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Effects of LED Light Irradiation on Ripening and Nutritional Quality of 'Puwalu' Banana (*Musa sp*.) During Postharvest Storage

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INTRODUCTION & AIM

Bananas (*Musa sp.*) are crucial food sources in many tropical countries. This study focuses on a local variety called 'Puwalu.' Bananas are typically harvested when light green and enter a climacteric phase marked by increased ethylene production, triggering ripening and heightened respiration. During ripening, significant physiological and biochemical changes occur, including peel de-greening, flesh softening, starch-to-sugar transformation, and flavor/aroma development, impacting shelf life and commercial value. Understanding ripening stages is essential for food processing. Consequently, efforts to optimize postharvest banana treatment have persisted for decades. Light-emitting diodes (LEDs) show promise in horticultural lighting due to their ability to tailor wavelengths to plant pigment requirements. The focus of this study is to investigate the effect of LED irradiation with different wavelengths on the ripening and nutritional quality of mature green bananas for 8-day postharvest storage.

METHOD

Sample Acquisition:

- Mature green bananas at similar ripeness (stage 1 − green) were sourced from a local wholesale market in Sri Lanka.

Experimental Setup:

- The bananas were segregated and placed in separate sectors within a climate chamber (Climacell 222, MMM Medcenter, Munich, Germany).
- The chamber maintained ambient room conditions of 20 ± 2ºC and 85−90 % RH throughout the experiment.

LED Irradiation:

- A group of fifteen bananas was subjected to irradiation with blue (464−474 nm), and red (617−627 nm) LED lights from Honglitronic, Guangzhou, China.

Measurement Techniques:

- **Peel Color Determination**: Banana peel color was assessed using a Minolta CM-5 colorimeter (Konica Minolta, Osaka, Japan).
- **Firmness Measurement:** The firmness of banana flesh was determined using a TA.XT2i Texture Profile Analyzer (Stable Micro Systems, Surrey, UK) equipped with a 6 mm P/6 cylindrical probe.
- **TSS Evaluation:** Total soluble solids (TSS) were evaluated only in the pulp, following protocols reported by Dadzie & Orchard (1997).
- **Respiration Rate Determination:** Fruit respiration rates were determined by placing them in a 5 L desiccator under vacuum for 10 min to remove internal air. Subsequently, headspace gas was analyzed for CO2 content using gas chromatography.
- **Total Phenolic Content (TPC):** Measured using the Folin - Ciocalteau method.
- **DPPH Scavenging Assay:** Capacity to scavenge the stable DPPH free radical assessed as per Samarasinghe et al. (2021).

