



Agriculture & Horticulture
DEVELOPMENT BOARD



New Project

PC 296

Examining the lighting requirements for daylength control so as to assess the suitability of energy saving bulbs

Project Number:	PC 296
Project Title:	Examining the lighting requirements for daylength control so as to assess the suitability of energy saving bulbs
Project Leader:	Prof Brian Thomas
Contractor:	University of Warwick
Industry Representative:	Colin Frampton. First Flora Ltd
Start Date:	1 October 2009
End Date:	31 May 2012
Project Cost:	£ 130,499

Project Summary:

Tungsten bulbs have traditionally been used for day-extension and night-break lighting as they are cheap to purchase and are rich in red and far-red light. However, Defra have announced that 'inefficient' tungsten bulbs will be phased out over the period Jan 2008 to Dec 2011. Furthermore, there is also a desire from some growers to move away from tungsten lamps to minimise stretching due to the light quality. Consequently, there is an urgent need to assess the suitability of alternative lamps so that clear recommendations can be made for their use.

It is likely that tungsten lamps will largely be replaced with compact fluorescent lamps, however, lamps that are sold as '60W equivalent' may be equivalent to a 60W tungsten bulb in terms of what the human eye perceives (lux), but they are not equivalent for plants. A number of recent HDC projects have used compact fluorescent lamps for day-extension and night-break lighting, without promoting a flowering response in what were thought to be long-day species. This project will therefore, examine the suitability of energy-saving lamps for daylength control by investigating flowering responses to light quality and quantity.

A range of important horticultural species will be grown with night-break (and possibly day-extension) lighting given by tungsten and compact fluorescent lamps. The effects of irradiance and light quality will be examined by growing plants in a suite of automated daylength controlled chambers and using light gradients. The light requirements will be determined and then compact fluorescent lamps will be compared to other lamp types (including LED and halogen lamps) in terms of their efficiency and light quality. Preliminary recommendations will be made which can then be tested in year 2.

Background & Objectives:

- Daylength is an important trigger for flowering in a number of species and is manipulated commercially for crop scheduling.
- Tungsten bulbs have traditionally been used for day-extension and night-break lighting as they are cheap to purchase and are rich in red and far-red light.
- Defra have announced that 'inefficient' tungsten bulbs will be phased out over the period Jan 2008 to Dec 2011 (<http://www.defra.gov.uk/news/2007/070927a.htm>) and so alternatives will need to be used. There is also a desire from some growers to move away from tungsten lamps to minimise stretching due to the light quality.
- The expectation is that tungsten bulbs will largely be replaced with compact fluorescent lamps with integrated ballast and starter circuit. These are typically warm-white/interna which when compared with tungsten has a high output in the green and yellow portions of the spectrum.
- Care should be taken when replacing tungsten lamps. The compact fluorescent lamps that are sold as '60W equivalent' may be equivalent to a 60W tungsten bulb in terms of what the human eye perceives (lux), but they are not equivalent for plants.
- The general rule of thumb derived from work on chrysanthemum (a short-day plant; SDP) at GCRI is that providing plants receive a similar light level to tungsten when measured in W/m² (PAR) or $\mu\text{mol}/\text{m}^2/\text{s}$ the output should be adequate. This was supported by a trial of compact florescent lamps on a commercial chrysanthemum crop.
- A number of recent HDC projects have used compact fluorescent lamps for day-extension and night-break lighting, however, plants that were thought to be long-day plants (LDP) have shown no response to lighting.
- A recent Japanese study has shown that FR is required in night-break lighting to promote flowering in Lisianthus (a LDP).
- Therefore with the phasing out of tungsten bulbs there is an urgent need to assess the suitability of alternative lamps so that clear recommendations can be made for their use.

Benefits to industry

As tungsten lamps are being phased out, alternative lamps will have to be adopted by the industry. However, if 'energy saving' lamps are used incorrectly, the cost in terms of disruptions to scheduling could be immense in, for example, an AYR crop like chrysanthemum. While in LDP, lighting incorrectly would involve installation and running costs, without any benefits in terms of earlier flowering.

Currently some growers may be deterred from manipulating daylength in LDP due to the undesirable effects of tungsten lamps on plant quality. However, this work might enable the detrimental effects to be minimised by optimising the far-red content. This would increase the potential for utilising night-break and day-extension lighting.

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