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Decreasing Blue Light from LED Increases Growth in Four Diverse Species

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Introduction

Light Emitting Diodes (LEDs) facilitate research into the effects of light quality and quantity because of their narrow band wavelength and the ability to control the quantity of light output.

- **Light Quantity**: Light intensity, measured as µmol m⁻² s⁻¹
- **Light Quality**: Light wavelength, measured as nm, indicates light color.

In some crops, decreasing blue light (400-500 nm) has been shown to increase growth. For this research, I studied four crops: kale, lettuce, tomato and cucumber. These crops were chosen because of commercial interest in light sensitivity.

The system included 16 chambers with eight unique spectral outputs (Table 1).

### Table 1- Chamber Spectral Outputs

<table>
<thead>
<tr>
<th>Chamber</th>
<th>Sunlight</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of total PPFD</td>
<td>Blue (400-499)</td>
<td>27</td>
<td>27</td>
<td>19</td>
<td>11</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Green (500-599)</td>
<td>35</td>
<td>48</td>
<td>46</td>
<td>41</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Red (600-699)</td>
<td>36</td>
<td>25</td>
<td>45</td>
<td>48</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Far Red %</td>
<td>700-750</td>
<td>28.3</td>
<td>2.5</td>
<td>3.9</td>
<td>5.9</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>715-745</td>
<td>10.4</td>
<td>1.3</td>
<td>2.1</td>
<td>3.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

Measurements were made using a spectroradiometer.

### Methods

- All crops were direct seeded and thinned at emergence.
- Lettuce, kale and tomato were harvested at maturity 21 days after emergence.
- Cucumbers were harvested at maturity 13 days after emergence.
- 23 C day and 20 C night temperature
- Other than light, conditions, remained constant between all studies.

### Results

Plants grown with high percentages of blue light were smaller than plants grown with less blue light. This was quantified by measuring dry mass and leaf area.

However this result was not consistent across species. Lettuce and cucumber where the species most effected by the increasing blue light. Tomato and kale were effected, however, less than the lettuce and cucumber.

### Conclusion

These data help to elucidate the effect of light quality and quantity on a variety of crops, which is important for photobiology and also for commercial production of these crops.

By understanding the effects of light quality and quantity, indoor growers will be able to produce crops more efficiently and reduce the cost of production as well as the carbon footprint while increasing food production.