COMMERCIAL – IN CONFIDENCE

HORTICULTURE RESEARCH INTERNATIONAL
EFFORD

Report to:

Horticultural Development Council
18 Lavant Street
Petersfield
Hampshire
GU32 3EW

Tel.: 0703 63736
Fax.: 0703 65394

HRI Contract Manager:

Miss M A Scott
HRI Efford
Lymington
Hampshire
SO41 0LZ

Tel.: 0590 673341
Fax.: 0590 671553

Period of investigation: December 1991 - April 1992
Date of issue of report: October 1992
No. of pages in report: 21
No. of copies of report: 5
This is copy no.1: Issued to Horticultural Development Council

CONTRACT REPORT

Hydrangea: Preliminary trial on the production of early quality plants

HDC PC44

PRINCIPAL WORKERS

HRI EFFORD

Mrs E J Hemming BSc Hons (Hort), M.I.Hort (Author of Report)	Technical Officer
Mrs S Foster	Scientific Officer
Mr R Goode	Assistant Scientific Officer
Miss C Jenkins	Assistant Scientific Officer
Mr C A J Hemming	Nursery Staff
Mr S Langford	Nursery Staff
Miss A Peek	Nursery Staff
Mrs M Jenvey	Nursery Staff
Mr P Burnell	Nursery Staff

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.

Signature ..... Margaret A. Scott .....

Margaret A Scott
Deputy Head of Station

Date ..... 15/10/92 .....

Report authorised by ..... M R Shipway
Signature
Head of Station

HRI Efford
Lymington
Hants
SO41 0LZ

Date 15/10/92 .....

CONTENTS

SUMMARY

This preliminary trial was funded through the Horticultural Development Council and looked at the potential for the production of early quality multiheaded pot *Hydrangea.*

Plants were brought in in 13F pots ready for forcing in December 1991. Four varieties were chosen; 'Blue Sky' (blue flowered), 'Twilight Red' (red flowered), 'Shower' (pink flowered) and 'Snow' (white flowered), all lacecap types.

Forcing took place under glass with plants subjected to the following treatments:

1. Unlit - control.
2. Lit - 2500 lux SON/T lamps (18 hrs/day).
3. Lit - 4000 lux SON/T lamps (18 hrs/day).

Assessments of growth, quality and subsequent shelf life performance were made. The following main treatment effects were noted:

* Increase in size ie. height and spread with increasing light level.

* Tendency for stretching to occur under highest light level.

* Improved flowering head count with increasing light level, except for cv. 'Snow'.

* Maximum diameter of heads under 2500 lux regime.

* More rapid deterioration in shelf life of lit plants.

INTRODUCTION

A large quantity of pot Hydrangeas are grown in the U.K., the majority of which are bought in as plants ready for forcing. The market demand for high quality multiheaded plants early in the year has led researchers and growers alike to look at various methods of advancing production and improving uniformity whilst maintaining quality.

Variability of plant material often leads to uneven plant development. Lighting treatment during the forcing period may help to reduce production times and even out growth. Care, however, must be taken as excessive temperatures can have a detrimental effect on growth, ie. reduction in bloom size.

This preliminary trial used two levels of illuminance, 2500 and 4000 lux and growth under these regimes was compared to unlit, control plants. Supplementary lighting, where used, was for 18 hours per day throughout production.

OBJECTIVE

To reduce the production time of multiheaded Hydrangeas grown in 13 cm pots by lighting during the forcing period early in the year.

MATERIALS AND METHOD

Plants ready for forcing were supplied by P Sonneville Nursery, Belgium. On arrival (18 December) pots were cleaned and excess roots protruding from the drainage holes trimmed before laying out according to the treatment plan (Appendix I, page 11). Pots were placed directly onto heated concrete floors in 'K' block equipped with computerised environmental control.

Treatments

1. Unlit - control.
2. Lit - 2500 lux SON/T lamps (18 hrs/day).
3. Lit - 4000 lux SON/T lamps (18hrs/day).

Cultivars

'Blue Sky'	}	
'Twilight Red'	}	Lacecap types
'Shower'	}	
'Snow'	}	

Start date

Week 51, 1991.

Design

4 cultivars

x

4 lighting treatments (double replication of control)

x

4 replicates (within compartments)

—

64 plots in total

—

Plot size = 20 plants. The plots of each cultivar were placed in the same relative position on the floors in each treatment compartment. This was done to facilitate the different liquid feed requirements of the various coloured blooms and to eliminate potential positional effects for treatment response.

