Abstract

In greenhouse cultivation, the spectral environment of plants is dependent on the use of growth lamps. In this thesis, distinct blue and red LED light combinations as well as different blue light ratios and intensities were applied to investigate the impact of supplemental LED lighting on growth, photo-synthetic performance, and secondary metabolism of different plants. As model plants we used rose (*Rosa hybrida*), chrysanthemum (*Chrysanthemum morifolium*), campanula (*Campanula portenschlagiana*), orchid (*Phalaenopsis*), and lettuce (*Lactuca sativa*). In our first experiment, by growing roses, chrysanthemums, and campanulas under four different LED combinations, we report that a fraction of 20 – 40% blue LED light was adequate to amend morphological abnormalities. Stomatal conductance increased with increasing blue light, but net photosynthesis remained unaffected. In our second experiment, we show that with a treatment containing 40% of blue and 60% of red LED light in *Phalaenopsis*, chlorophyll fluorescence was affected by decreasing the quantum efficiency of PSII and by increasing the yield of non-photochemical quenching. In our third and last experiment, we demonstrate that blue LED lighting in different application times and intensities did not affect fresh and dry weight of green and red leaf lettuce, but led to more compact plants. Stomatal con-ductance increased with blue light with the effect being more prominent in red lettuce. Red leaf lettuce also proved to be more responsive to chlorophyll fluorescence measurements. In all three experiments, we also addressed the effects of supplementary blue and red LED lighting on phytochemicals. With increasing amount of blue light, roses, chrysanthemums, and campanulas increased their phenolic amount; *Phalaenopsis* cultivars increased their pigment content; lettuce plants increased both their phenolic and pigment content. The effects were not observed in the same way in all plants, highlighting the fact that plant responses to blue and red LED lighting are species and/or cultivar dependent. LED-based systems are a promising alternative choice for greenhouse growers and have great potential as supplemental lighting technology.