Light Emitting Diodes Lights Make Rooting Micro-Cutting Lilacs Easier and Safer©

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INTRODUCTION

Minnesota in the winter is not the ideal place to try to propagate woody ornamental cuttings. Cold temperatures and low light conditions make rooting cuttings a real challenge. So when Bailey Nurseries (www.baileynursery.com) in St. Paul, began reading about how European growers were using light emitting diodes (LED) lights to root cuttings it piqued our interest.

In 2011, we worked with Philips and Hort Americas (our supplier and technical support — the contact info is Chris Higgins at chiggins@hortamericas.com) to design a separate propagation room not in the greenhouses to trial the LED lights.

OUR START IN 2011 WITH LIGHT EMITTING DIODES LIGHTS

We started our trial in Feb. 2011 and ran a range of crops under the lights. We used three Cannon carts tied together side by side to form one large shelf that can hold up to 15 trays. The trial was conducted in a corner of the germination room. The germination chamber was the perfect location for the trial. It is located inside a production building, provides a constant 70°F temperature, has misting capacity (fog nozzles in the ceiling), and electricity is easily available. The propagation area was partitioned with black and white plastic to avoid light contamination from the fluorescent lights (used for germination). The trial area had no other lights, other than the "GreenPower LED production modules" made of 75% deep red and 25% blue lights that were located about 16 in. away from the cuttings. The modules are 5 ft long, which matches the size of the Cannon carts.

A range of cuttings were taken from plants in the greenhouses, including *Spiraea*, *Celastrus*, *Physocarpus*, and *Hydrangea* to name a few. We also included in the trial 900 microcutting lilacs. The greenhouse cuttings were stuck in 38-cell plastic trays (standard 11 in. × 21 in. size). The tissue cultured lilacs (microcuttings) were grown in three 288 trays. The medium used was Preforma®. The cuttings were sprayed with IBA to help initiate rooting, except for the tissue cultured lilacs.

- The fogging system fills the entire room with fog, and for this reason, there is no hand misting necessary. The fog kept the cuttings turgid.
- The fluorescent tubes maintain the room at a constant air temperature of 75°F.
- The LED lights generate some heat and provide the light spectrum that is required to sustain plant growth.

For these reasons, The Preforma plugs remain moist, the cuttings remained turgid, the temperature and light source is constant, and the cuttings never get stressed. There is little to no grower care required under these growing conditions, but the cuttings still receive a weekly preventative fungicide treatment.

OUR CURRENT SETUP: GREENPOWER LED PRODUCTION MODULES

Based on the 2011 successful results in the chamber, we purchased more GreenPower LED production modules. We are now able to move carts in and out of the chamber with total ease. We have six carts, with five layers per cart for a total of 150 flats. This is the only space currently allocated to LED multi-layer production where we now think in number of plants per cubic foot instead of square foot.

During the 2012 winter we rooted 16,000 lilac microcuttings or 25% of the French lilacs (*Syringa vulgaris*) schedule. The rest of the schedule (48,000 cuttings) was rooted in our greenhouses. In 2013, we rooted 66,000 microcutting lilacs, the full schedule.

Our normal greenhouse conditions require the presence of a grower every 20 min. These

tissue culture lilacs are rooted inside several tents in one of our greenhouses. The tents are used to create a microclimate that is easier to control than trying to control an entire greenhouse. Depending on the level of sun intensity, on how much moisture is in the air, on how often the heaters are running, the grower in charge has to adjust the mist cycle, the amount of shade, and how much venting to match the outside growing conditions constantly. In the chamber, there is none of that.

Table 1. Lilac 2013 yield summary.

