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Far-red Radiation and Photosynthetic Photon Flux Density Independently Regulate Seedling Growth but Interactively Regulate Flowering

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Highlights

- Far-red radiation promoted seedling growth regardless of light intensity
- High light intensity did not attenuate shade-avoidance responses at a fixed blue photon flux density
- Light intensity regulated photosynthetic acclimation independent of blue photon flux density
- Far red promoted flowering in petunia, especially under a lower light intensity

Abstract

Shade-avoidance responses can be triggered by a decrease in the red (R, 600–700 nm) to far-red (FR, 700–800 nm) radiation ratio, by a decrease in photosynthetic photon flux density (PPFD), or both. The effects of decreased PPFD on plant responses are often confounded with the effects of reduced blue (B, 400–500 nm) photon flux density, which is another signaling factor for shade-avoidance responses. We postulated that PPFD would not influence R:FR-mediated shade-avoidance responses if B photon flux density was constant. We grew seedlings of geranium (*Pelargonium ×hortorum*), petunia (*Petunia ×hybrida*), and coleus (*Solenostemon scutellariodes*) under three R:FR (1:0, 2:1, and 1:1) at two PPFDs (96 and 288 $\mu mol \cdot m^{-2} \cdot s^{-1}$), all with a B photon flux density of 32 $\mu mol \cdot m^{-2} \cdot s^{-1}$. As R:FR decreased, stem length in all species increased. Decreasing R:FR increased individual leaf area and chlorophyll concentration of petunia, and shoot dry weight of petunia and coleus decreased. Increasing PPFD decreased chlorophyll