Cultural details

Forcing took place at 18°C Day and Night with venting at 20°C from the start of the trial on 23 December. The supplementary lighting treatments were applied from midnight through to 18.00 once buds had broken (approx 1 week after start of forcing). CO_2 input was at a level of 800 ppm when vents were closed decreasing to ambient when vents 5% open.

During the course of the trial the following sprays were applied.

3 January	bupirimate as Nimrod at 3.8 ml/litre
7 January	Librel Fe lo at 0.5 g/litre + Agral (wetter) 0.1 ml/litre
13 January	pirimicarb as Pirimor at 0.5 g/litre
	dicofol + tetradifon as Childion at 0.62 ml/litre

Spacing took place on 9 January to 25 plants/m^2 and to a final spacing on 15 January of 11 plants/m^2.

Liquid feeding commenced immediately from the start of the trial at every watering. The following stock solutions were used:

For 'Blue Sky' and 'Snow'

Material	g/litre
Potassium nitrate	70
Ammonium nitrate	60
Aluminium sulphate	60 mg/litre

pH maintained at 4.5 to 5.5. Conductivity of feed 1375 microsiemens plus own water supply (Efford water approx. 650 microsiemens).

For 'Shower' and 'Twilight Red'

Material	g/litre
Potassium nitrate	70
Ammonium nitrate	60

pH maintained at 6.8. Conductivity of feed 1375 microsiemens plus own water supply (Efford water approx. 650 microsiemens).

Both feeds supplied 150 ppm N and 150 ppm K_2O.

No plant growth regulants were applied in case possible treatment effects were masked.

Assessments

During the course of the trial the following assessments were made:

1. Crop diary.
2. Period of forcing to colouring and marketing.
3. Final plant height from rim of pot (mm).
4. Final plant spread (mm) 2 measurements, one across widest part, second at 90° to this.
5. Number of heads greater than 50 mm in diameter.
6. Diameter of two largest heads (mm).
7. Quality.
8. Shelf life performance.

Statistical analysis

Limited replication due to space availability meant that it was not possible to make a statistical analysis of the recorded data. Treatment means are presented in the results tables.

RESULTS

The effects of supplementary lighting treatments compared to the unlit control on growth and quality are shown for each cultivar in Appendix II. Photographic records comparing growth during the course of the trial are shown in Appendix III, Plates 1 to 8, pages 14 to 16. Treatment differences should be treated with caution due to the limited replication of this preliminary trial.

'Blue Sky'. Table 1, Appendix II, page 12.

The measured variates of height, spread and number of heads greater than 50 mm in diameter all increased from unlit controls through 2500 lux to 4000 lux treatment. This was not necessarily considered beneficial as some plants, particularly under the highest light intensity were too tall and somewhat stretched to qualify for the highest quality grades. Overall quality for 'Blue Sky' was considered better under lit regimes than unlit. The largest diameter of heads was recorded under 2500 lux which were some 22 mm larger than those recorded for the unlit plants. Lit plants were at 50% colouring some 2 weeks earlier than unlit plants, colouring after only 49 days of forcing.

'Twilight Red'. Table 2, Appendix II, page 12.

A very similar pattern of growth to that of 'Blue Sky' was noted, with this tall growing cultivar stretching badly under the lit treatments. Very weak spindly growth resulted with plants having to be staked for support. Any beneficial effect of lighting ie. increase in number of heads greater than 50 mm was completely offset by the unbalanced nature of the growth obtained. Thus, despite advancing colouring date and increasing size, quality markings for lit plants were extremely poor with the majority unmarketable compared to unlit controls.

'Shower'. Table 3, Appendix II, page 13.

The trends for days to 50% colouring, height, average spread, number of heads were similar to the previous two cultivars. However, 'Shower' proved a more balanced plant and lighting treatments did not detrimentally effect finished quality. Head size, however, was not particularly different between treatments, with unlit plants averaging 120 mm in diameter and lit plants 135-136 mm unlike the other varieties where larger differences were recorded between unlit and lit.

A marginally higher quality score was recorded under 2500 lux treatment than the other two treatments.

'Snow'. Table 4, Appendix II, page 13.

The response of 'Snow' was similar to other cultivars with regard to days to 50% colouring and height. Results for other variates such as spread gave no increase in size with 4000 lux over the 2500 lux treatment as with other cultivars though there was a large increase of lit treatments over unlit plants. 'Snow' also demonstrated a slight decrease in head numbers recorded unlike the other three cultivars with increasing light intensity. Head diameter was marginally greater under 2500 lux than the other two treatments, unlit and 4000 lux. As with 'Twilight Red' quality scoring of the lit treatments was much poorer than the unlit controls due to the somewhat weak spindly growth obtained.