2013 micro-cutting lilacs	Cuttings received (no.)	Rooted cuttings (no.)	Cuttings lost during rooting no. (%)	2013 LED chamber	7 years average
First shipment (1/8/13)					
Common White	19872	18536	1336 (6.72)[x]	93.28	87.5
Madame Lemoine	4032	3864	168 (4.17)	95.83	71.3
Wonderblue	2016	1904	112 (5.56)	94.44	82.8
Second shipment (1/30/13)					
Andenken an Ludwig Späth[z]	2880	2594	286 (9.93)	90.07	66.8
Miss Ellen Willmott	1152	1026	126 (10.94)	89.06	74.75
Sensation	11808	11400	408 (3.46)	96.54	79.71
Third shipment (2/19/13)					
Yankee Doodle[y]	6048	3116	2932 (48.48)	51.52	63.4
Sensation	10368	9760	608 (5.86)	94.14	79.71
Albert F. Holden	2016	1444	572 (28.37)	71.63	61.4
Krasavitsa Moskvy[z]	4896	4256	640 (13.07)	86.93	74.16
President Lincoln	1100	1100	0 (0)	100.00	71.66
Total	66188	59000	7188 (10.86)	89.14	73.92

[x]The number in parenthesis indicates the loss percentage.

[y]'Yankee Doodle' suffered some shipping damages. That is why this cultivar is the only one that reads a lower percentage under LED compared to the 7-year average.

[z]'Andenken an Ludwig Späth', syn. 'Ludwig Spaeth'; 'Krasavitsa Moskvy', syn. 'Beauty of Moscow'.

CROP GUIDELINES FOR THE CHAMBER

The grower responsible for the crop will check the fog level, how wet the cuttings are, and check the cycle on the clock. This only takes a few minutes 4 or 5 times a day.

The light regiment is 16 h on and 8 h off. They start at 4 AM and they go off at 8 PM. The mist water is treated with a water softener to remove the impurities (calcium deposits) that could accumulate on the diodes. It is important to keep them as clean as possible or the light quality and intensity will be reduced. The mist cycle is also on a timer. When the pegs on the timers are "out" the mist is on. If the pegs are "in" the fog is off. This gives us the ability to control the amount of water that goes on the cuttings. Early on, the mist will be close to live. As the cuttings age, they receive less and less water. The first roots are seen after a few days. At 10 days most cuttings will show some roots. At 2 weeks, some roots will be at the bottom of the cell and coming out of the drain holes. Most of the cuttings have roots. This is also the time when we fertilize them. The lilacs are fertilized by dipping the trays in a 50 ppm solution of liquid fertilizer. At 3 weeks they are ready to leave the chamber. It is recommended to keep them for a few more days to let the stragglers catch up. Once in the greenhouse, they are fertilized again, and will be transplanted in the sand soon after.

THE 2013 ECONOMICAL ANALYSIS

- We purchased 66,200 cuttings.
- We planted 59,000 rooted cuttings in our greenhouses.
- The yield percentage was 89% under LED.
- The 7-year yield average is 74% in our greenhouses.
- The cost of a cutting is about $0.70.

Table 1. Analysis.

66,200 × 89% = 58,918 rooted cuttings or 7,282 lost cuttings at $0.70 = $5,000 lost
66,200 × 74% = 49,000 rooted cuttings or 17,212 lost cuttings at $0.70 = $12,000 lost
The difference, $12,000 - $5,000 = $7,000 saved when using LED versus the greenhouse

Because of the increased yield under LED lights, the estimated losses can be reduced by 10,000 cuttings or by $7,000. Running 60 production modules for 16 h per day cost less than $3 per day.

SUMMARIZED LIST OF BENEFITS FROM THIS PROPAGATION METHOD

- Increased yield,
- Reduced plant loss,
- Increased plant quality,
- Reduced crop timing,
- Reduced and simplified grower care,
- Reduced greenhouse cost, heat, and maintenance,
- Free greenhouse space,
- Avoid greenhouse construction and make better use of current space,
- Simplify and streamline production,
- Accelerate propagation,
- And make propagating possible at any time of the year as long as a cutting source is available.