethylene inhibiting compounds.

* These treatments may be modified following further discussion with the manufacturers, the project co-ordinator and the HDC.

Varieties

10 to be chosen after discussion.

Culture

DIF drop of 4°C for 2 hours at sunrise.

Design

4 main lighting treatments
x
4 shelf life treatments

16 treatments
x
10 varieties

160 plots in total

Assessments

Time to 50% flowering

At marketing: size score
quality score
bud and flower count

Shelf life: flowering assessments
bud drop assessments
final quality score

Photographs at all stages as appropriate.

Trial 2. To start May 1993.

This trial would draw on data from the January trial, allowing the more promising treatments to be followed up, especially in relation to shelf life. Lighting would be less applicable at this time of year allowing other cultural factors such as plant growth regulators, temperature, nutrition and shading to be examined.

Shelf life in this trial may be in bedding out and/or patio facilities.

Commercial trialling

To be carried out at two nurseries.

The ten varieties grown at Efford would be grown at the nurseries along with a range of other varieties. The plants would be grown under the standard culture conditions appropriate to each nursery. The use of the DIF 4°C drop for two hours at sunrise and application of plant growth regulators as required would be common to all sites.

7. COMMENCEMENT DATE AND DURATION

Start date: 01.01.93; duration 8 months.

First trial to commence: January 1993, second May 1993.

8. STAFF RESPONSIBILITIES

Trials officers: Dr E Attfield/Mr L Sach - HRI Efford
Mr H Kitchener - ADAS for Commercial trialling

HDC Co-ordinator: Mr Steve Morely

9. LOCATION

Main Trial: HRI Efford

Commercial Trials: S Morely, Raceground Nursery, Spalding
Hill Brothers, Chichester

Additional bedding out sites: Springfields, Spalding
University of Plymouth, Bere Alston

Contract No: PC/80

TERMS AND CONDITIONS

The Council's standard terms and conditions of contract shall apply.

Signed for the Contractor(s)

Signature.....

Position..Commercial and Marketing Manager HRI

Date.....18/3/93.....

Signed for the Contractor(s)

Signature.....

Position.....

Date.....

Signed for the Council

Signature.....

Position.....CHIEF EXECUTIVE

Date.....20.1.93.....