Grower Summary

PO 010

LED Lighting for Horticultural Applications – Establishing the Economics of Current Hardware Offerings

Final 2012

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Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

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Project Leader:	Chris Plackett
Contractor:	Farm Energy Centre
Industry Representative:	Alan Davis
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Headline

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- Multi-tier lighting is currently the most promising commercial option for Light Emitting Diodes (LEDs)
- Photoperiod and inter-crop LED lighting would need to demonstrate additional crop production benefits in order to generate the extra income warrant investment
- LED economic calculators can be downloaded from www.growsave.co.uk.

Background

There are currently a number of examples of commercially available LED light sources that manufacturers have developed specifically for horticultural applications. Several leading horticultural companies (located in countries like, The Netherlands, Denmark, Sweden and North America) are investing in these lighting technologies in the following applications:

- Day-length manipulation – as a direct replacement for tungsten lighting over flowering crops, soft fruit etc.
- Young plant lighting – as a replacement for fluorescent tubes in growing rooms or for multilayer growing on of small plants like cuttings, etc. It is also suggested that foliage crops such as herbs and lettuce can be successfully grown with these systems.
- Inter-crop lighting – here arrays of LEDs are placed deep in the crop canopy to stimulate activity from the parts of the plants that are shaded in traditional production systems. Applications are in both the ornamental and edible protected crops (PC) sector with cut flowers and vine crops (e.g. tomato) being the most suitable.

At the moment, little is understood about the economics of using these techniques on UK nurseries.

To provide indications of the likely economics of using the available equipment on UK nurseries, a number of example scenarios have been evaluated for the lighting techniques listed here. In all cases the LED solution has been compared to current commercial ‘best practice’ using conventional lighting equipment.

Summary

The findings of the work are:

1. **Photoperiodic lighting** - the switch from incandescent (tungsten) light bulbs to the equivalent LED is only financially viable if additional crop benefits worth at least £1.68 /m^2/year are achieved. The LED installation will give energy cost savings of £0.44 /m^2/year, and although this is the biggest contribution to repaying the capital cost of installing LEDs, it is insufficient to give a payback period of five years or less.

2. **Multi-tier lighting** – this is currently the most economically viable application as, when compared to an existing installation using tubular fluorescent lamps, the energy cost savings from LEDs are sufficient to give a payback inside five years. When appraised over a five year project, the costs for the LED installation (including capital purchase, energy and operation and maintenance) are around £13.50 /m^2/year less than the operating costs for the existing installation.

3. **Inter-crop lighting** – this technique is a new innovation that has come to the fore alongside the development of LEDs. When it is used alongside traditional supplementary lighting with high pressure sodium (HPS) lamps positioned overhead, it allows the rating of the HPS lamps to be reduced. This is because the LEDs can deliver light into the plant canopy rather than relying on the ability of the overhead lights to penetrate beyond the head of the crop. Currently the technique is restricted to growing vine salad crops like tomato and cucumber, and with these applications additional income in excess of £42.68 /m^2/year is needed for a project to repay in less than five years. This comparison is made based on the assumption that no supplementary lighting is being used at present.

It is worth noting that, if the lighting in this application is based on overhead HPS alone, and a project payback of five years or less is targeted, the additional income needed compared to 'no lighting' is £31.50 /m^2/year. This shows that inter-lighting with LEDs requires an additional £10.18 /m^2/year.

Financial Benefits

The financial benefits of the scenarios and applications tested in the project are given in summary above, however these are indicative only figures based on the assumptions made for the analysis. Growers are therefore advised to carry out similar calculations for their own circumstances using the calculators developed by this project. These are available as downloadable spreadsheets from www.growsave.co.uk. Spreadsheets are available for each of the three lighting applications studied by the project.

Action Points

1. The use of LED for multi-tier lighting is currently the most economically attractive proposition, with applications either in growing rooms or on multi-level benches in greenhouses. Growers currently using fluorescent bench lighting should look at the option of using LEDs, as the energy savings given by these lights can give commercially attractive paybacks. Also, with suitable crops, the option of increasing production capacity by adding additional tiers of benches with LED lighting could also be a cost effective alternative to expanding greenhouse area.
2. Photoperiodic lighting with LEDs is not economically viable at the moment as the energy cost saving from the lamps does not payback the capital investment in a commercially acceptable time (i.e. five years or less). However, growers should keep a watching brief on this technique as falls in capital cost (to just under £10 per lamp) could make this application economic.
3. Compared to crops produced with conventional lighting systems, LEDs need to provide additional income to be economically viable. This may be achieved through production improvements such as increased yield, higher quality, reduced disease incidence etc. Growers must look out for the results of research & development with crops grown under LEDs to asses if the improvements achieved are sufficient to justify investment.