Using Artificial Light in Plant Propagation

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We are all aware of the importance of light in the growing of plants, of the reaching for light by plants in crowded situations, and of phototropism—the directional attraction to a light source by plants. It has not been my experience, however, to hear much talk of the effects of light on the propagation of plant material.

The light emitted by the sun has many different forms of radiation mixed up in the total product, each characterized by its precise wavelength. Most common amongst these radiations are ultra violet light (UV) at the short wavelength end of the scale, visible light in the middle area, and infra red (IR) emissions of long wavelength producing heat as we know it. UV emissions are of wavelengths of less than 380 nm (1 nm, is one millionth of a mm), while IR is above 780 nm, with visible light being in the area between these two boundaries. It is the energy produced between 380 and 780 nm about which I am referring in this article, and which we call light.

Light provides the energy for photosynthesis, which is the process plants use to produce carbohydrates from carbon dioxide and water. This process together with other chemical reactions within plant cells allows the plant to live and grow through active cell multiplication.

It is fairly generally appreciated by those who do a lot of propagation from seed material that some seeds are blessed with the ability to determine their germination according to the availability and intensity of the light at the time they are sown, or fall on the ground. *Ficus* seeds, for instance, must be fully exposed to light to successfully germinate, while *Cyclamen* seeds require total darkness for successful germination. *Philodendron* seeds will not readily germinate between April and October. However, if the light intensity is considerably increased on the seed during this period, germination can occur reasonably easily, if a little erratically.

The evidence of the effect of light on root formation in vegetative cuttings is not completely understood, and in particular the most beneficial wavelengths to promote rooting are confused by conflicting evidence. Some experimental work suggests that light in the region of 600 to 750 nm encourages root initiation, whereas other research has shown that exposure of cuttings to prolonged treatment by light of wavelengths from 380 to 450 nm encourages fairly rapid formation of roots. It is also known that treatment of the mother plants with light from the blue region of the spectrum produces cutting material which readily forms roots. So it appears that the light of shorter wavelength provides a better quality cutting and consequently more rapid rooting.

Four or five years ago we finally became tired of slow-rooting cuttings—even with the addition of bottom heat and mist—in September/October. Root formation was very slow and frustratingly uncertain.

Finally, we decided to try artificial light. After a discussion with a lighting engineer, we bought a Philips metal halide lamp which looks very much like a mercury vapour lamp but has metal halide additives. The light was suspended over a propagation bench at a height of 1 m. The bench is 1.2 m in width, and the area effectively covered by the light was about 1-1/2 m^2. In the case of *Genista* × *spachiana* [syn. *Cytisus racemosus* 'Nana'] rooting was reduced from 3 to 4 months at that time of the year to 5 to 6 weeks, and since installing this first light the propagation of plants from cutting material has improved markedly.

Having demonstrated the benefit of added light in the propagation of our plants, we decided to expand the lighting regime. We calculated that we would need five lights per 6-m bench. Apart from the cost, five lights also represented a considerable shadowing of the benches during daylight hours. Members of our staff came up with the idea of a mobile light and, with the aid of a considerable length of bicycle chain and a small electric motor geared down to an output of one revolution per min, we built a travelling light which covers one length of the bench in about half an hour. By running the 400 W lights for 12 h each night, sometimes longer during winter, we irradiate the cuttings for the equivalent time of five lights for about 2.25 h.

Plants deflasked from tissue culture are also given the same treatment and under normal circumstances we get a 100% result. Though we are not able to say we obtain the same results with cuttings, we can report that we have more success with the use of lighting.

I am not saying that the same results can not be obtained with other types of lighting, for example, high intensity sodium lights. We have not tried lights other than the metal halide type. If no natural daylight is used during rooting, selected fluorescent tubes would be more economical to install and use.

We have not tried using light without bottom heat. I have a suspicion that light may be of greater significance than bottom heat, and if so, it may be somewhat cheaper to irradiate cuttings than provide them with heat in the rooting zone.

For those interested in trying artificial lighting in propagation, the cost of the metal halide lamps, including the reflectors and chokes, is about A $200 each. When we used lighting on *Philodendron* seeds, we simply used 150 W incandescent domestic flood lights to achieve germination between April and October. We do not know whether metal halide lamps, or lamps with other wavelengths, would be more beneficial than incandescent lamps for seed germination.

REFERENCES

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