Grower Summary

PO 017

Enhancing crop quality and diminishing water use in bedding plants

Final 2015

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Project title:	Enhancing crop quality and diminishing water use in bedding plants
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Project leader:	Dr Ian Dodd, Lancaster University; Dr Martin McAinsh, Lancaster University
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Key staff:	Richard Boyle, Lancaster University
Location of project:	Lancaster Environment Centre, Lancaster University
Industry Representative:	Sarah Fairhurst
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Date project completed (or expected completion date):	30/10/2015

GROWER SUMMARY

Headline

- Plant morphology and water use can be manipulated through reducing irrigation volumes and frequency (deficit irrigation), and by altering light quality via LEDs

Background

Bedding plant producers aim to ensure plants are at the appropriate developmental stage and of a high quality prior to sending to market, all within a strict production schedule. Reducing irrigation volumes and frequency tailored to plants water requirements (deficit irrigation) can either delay, or accelerate crop development, but knowledge of these management regimes with regard to the impact on plant quality are limited to a few species.

Many growers make use of supplementary lighting (e.g. high pressure sodium lamps), particularly during the winter, but the economic costs of this lighting can be substantial. LEDs provide a more energy efficient alternative lighting source. Current research has highlighted that LEDs may prove to be a sustainable and economically more viable approach as a sole lighting source for annual crop production.

Both deficit irrigation and the spectral quality of LED lighting will affect multiple plant physiological processes. These include photosynthesis and transpiration, both of which contribute to the efficiency with which a plant uses water, as well as the biosynthesis of, and/or sensitivity to, endogenous plant hormones that regulate crop growth and quality. Impacts of these different treatments on plant quality (particularly leaf colouration and plant compactness) have received relatively little attention, despite their commercial significance.

Summary

This project focused on improving resource use efficiency in bedding plants using sustainable plant management strategies – alternative irrigation and lighting with LEDs.

In the first part of the project, irrigation frequency was identified as a key aspect of irrigation management that may be under-valued by growers. Further, it is critical that growers can utilise approaches that allow them to better adapt their irrigation scheduling to the requirements of the plant. Initial studies identified that altering deficit irrigation frequency can have significant impacts upon leaf gas exchange, leaf water status and water use within a single bedding plant species, *Pelargonium x hortorum*. This highlights the need for growers to monitor and/or revisit the physiological impact of irrigation practices. Further investigation revealed that growers could increase plant quality whilst reducing water inputs by reducing the volume and frequency of irrigation. Subsequent experiments identified that the stress

hormone abscisic acid (ABA) as one of the key signals involved in regulating stomata in response to soil drying in *P. hortorum*. This has important implications for growers scheduling irrigation to increase water use efficiency (WUE).

In the second part of this project, *P. hortorum* plants were grown under different proportions of blue and red LED lighting within a closed environment system. It was found that spectrally different light sources at the same intensities had significant effects upon leaf gas exchange, morphology and leaf pigment concentrations, whilst optimal results were achieved with combined blue and red lighting. This has important implications for growers' decisions to change from conventional lighting to LEDs. However, further work is required to establish the optimal spectra of light for production over a broad range of species which is underway for example in AHDB funded projects (currently CP 085, CP 125 and CP 164).

Financial Benefits

Developing techniques to allow more effective application of irrigation on a commercial scale could significantly reduce costs associated with water consumption. Furthermore, if plant growth can be regulated by reducing water inputs ('deficit irrigation'), this may improve the quality of the plant, and reduce the need for growth regulating chemicals. The implementation of LEDs, although requiring an initial high investment by growers, offers savings through reduced energy consumption. Constructing LEDs with species-specific wavelengths may also lead to other benefits including reduced water use, or improved ornamental value of the plants.

Action Points

- Understanding the specific water requirements of the plant will allow for growers to more accurately schedule irrigation strategies, which can deliver benefits including water savings and increased plant quality.
- LEDs present an alternative supplemental light source that offers growers the option to control plant morphology and quality not offered by more conventional lighting methods. This extends to plant water relations and has potential overlap with the deficit irrigation outcomes highlighted above although work is needed to determine benefit in supplementary lighting rather than sole source lighting situation.