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101 Ways to Try to Grow Arabidopsis: What Light Intensity Worked Best in This Study? Can High Intensity Discharge Lights Be Used?

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Purdue Methods:



What light intensity worked best in this study? Can high intensity discharge lights be used?

Short answer:

200 $\mu\text{mol}/\text{m}^2/\text{s}$. Yes, HID lighting is suitable.

Results:

In an earlier study using 24-hour lighting, we observed damage to plants growing at 300 $\mu\text{mol}/\text{m}^2/\text{s}$ but not at 100 $\mu\text{mol}/\text{m}^2/\text{s}$. We followed this up with a study where we grew plants at 100, 200, 250 and 275 $\mu\text{mol}/\text{m}^2/\text{s}$ using a combination of fluorescent and incandescent lamps in a growth chamber. This time, though, the lights were on a more standard photoperiod of 16 hours.

Plants grown at 200 $\mu\text{mol}/\text{m}^2/\text{s}$ were larger and appeared greener than those at 100 $\mu\text{mol}/\text{m}^2/\text{s}$. Higher light intensities than 200 resulted in death of some seedlings. It should be noted that in both experiments, no barrier was placed between the lamps and the plants, so the death could have been caused by high temperatures emitted from the lamps.

Next, we compared plants grown using a combination fluorescent and incandescent lighting with three other treatments using high-intensity discharge (HID) lamps as sole source of illumination: high pressure sodium at 180 $\mu\text{mol}/\text{m}^2/\text{s}$; metal halide at 250 $\mu\text{mol}/\text{m}^2/\text{s}$; and a mix of these two lamp types at both 125 and 200 $\mu\text{mol}/\text{m}^2/\text{s}$. All produced satisfactory plants. The plants under HIDs appeared to have longer petioles and narrower leaves (data not taken). There was some observable twisting of petioles under these lights as well.

Discussion:

200 $\mu\text{mol}/\text{m}^2/\text{s}$ is a slightly higher intensity than suggested by the Arabidopsis Biological Resource Center at The Ohio State University, which recommends 130-150 $\mu\text{mol}/\text{m}^2/\text{s}$ for 16 hours per day. The Nottingham Arabidopsis Stock Centre which uses 122 $\mu\text{mol}/\text{m}^2/\text{s}$ for 24 hours per day in their greenhouses. We did not investigate intensities between 100-200 $\mu\text{mol}/\text{m}^2/\text{s}$.

HID lamps of 400-1000 watts are common in research greenhouses in temperate climates. They are used for lengthening the natural photoperiod or for supplementing sunlight. This study proves that they can be used as sole source of illumination for this species. Warnings that *Arabidopsis* cannot grow using HIDs may have resulted from damage seen after moving plants from low-light environment of tissue culture rooms without acclimation.



Figure 1. Plants grown in 16-hour photoperiod under four fluorescent/incandescent light intensities (left to right): 100, 200, 250 and 275 $\mu\text{mol}/\text{m}^2/\text{s}$.



Figure 2. Plants grown in 16-hour photoperiod under fluorescent/incandescent lighting (top row) at four light intensities (left to right): 100, 200, 250 and 275 $\mu\text{mol/m}^2/\text{s}$; and under HID lighting. The HID lighting treatments are (left to right): 125 $\mu\text{mol/m}^2/\text{s}$ from metal halide/high pressure sodium; 200 $\mu\text{mol/m}^2/\text{s}$ from metal halide/high pressure sodium; 180 $\mu\text{mol/m}^2/\text{s}$ from high pressure sodium; and 250 $\mu\text{mol/m}^2/\text{s}$ from metal halide.