

Response Of *Fothergilla*, *Hydrangea* And *Viburnum* To Photoperiod During Stock Plant And Liner Phases

Internal report for Young Plant Research Center

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EXECUTIVE SUMMARY AND CONCLUSIONS

Losses of rooted liners of *Fothergilla*, *Hydrangea* and *Viburnum* can occur over winter. One hypothesis is that dormancy under natural day lengths and cool temperature in the fall means that liners are not sufficiently developed to successfully overwinter. Stock plants of the three species were placed in three different environments: natural day, short days (black cloth pulled from 5 p.m. to 8 a.m.) and long days (black cloth, plus incandescent lights from 10 p.m. to 2 a.m.). The unrooted cuttings, once stuck, were also placed in three day length environments in a propagation greenhouse, with all combinations of lighting during the stock and liner phases.

Photoperiod had a greater effect on stock plants than cuttings. For stock plant production of cuttings, there was greater growth under long days than short days, increased cutting production, and also greener foliage color. In propagation, there was no clear difference in root systems between the three light treatments, but foliage tended to stay greener under long days.

Overall, we conclude:

- Long day lighting of stock plants is likely to keep these crops actively growing for a longer period into the fall, and perhaps earlier growth in the spring, compared with short days with a resulting increase in cutting production. However, maintaining warm temperature (which we had in our trials) is probably also important in terms of delaying plant dormancy in many seasonal plants.
- There may be benefits of long day lighting during propagation when days are naturally short, but this was not conclusively shown in our study other than observing that foliage remained greener under long days. In my opinion, long days in propagation would probably be positive. However, questions remain on whether photoperiod lighting levels alone (at around 10 footcandles) would be sufficient to have a benefit in northern locations, or if supplemental lighting (typically around 400 foot candles) would be required.
- The fact that we saw some dormancy in plants in February even under warm temperatures and long days means that there are limits in how much photoperiod will overcome “pre-programmed” dormancy cycles in stock and cuttings. Perhaps a higher-light treatment than our 10 footcandle lighting with incandescents would be necessary.

OBJECTIVE

To evaluate the effect of photoperiod on stock plant production of unrooted cuttings and propagation of rooted liners of *Fothergilla*, fragrant *Viburnum*, and oak-leaved *Hydrangea*.

MATERIAL AND METHODS

On July 29 2008, rooted liners of *Fothergilla* hybrid 'Mt. Airy', fragrant *Viburnum carlesii*, and oak-leaved *Hydrangea quercifolia* 'Snow Queen' were received from Spring Meadow Nursery in Michigan. These liners were planted in 4-gallons pots (24 pots total for each species) and grown as stock plants in the following three light environments: natural day lengths, short days (black cloth pulled from 5 p.m. to 8 a.m.) and long days (black cloth, plus incandescent lights from 10 p.m. to 2 a.m. at 10 footcandles).

Cuttings from the stock plants were harvested to specifications from Spring Meadow. Cuttings were harvested by clipping each variety below the second node, with a consistent stem length below the bottom node; *Fothergilla* (2 cm stem), *Hydrangea* (4 cm stem) and *Viburnum* (1 cm stem). Hormodin 2 was used on each cutting before sticking.



Average temperature and light level (moles/m²/day) in the two greenhouses:

Month	Stock plants		Propagation	
	Avg Temperature (F)	DLI Light	Avg Temperature (F)	DLI Light
Aug/2008	80.1	12.61	79.3	9.0
Sep/2008	78.8	14.03	77.8	8.6
Oct/2008	74.5	11.51	83.7	10.4
Nov/2008	67.3	6.2	72.2	8.6
Dec/2008	68.2	6.8	72.6	5.9
Jan/2009	Outside, No Data		72.9	6.3
Feb/2009	Outside, No Data		73.3	6.4

Cuttings were harvested twice during the experiment, with two experimental runs and evaluations of the stock plants and liners.

For the first evaluation, cuttings were stuck on week 38 (09/18/08) and evaluated on week 45 (11/03/08). In the second evaluation, cuttings were planted on week 49 (12/03/08) and evaluated on week 3 (01/15/09) (*Fothergilla* was evaluated on 02/12/09).

The cuttings were propagated in a poly-greenhouse under the following lighting schedules: natural day lengths, short days (black cloth pulled from 5 p.m. to 8 a.m.) and long days (black cloth, plus incandescent lights from 10 p.m. to 2 a.m. at 7 foot-candles).

The mist frequency was 15-20min/ 2sec during the day and 25-45min/ 2 sec at night before rooting.

Replicated photoperiod environments in propagation. We had three blocks under each of the natural, short, or long day (night interruption) environments.



Cuttings in one of the photoperiod blocks.



RESULTS

Stock plants

Long days increased elongation of stock plants, and active growth continued longer into the winter. The photos below, taken on December 1 (top) or January 12 (bottom), 2008, show a representative plants from each species (Fothergilla, Hydrangea, and Viburnum from left to right) from natural (left of each photo), long (night interruption, middle) or short day (right) environments.