In summary across all four cultivars the major features of the results were that a distinct advancement in period to marketing was recorded. Height increased with increasing light intensity as did average spread of plants. Lighting increased head numbers for 'Blue Sky, 'Twilight Red' and 'Shower' but not 'Snow'. The diameter of these heads tended to be larger at 2500 lux than 4000 lux and unlit plants suggesting that 4000 lux might be considered a luxury level of irradiance which may actually begin to limit head development.

Shelf life assessment

Typical plants from each plot were taken and assessed over a 4 week period in an unlit glasshouse compartment to monitor deterioration. The major defects considered for shelf life were the speed of individual inflorescence loss from the flower head and any paling in colour. (Appendix III, plates 9 and 10, page 18).

Treatment means across all four cultivars followed a similar pattern under the three regimes. Despite lighting having generally improved flower head number during production there was a tendency for lit plants to 'go over' more rapidly in shelf life. The summary below represents average number of flower head, loss of flowers and petal colour paling across the four cultivars during shelf life.

Deterioration in shelf life - average per plant (across 4 cultivars)

Treatment		Assessment date					
		20 March	26 March	30 March	6 April	9 April	21 April
Unlit	Head no.	4.6	4.6	4.7	4.8	4.8	4.8
	Flower loss	-	-	-	1.06	3.18	4.12
	Paling flowers	-	-	-	0.18	1.37	2.31
2500 lux	Head no.	5.1	5.1	5.2	5.2	5.2	5.3
	Flower loss	-	0.06	0.87	3.31	4.30	4.90
	Paling flowers	-	-	0.13	1.56	2.81	3.18
4000 lux	Head no.	5.1	5.1	5.6	5.6	5.6	5.6
	Flower loss	-	0.06	1.18	3.50	4.44	5.06
	Paling flowers	-	-	0.56	2.00	2.80	3.25

DISCUSSION AND CONCLUSIONS

This preliminary investigation into the potential for supplementary lighting treatment for the forcing of *Hydrangea* demonstrated several effects on growth. The four lacecap cultivars showed some differences in their response which would not necessarily be desirable commercially.

As might be expected lighting treatment at 2500 lux and 4000 lux accelerated flowering compared to unlit plants. Differences between variates measured for unlit plants compared to lit treatments were larger than differences recorded between 2500 and 4000 lux treatments. The overall trend was for measured variates such as height and spread to increase with increasing light level. This increased height and spread in 'Blue Sky' and 'Shower' did not detrimentally effect the balance of growth and hence final quality. For 'Twilight Red' and 'Snow' very weak spindly stems resulted meaning that plants had to be staked. During the course of this particular trial no plant growth regulators were applied and it may well be that the finished quality of these plants to within specification could have been achieved with lighting treatments plus PGR's application.

Generally, the higher the lighting intensity the greater the number of flowering heads greater than 50 mm in diameter recorded, although the reverse was found for the cultivar 'Snow'.

An important feature of the quality of pot *Hydrangea* is bloom size. Both lighting treatments increased average bloom diameter compared to unlit plants but there was a tendency for plants lit at 4000 lux to have a slightly smaller head size than 2500 lux perhaps indicating that 4000 lux was a sub optimal treatment. Lighting at 4000 lux would have a greater heating effect than lighting at lower levels which may have had an influence on head development.

Despite the overall improvements in growth recorded during production, subsequent shelf life performance was poorer from lit plants than unlit. Plants lit at the highest light intensity (4000 lux) deteriorated more rapidly with regard to flower loss and paling of blooms. Lighting at 2500 lux followed a similar pattern but at a lower level with the least and slowest deterioration from unlit control plants.

Thus results taken overall suggest that 2500 lux is an adequate light level for forcing *Hydrangea*, though some cultivars would need PGR application to prevent excessive 'stretching'. Lighting at 2500 lux would also be more economic than at higher levels eg. 4000 lux.

Suggestions for future work include the addition of plant growth regulators during forcing and their interaction with any lighting treatment. More detailed investigations should also be carried out looking at timing and duration of lighting treatment during the forcing period. It may well be that plants need not be lit continuously throughout forcing and that a shorter period of lighting treatment may enhance growth without detrimentally effecting post marketing performance by "conditioning" plants to their future "home life" environment.

