

The effect of artificial light at nighttime on the development of bean plants

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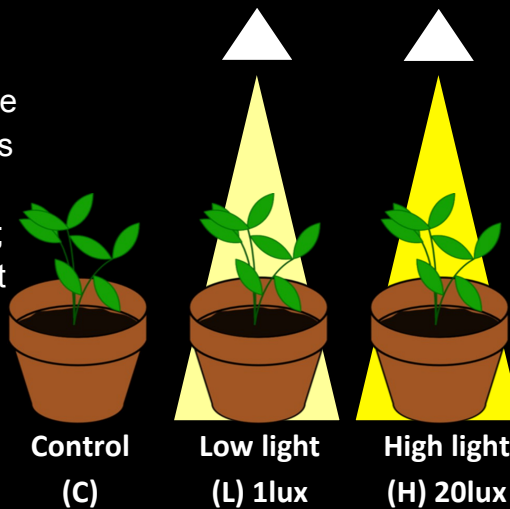


Background: Light is extremely important for plants as an information and energy source. It helps to regulate a plant's 24 hour circadian clock and keeps internal processes that manage growth, flowering and budburst in a rhythmic state¹.



The problem: The use of artificial light at nighttime is increasing by up to 20% each year². There is a lack of knowledge known about how this will impact plants and their development¹.

Methodology: 240 bean seeds (*Vicia faba*, Sutton) were planted equally in 60 plant pots and placed in a greenhouse. There were 3 treatment levels; field condition control, low light (1 lux) and high light (20 lux) intensity (Fig. 1). The 'white' LED lights would turn on automatically to provide artificial light at nighttime.



Results: Days taken to germinate, height growth rate, leaf development, flower development and biomass have all been examined and analysed. Significant differences in plant biomass and trends in flower production between treatment groups have been discovered (Fig. 2).

Figure 1: Experimental set up

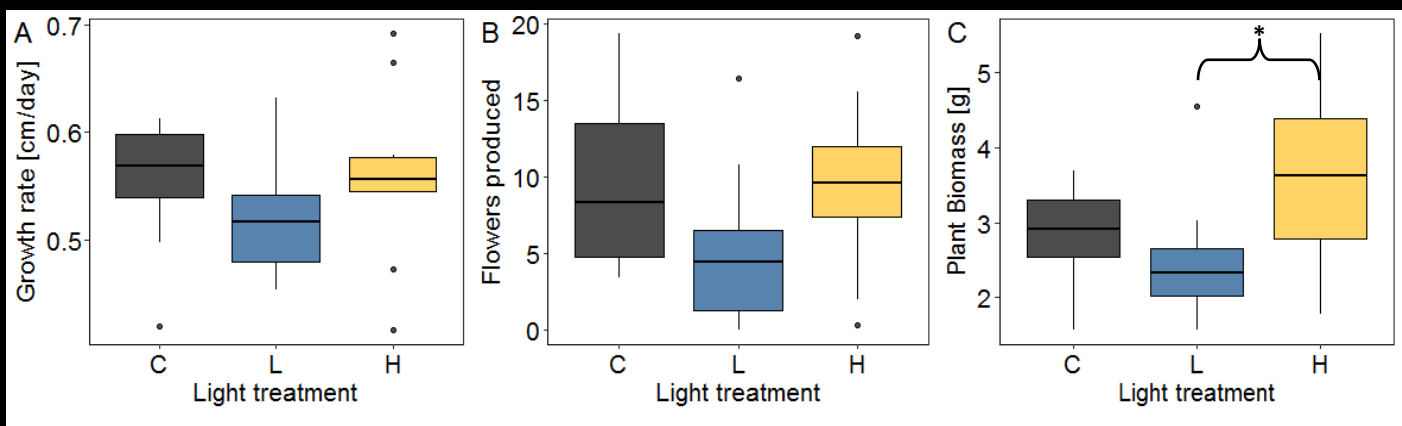


Figure 2: A - Height growth rates C (field control, n=62, L (1 lux, n=72) and H (20 lux, n=64) (F-value = 3.89568, d.f=2, p=0.0393 *(p=0.0161). B - Flowers produced C (field control, n=60), L (1 lux, n=72) and H (20 lux, n=61). C - Plant biomass C (field control, n=59), L (1 lux, n=67) and H (20 lux, n=57).

Conclusions:

- The intensity of artificial light at nighttime can effect certain aspects of plant development.
- This could not only cause serious plant health implications but also bottom-up effects which could have wider effects on the ecosystem and food security³.

1. Bennie, J., Davies, T.W., Cruse, D., and Gaston, K.J. (2016). Ecological effects of artificial light at night on wild plants. *J. Ecol.* 104, 611–620.

2. Hölker, F., Moss, T., Griefahn, B., Kloas, W., Voigt, C.C., Henckel, D., Hänel, A., Kappeler, P.M., Völker, S., Schwöpe, A., et al. (2010). The Dark Side of Light: A Transdisciplinary Research Agenda for Light Pollution Policy.

3. Sanders, D., Kehoe, R., Tiley, K., Bennie, J., Cruse, D., Davies, T.W., Frank van Veen, F.J., and Gaston, K.J. (2015). Artificial nighttime light changes aphid-parasitoid population dynamics. *Sci. Rep.* 5, 15232.