Dec 1 photos



Jan 12 photos



There was also more red fall coloring of the hydrangea under short and natural days compared with long days. Natural day plants were shorter than long day plants. Short days produced the weakest plants.

There was no difference in number of tip cuttings that could be harvested from long and natural day stock plants – long day plants were taller, but had a similar number of branches. Between the first and second evaluations, there was a drop in the number of cuttings harvested per pot. At the second evaluation, short day plants appeared to be going dormant which resulted in fewer cuttings per pot. Plants in all environments gradually showed fall color in Jan-Feb even under long days.

Stock plant cutting yield (average per pot, from 24 pots in each day length treatment)

First evaluation

12/3/2008	Natural days	Long days	Short days
Hydrangea	3.5	3.6	3.0
Fothergilla	1.6	1.8	1.9
Viburnum	1.6	1.6	1.5
Average	2.3	2.3	2.1

Second evaluation

1/12/2009	Natural days	Long days	Short days
Hydrangea	1.4	0.8	0.5
Fothergilla	0.6	0.8	0.5
Viburnum	1.0	1.1	0.5
Average	1.0	0.9	0.5

Propagation of rooted liners

The first and second evaluations had all combinations of species, stock plant day length, and propagation day lengths as illustrated the table below.

There were no consistent effects of light environment during the stock or propagation phases on performance of cuttings during propagation. Between the first and second evaluation the number of primary roots and root length were both reduced. There was a lot of variability in the rooting between cuttings on a tray, and we conclude that more replicate cuttings were needed to determine a trend.

First evaluation (Planting date: 9/18/08, Evaluation date 11/3/08)

specie	stock	propagation	Average				
			No leaves	No primary roots	Average No Roots	Root Length	Average Roots Length
Hydrangea	Natural Days	Natural Days	7.22	10.56	8.33	8.04	7.00
Hydrangea	Long Days	Natural Days	6.44	5.22		6.47	
Hydrangea	Short Days	Natural Days	7.22	9.22		6.49	
Hydrangea	Natural Days	Long Days	5.89	14.44	12.41	9.08	8.52
Hydrangea	Long Days	Long Days	6.22	10.33		7.79	
Hydrangea	Short Days	Long Days	7.11	12.44		8.69	
Hydrangea	Natural Days	Short Days	6.89	13.22	16.81	7.63	8.19
Hydrangea	Long Days	Short Days	6.22	18.44		7.93	
Hydrangea	Short Days	Short Days	4.56	18.78		9.00	
Viburnum	Natural Days	Natural Days	2.89	9.11	9.00	7.76	7.77
Viburnum	Long Days	Natural Days	2.78	8.44		6.85	
Viburnum	Short Days	Natural Days	2.78	9.44		8.69	
Viburnum	Natural Days	Long Days	2.22	3.00	7.59	2.17	5.16
Viburnum	Long Days	Long Days	3.00	10.44		6.28	
Viburnum	Short Days	Long Days	2.67	9.33		7.04	
Viburnum	Natural Days	Short Days	2.89	4.33	6.56	4.58	5.38
Viburnum	Long Days	Short Days	2.22	7.33		4.76	
Viburnum	Short Days	Short Days	2.56	8.00		6.81	
Fothergilla	Natural Days	Natural Days	1.56	9.33	7.52	6.88	7.55
Fothergilla	Long Days	Natural Days	1.67	6.78		6.85	
Fothergilla	Short Days	Natural Days	2.00	6.44		8.92	
Fothergilla	Natural Days	Long Days	1.67	7.89	7.19	7.97	8.80
Fothergilla	Long Days	Long Days	2.22	8.00		10.74	
Fothergilla	Short Days	Long Days	2.33	5.67		7.68	
Fothergilla	Natural Days	Short Days	1.56	8.89	8.19	8.04	8.45
Fothergilla	Long Days	Short Days	2.00	8.00		7.60	
Fothergilla	Short Days	Short Days	1.67	7.67		9.71	

Second evaluation (Planting date: 12/3/08, Evaluation date 01/15/09)

