Basil cultivation without sunlight

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To enable a high-quality as well as cost-efficient greenhouse production in Berlin and Brandenburg all year round, an LED light system was developed which optimally reflects the sunlight spectrum in the range of the photosynthetically active (400-700 nm) as well as of the ultraviolet A and B (280-400 nm) radiation.

To evaluate the effectivity of these LED lights for the cultivation of certain aroma and medicinal plants, a randomized full-factorial experiment with two different light intensities (PPFD of 200 and 100 µmol/m²/s) and four independent replications with four basil cultivars (*Ocimum basilicum* L. var. *cinnamomum 'Cinnamon'*, *O. basilicum* L. var. *thyrsiflorum* 'Thai Magic', *O. basilicum* L. var. *odoratum* 'Anise' and *O. basilicum* L. var. *purpureum* 'Dark Opal') under the exclusion of natural sunlight was conducted. The weekly assessment of plant height and plant development of 288 individuals per cultivar demonstrates a significantly faster growth of all four basil cultivars when grown under the maximal light intensity of 200 µmol/m²/s in comparison to basil cultivars grown under the lower light intensity of 100 µmol/m²/s. Comparable growth results are achieved two ('*Cinnamon'*), five ('*Anise'*), and seven ('*Thai Magic'*, '*Dark Opal'*) days later for basil plants grown under the lower light intensity. In a second experiment with identical study design, UV-A (315-400 nm) or UV-B (280-315 nm) light were added to the spectrum with the PPFD of 200 µmol/m²/s. The development of the basil cultivars did not differ significantly between both spectral ranges, but was slowed down by five ('*Cinnamon'*), six ('*Dark Opal'*), seven ('*Anise'*) and nine ('*Thai Magic'*) days in comparison to the results found in the first experiment.

Within the short cultivation period of four weeks, 'Cinnamon', 'Anise' and 'Thai Magic' grown under the high light intensity reached a marketability, which is only met under optimal commercial greenhouse cultivation conditions of the region, and takes up to seven weeks in dependence of the season. A PPFD of 100 µmol/m²/s as well as the addition of UV radiation delays the development of all four basil cultivars by a maximum of nine days.

Under all tested light intensities and spectral ranges, the LED system permits an accelerated as well as target-oriented production of basil under the absence of sunlight. However, a comprehensive final evaluation of the applied LED system will be only possible when the composition of the basil leaves has been properly determined by GC-FID and GC-MS and the outcome of an extensive cost-benefit analysis has been calculated in detail.