HYDRANGEA TRIAL

K4 4000 lux

R_{49}	P_{50}	R_{51}	P_{52}
P_{53}	R_{54}	P_{55}	R_{56}

B_{57}	W_{58}	B_{59}	W_{60}
W_{61}	B_{62}	W_{63}	B_{64}

N

K5 2500 lux

R_{33}	P_{34}	R_{35}	P_{36}
P_{37}	R_{38}	P_{39}	R_{40}

B_{41}	W_{42}	B_{43}	W_{44}
W_{45}	B_{46}	W_{47}	B_{48}

K10 Unlit

R_{17}	P_{18}	R_{19}	P_{20}
P_{21}	R_{22}	P_{23}	R_{24}

B_{25}	W_{26}	B_{27}	W_{28}
W_{29}	B_{30}	W_{31}	B_{32}

K15 Unlit

R_{1}	P_{2}	R_{3}	P_{4}
P_{5}	R_{6}	P_{7}	R_{8}

B_{9}	W_{10}	B_{11}	W_{12}
W_{13}	B_{14}	W_{15}	B_{16}

Cultivars :

R = Twilight Red
P = Shower (or Sunset)
B = Blue Sky
W = Snow

Plot Size :

20 plants per plot
=> 320 per compartment

APPENDIX II.

Table 1. 'Blue Sky' - effect of lighting treatment on growth and quality.

	Treatment		
Variate	Unlit	2500 lux	4000 lux
Days to 50% colour*	62	55	49
Height (mm)	237	374	418
Average Spread (mm)	472	555	570
Heads 50 mm	3.5	4.1	4.4
Mean diameter of two largest heads (mm)	146	168	159
Quality#	2.8	3.2	3.7

* Days from housing for forcing to 50% colour.

Quality: 1 = poorest; 4 = best; 0 = unmarketable.

Table 2. 'Twilight Red' - effect of lighting treatment on growth and quality

	Treatment		
Variate	Unlit	2500 lux	4000 lux
Days to 50% colour*	70	61	53
Height (mm)	226	380	387
Average Spread (mm)	518	657	690
Heads >50 mm	4.3	5.0	5.3
Mean diameter of two largest heads (mm)	160	164	149
Quality#	3.0	0.7	0.9

* Days from housing for forcing to 50% colour.

Quality: 1 = poorest; 4 = best; 0 = unmarketable.

Table 3. 'Shower' - effect of lighting treatment on growth and quality.

	Treatment		
Variate	Unlit	2500 lux	4000 lux
Days to 50% colour*	70	59	53
Height (mm)	207	345	368
Average Spread (mm)	465	555	576
Heads 50 mm	4.1	4.3	4.9
Mean diameter of two largest heads (mm)	120	136	135
Quality#	2.8	3.1	2.9

* Days from housing for forcing to 50% colour.

Quality: 1 = poorest; 4 = best; 0 = unmarketable.

Table 4 'Snow' - effect of lighting treatment on growth and quality

	Treatment		
Variate	Unlit	2500 lux	4000 lux
Days to 50% colour*	70	61	53
Height (mm)	206	358	367
Average Spread (mm)	507	684	673
Heads >50 mm	4.8	4.7	4.5
Mean diameter of two largest heads (mm)	140	151	146
Quality#	2.4	0.8	1.0

* Days from housing for forcing to 50% colour.

Quality: 1 = poorest; 4 = best; 0 = unmarketable.

APPENDIX III.

Plate 1. 'Blue Sky' - comparison of growth after 35 days forcing.

Unlit 2500 lux 4000 lux

Plate 2. 'Blue Sky' - comparison of growth at marketing.

Unlit 2500 lux 4000 lux

Plate 3. 'Twilight Red' - comparison of growth after 35 days forcing.

Unlit 2500 lux 4000 lux

Plate 4. 'Twilight Red' - comparison of growth at marketing.

Unlit 2500 lux 4000 lux

Plate 5. 'Shower' - comparison of growth after 35 days forcing.

Unlit 2500 lux 4000 lux

Plate 6. 'Shower' - comparison of growth at marketing.

Unlit 2500 lux 4000 lux

Plate 7. 'Snow' - comparison of growth after 35 days forcing.

Unlit **2500 lux** **4000 lux**

Plate 8. 'Snow' - comparison of growth at marketing.

Unlit **2500 lux** **4000 lux**

Plate 9. 'Twilight Red' - colour loss of petals in shelf life.

Plate 10. 'Snow' - colour loss of petals in shelf life.