Light-Emitting Diode (LED) Lighting in Plant Propagation©

Matt Mansfield
Mansfield's Propagation Nursery, P.O. Box 8094, Carrum Downs, Vic 3201, Australia
Email: matt@mansfields.net.au

INTRODUCTION

In 2013 at the IPPS Australian Region Conference Karen Brock presented a paper on the use of light-emitting diode (LED) lighting in her propagation facility. There was not much detail on the potential benefits for a propagation nursery so a commercial trial was set up with the following aims:

- To identify the difference in strike rate (the number of plants to successfully set roots) between an LED lit and an unlit bench. Making it easy to quantify the cost benefit such a system will provide by improving strike rates.
- To identify the length of time for root initiation in days between the LED lit and the unlit trays. This will outline the potential turnover and efficiency gains the LED lights will give the propagation house.
- To ultimately measure the cost benefits of installing lights to improve productivity of a green house compared with building more production space.

BACKGROUND

We were contacted by Powerplants Australia, who was bringing out a European representative of Phillips lighting as part of their initiative to introduce LED lighting in to the Australasian horticultural market. We had a meeting with Philips and Powerplants and had a close look in to the technology that European, American, and Asian growers were adopting. I was able to recall the similar presentation at the 2013 Melbourne IPPS Conference by Karren Brock on the set up of LED lighting in her propagation house. Although Karen's trial was extremely interesting it hadn't quantified the potential benefits for a propagator or nursery should they adopt the technology.

I contacted Powerplants and Philips and asked if they would both be interested in supplying enough material to set up LED "grow light" technology over one of our propagation benches, which is capable of holding 16,000 cuttings per week. I proposed this to both companies with the understanding I would conduct a full scale propagation trial, record the results and present the paper as an entry for the Rod Tallis Award for the 2014 IPPS Combined Australia and New Zealand Conference.

METHOD

- The trial commenced on 14 Jan 2014.
- Propagation for the trial was 2 trays per taxon with the same number of cuttings per tray.
- There was a range of plants each week to give a good cross section, including trees shrubs, grasses, perennials, and succulents.
- Each trial tray was produced on the same day, by the same propagator, from the same mother stock, using the same hormone but placed on separate benches. Both benches were in the same location of the green house and experienced the same watering, misting, fertilisation, and growing environments.
- The only variable within the trial was one bench being lit by red and blue LED lights as designed and installed by Phillips. These plants placed under LED lights experienced 16 h of LED light per day. The control plants on the unlit bench received normal day light regulated by the automatic shade screens, as required by the propagation house between January and April.
- Daily recordings of the greenhouse conditions were made using the greenhouse management software program. Included in these conditions were inside and outside light levels. A light photometer was used at the same time every day to measure the available light to all plants, both the LED bench and the unlit control bench. In addition,

each day the following measurements were recorded; actual sunlight hours each day outside of the greenhouse (to gain an understanding of the difference between inside and outside light differentials), the atmospheric temperature, media temperature, and humidity levels inside the green house.

RESULTS

Lighting the initial stage of propagation increased strike rate across the range by 7%. Put in to context a 7% rise in strike rate over the 1,900,000 cutting grown plants produced annually would result in an extra 136,500 plants through the nursery. On one of the major lines in blueberries there was a 12% increase in strike rate. A raise in the strike rate of the blueberries by 12% a year would result in $26,000 extra per year for the business (Table 1).

Table 1. Species propagated with strike rate and duration.

Plant name	Week propped	Strike rate (%)		Weeks in propagation house		
		Lit	Unlit	Weeks in propagation	Mansfield average	Weeks faster
Agonis flexuosa 'Nana'	4	38	47	13	12	-1
Banksia spinulosa × *B. ericifolia* 'Giant Candles'	7	99	97	5	15	10
Blueberries (*Vaccinium*)	6	83	37	11	21	10
Vaccinium corymbosum 'Sunshine Blue'	7	62	46	8	21	13
Callistemon citrinus 'Endeavour'	7	46	42	8	14	6
Cupressus macrocarpa 'Wilma'	6	54	49	8	15	7
Grevillea 'Poorinda Royal Mantle'	4	70	53	7	14	7
Pandorea jasminoides	7	93	89	4	6	2
Philotheca myoporoides	5	57	38	9	9	0
Photinia × *fraseri* 'Robusta'	5	46	36	13	30	17
Scabiosa columbaria 'Mauve Delight'	5	84	100	9	7	-2
Westringia fruticosa	5	84	84	6	7	1
Westringia fruticosa 'WES06', Low Horizon™ coastal rosemary PPAF	3	65	70	6	7	1
		68%	61%	8 weeks	14 weeks	5 weeks
		7% better				improvement

By lighting the propagation house crops were ready for tubing 2 weeks earlier on average. If that was across the board the total amount of cutting grown plants to move through that house would go from 2.7 million to 3.2 million without expanding. It is expected that by also lighting the second stage, crops would be ready 4 weeks earlier than with unlit propagation.

CONCLUSION

The trial has proven that LED lighting for propagation works! It's a matter of the fit out cost compared with the gains that that will benefit from the application. The LED lights have grown healthier, stronger plants in a shorter space of time.

So if you are at capacity in your house and need to expand, the lights are a great way to go. If you're looking to increase strike rate the lights are worth investigating further.

I would like to thank the companies who have allowed me to complete this extensive trial: Powerplants, Phillips, Mansfield's Propagation Nursery, and Tissue Culture Australia.