EVALUATION OF GROWTH AND MORPHOLOGICAL RESPONSES OF SELECTED TOMATO (*Solanum lycopersicum* L.) VARIETIES TO FULL-SPECTRUM WHITE LIGHT INTENSITIES IN A BALCONY-BASED VERTICAL GROWING SYSTEM

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Vertical farming is a vital food security strategy amid rapid urban population growth. However, integrating high-light-demanding tomatoes (*Solanum lycopersicum* L.) into shaded balconies remains challenging due to insufficient solar radiation. This study evaluated the vegetative growth of four locally adapted Sri Lankan tomato varieties (*Aruni, Bathiya*, *Tharindu*, and *Thilina*) under varying full-spectrum white LED intensities to identify optimal low-cost balcony lighting. The experiment was conducted at the Faculty of Urban and Aquatic Bioresources, Kohuwala, Sri Lanka (6°52'N, 79°52'E) using a Completely Randomized Design with five replicates in a 3-tier vertical cage under an 8-hour photoperiod (08:30–16:30 h). Four treatments were evaluated: 20W white LED at 549 lux (T1), 40W white LED at 776 lux (T2), outdoor ambient light at 316 lux (T3), and an indoor control at 167 lux (T4). Over 13 weeks, plant height (PH), number of leaves (NL), number of suckers (NS), stem diameter (SD), and chlorophyll content (CC) were recorded weekly and analysed using one-way ANOVA, Tukey's HSD ($\alpha = 0.05$), Pearson correlation, and linear regression in Minitab 16. All parameters showed statistically significant varietal differences ($p < 0.05$). Under T2, *Thilina* recorded the highest NL (86.0 ± 7.12^{a}) and NS (19.4 ± 1.4^{a}), compared to T4 (50.8 ± 6.24^{b} and 9.8 ± 0.73^{b}). T2 produced the greatest SD in *Aruni* (6.37 ± 0.17^{a} mm), *Tharindu* (6.37 ± 0.27^{a} mm), and *Thilina* (6.37 ± 0.45^{a} mm), and the highest late-stage CC in *Thilina* (51.82 ± 3.14^{a} SPAD). Conversely, T4 induced etiolation in *Bathiya* (83.62 ± 3.53^{a} cm; SD: 3.95 ± 0.16^{ab} mm) and the lowest CC (23.28 ± 5.87^{b} SPAD) and SD (2.93 ± 0.78^{a} mm) in Tharindu. These findings recommend 40W full-spectrum white LED at 776 lux as the most effective supplemental lighting for vegetative growth across diverse Sri Lankan tomato varieties in low-cost balcony systems.

Keywords: chlorophyll content, controlled environments, food security, supplemental lighting, vegetative growth, vertical farming