Title Stock plant and propagation photosynthetic daily light integral and storage influence postharvest performance of herbaceous cuttings

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Abstract

Herbaceous shoot-tip cuttings of ornamental plants are commonly harvested from stock plants in equatorial countries and then packaged, stored, shipped, and subsequently rooted by greenhouse growers in the United States and Europe. The effects of environmental conditions during this supply chain process on cutting yield, acclimatization, morphology, physiology, rooting, and subsequent growth and development of nonrooted cuttings are unknown on most species. The objectives of this research were: (1) to quantify how photosynthetic daily light integral (DLI) provided to stock plants and during propagation and (2) how post-harvest storage temperature and duration influence the physiology and morphology of six vegetatively propagated herbaceous species. Stock plants of bacopa [Jamesbrittenia *grandiflora* (Galpin) Hilliard], heliotrope (*Heliotropium arborescens* L.), petunia (*Petunia ×hybrida* hort. Vilm.-Andr.), thunbergia (*Thunbergia alata* Bojer ex Sims), and verbena (*Verbena ×hybrida* Groenl. & Ruempl) were grown at 20°C under DLI treatments ranging from a mean of 4 to 15 $mol \cdot m^{-2} \cdot d^{-1}$. New Guinea impatiens (*Impatiens hawkeri* Bull.) 'Harmony Magenta', 'Harmony White', and 'Celebrette Red' were grown at 23°C under DLI treatments ranging from 6 to 18 $mol \cdot m^{-2} \cdot d^{-1}$. After 12 weeks of treatments, the light saturated maximum photosynthesis, dark respiration, relative chlorophyll content, cutting dry mass, stem caliper, leaf thickness, and cutting yield of bacopa, heliotrope, thunbergia, and verbena increased as stock plant DLI increased from 4 to 14 $mol \cdot m^{-2} \cdot d^{-1}$. Cuttings were subsequently harvested and stored for 0, 2, 4, or 6 d at 5, 10, or 15°C followed by 2 d in darkness at 20°C to simulate shipping. Cuttings were subsequently rooted in a controlled greenhouse environment with overhead mist, a vapor-pressure deficit of 0.3 kPa, and air and media temperatures of [approximate]25°C. The percentage of stored bacopa, heliotrope, and verbena cuttings that had initiated roots after 7 or 10 d of propagation was reduced by up to 23% when harvested from stock plants provided with a mean DLI $\geq$15 $mol \cdot m^{-2} \cdot d^{-1}$. Regardless of stock plant DLI, chlorophyll fluorescence, photosynthesis, and rooting of new guinea impatiens 'Harmony Magenta' were reduced when cuttings were stored >2 d at 5°C. In a separate experiment, three cultivars of

petunia and new guinea impatiens were propagated under DLI treatments ranging from 1.2 to 10.7 mol·m^{-2}·d^{-1}. Root dry mass of new guinea impatiens 'Harmony White', 'Harmony Magenta', and 'Celebrette Red' increased linearly and by 867%, 604%, and 580%, respectively, as propagation DLI increased from 1.3 to 6.1 mol·m^{-2}·d^{-1}. In petunia 'Tiny Tunia Violet Ice' and 'Supertunia Mini Purple', subsequent time to flower at 20°C decreased by 3 weeks as the DLI during propagation increased from 1.4 to 10.7 mol·m^{-2}·d^{-1}. Collectively, these experiments quantify the importance of controlling shipping and storage temperature and managing the DLI during stock plant production and propagation when producing high-quality herbaceous ornamental cuttings.