

ABSTRACT

Rapid population growth has led to limited agricultural land, especially in urban areas, creating challenges in fulfilling healthy food needs. Urban farming is an alternative solution, one of which is through the cultivation of red spinach Microgreen which is superior in nutritional content and has a short planting period. To support the optimal growth of Microgreen in the indoor environment, well-controlled artificial lighting is needed. This research designs and analyzes an Internet of Things (IoT)-based artificial lighting system using WS2812B LEDs with a red and blue color ratio of 1:1, which allows automatic lighting duration settings through integration with Network Time Protocol (NTP). The study tested four variations of lighting duration, namely 6, 9, 12, and 16 hours per day over a 12-day growing period, with the main parameters observed being plant height and number of leaves. Results showed that the 16-hour duration provided the best morphological growth with evenly distributed red leaf color, compact plant structure, and no etiolation. Duration of 12 hours produced significant plant height but the plant shape was not proportional. Duration of 6 and 9 hours showed less optimal growth. This system supports efficient and sustainable precision agriculture on limited land.

Keywords: *Microgreen, Red Spinach, Artificial Lighting, IoT, Lighting Duration.*