specie	stock	propagation	Average				
			No leaves	No primary roots	Average No Roots	Root Length	Average Roots Length
Hydrangea	Natural Days	Natural Days	3.82	14.03	14.10	6.22	5.81
Hydrangea	Long Days	Natural Days	3.96	15.33		6.45	
Hydrangea	Short Days	Natural Days	3.67	12.94		4.76	
Hydrangea	Natural Days	Long Days	4.46	8.96	10.17	5.07	5.16
Hydrangea	Long Days	Long Days	4.04	10.04		4.66	
Hydrangea	Short Days	Long Days	4.00	11.50		5.73	
Hydrangea	Natural Days	Short Days	4.63	14.25	15.09	5.33	5.71
Hydrangea	Long Days	Short Days	4.21	18.25		6.67	
Hydrangea	Short Days	Short Days	4.50	12.77		5.14	
Viburnum	Natural Days	Natural Days	2.58	5.42	5.39	3.51	3.17
Viburnum	Long Days	Natural Days	2.92	3.00		1.55	
Viburnum	Short Days	Natural Days	2.00	7.75		4.46	
Viburnum	Natural Days	Long Days	2.33	6.67	4.75	4.21	3.46
Viburnum	Long Days	Long Days	2.00	2.92		2.55	
Viburnum	Short Days	Long Days	1.50	4.67		3.60	
Viburnum	Natural Days	Short Days	3.08	6.00	5.47	4.83	4.44
Viburnum	Long Days	Short Days	3.08	6.25		4.75	
Viburnum	Short Days	Short Days	1.08	4.17		3.74	
Fothergilla	Natural Days	Natural Days	1.67	4.67	3.89	5.59	4.60
Fothergilla	Long Days	Natural Days	2.00	4.58		3.50	
Fothergilla	Short Days	Natural Days	2.00	2.42		4.70	
Fothergilla	Natural Days	Long Days	2.00	3.58	2.56	5.85	3.90
Fothergilla	Long Days	Long Days	1.42	0.92		1.73	
Fothergilla	Short Days	Long Days	2.25	3.17		4.12	
Fothergilla	Natural Days	Short Days	2.00	4.67	5.58	5.05	4.90
Fothergilla	Long Days	Short Days	1.83	6.17		2.95	
Fothergilla	Short Days	Short Days	2.00	5.92		6.70	

Of the three species, hydrangea produced the most cuttings, and was easiest to propagate. We have therefore concentrated on them in the comments below.

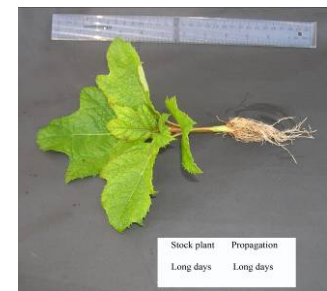
We were interested to see if there was more elongation of cuttings during propagation under different light environments. Increase in stem diameter and length of hydrangea cuttings during propagation was measured from the sticking date to evaluation date.

Plants under natural days during propagation elongated slightly more than under the other two photoperiods, but plant heights were within 0.3 cm of each other which is not horticulturally important.



Hydrangea increase in stem diameter (mm) and stem length (cm) during the liner phase in the first evaluation (Sept 18/08 to Nov 3/08)

Photoperiods		Stem diameter (mm)	Stem length (cm)
Stock	Propagation		
Natural	Short	0.90	0.59
Natural	Natural	0.95	0.85
Natural	Long	0.74	0.46
Long	Short	0.66	0.53
Long	Natural	1.00	0.83
Long	Long	0.81	0.55
Short	Short	0.69	0.52
Short	Natural	0.60	0.83
Short	Long	0.88	0.58



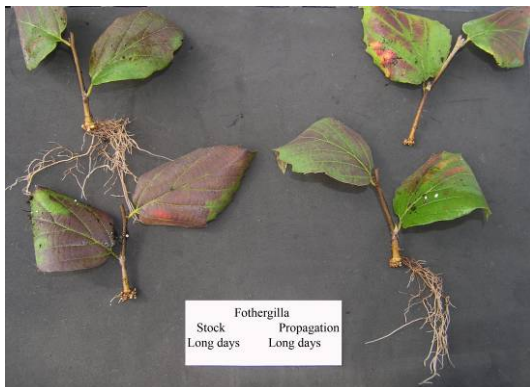
Cuttings from long days (on stock plants) to Long days (propagation area) had darker foliage than cuttings from natural and short to short days. Second evaluation (Planting date 12/3/08).



In the first evaluation of Fothergilla (planting date 9/18/08), we saw fairly good rooting under all light conditions, as shown in the photo below for plants grown under long days, followed by natural days.



However, in the second evaluation (planting date 12/3/08) there was considerably more red color in leaves, in all light environments (long days stock followed by long days propagation).

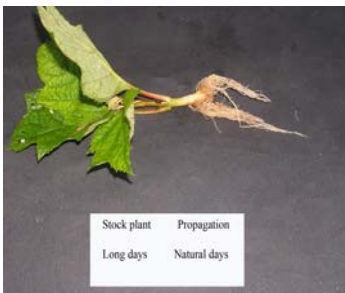
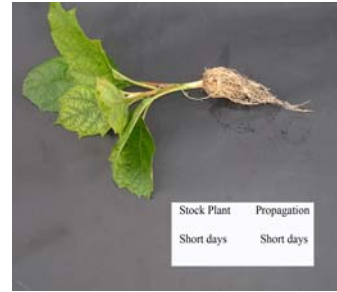
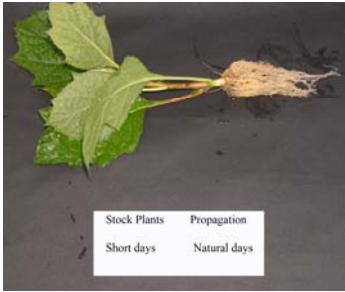


Viburnum cuttings in the second evaluation were also small, and we had losses from disease.



Additional photos

First evaluation (9/18/09 stick date)



Second evaluation (12/3/08 stick date)