RESULTS & DISCUSSION

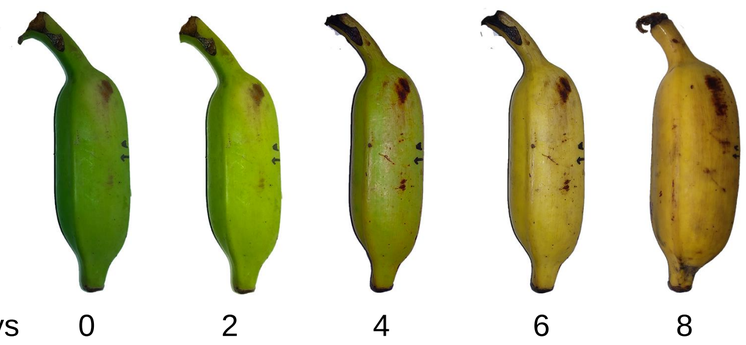

Figure 1. Peel colour changes of banana under blue light condition

Figure 2. Peel colour changes of banana under red light condition

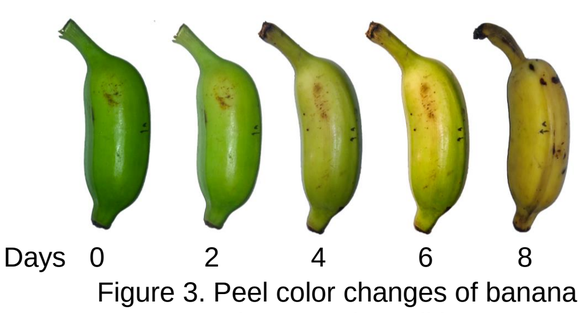

Figure 3. Peel color changes of banana under control condition

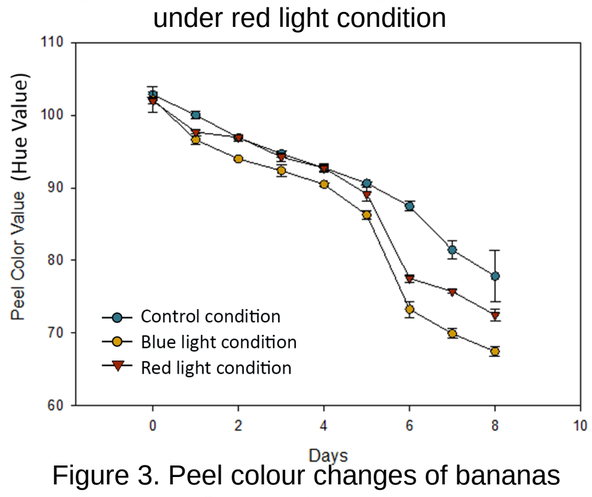

Figure 3. Peel colour changes of bananas during 8 days of storage period

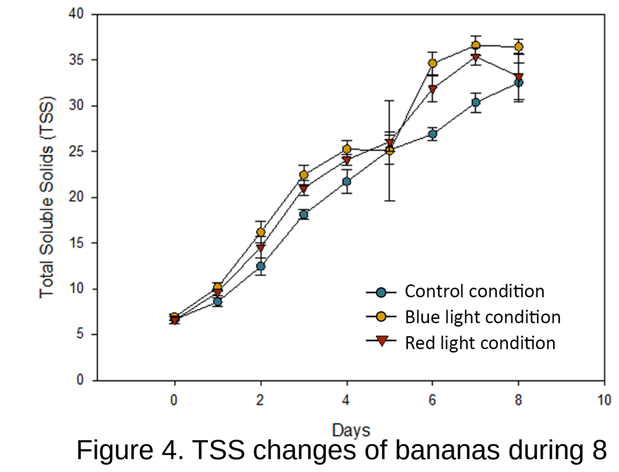

Figure 4. TSS changes of bananas during 8 days of storage period

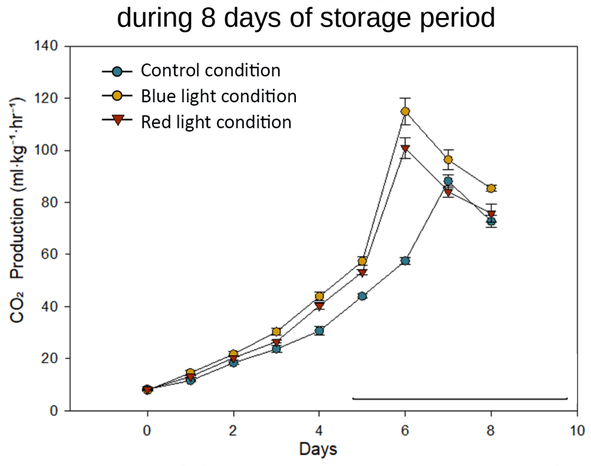

Figure 4. CO_2 Production rate changes of bananas during 8 days of storage period

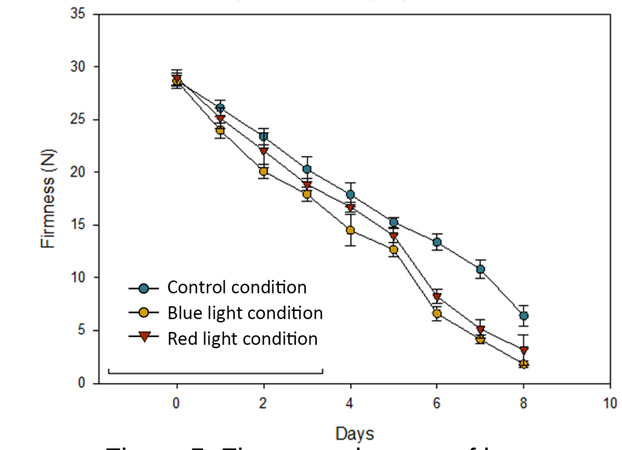

Figure 5. Firmness changes of bananas during 8 days of storage period

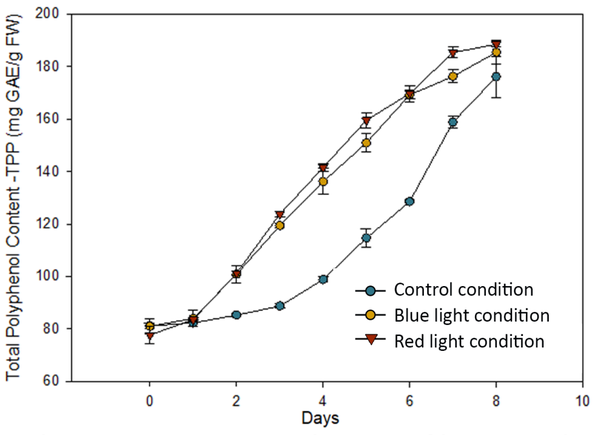

Figure 4. TPP content changes of bananas during 8 days of storage period

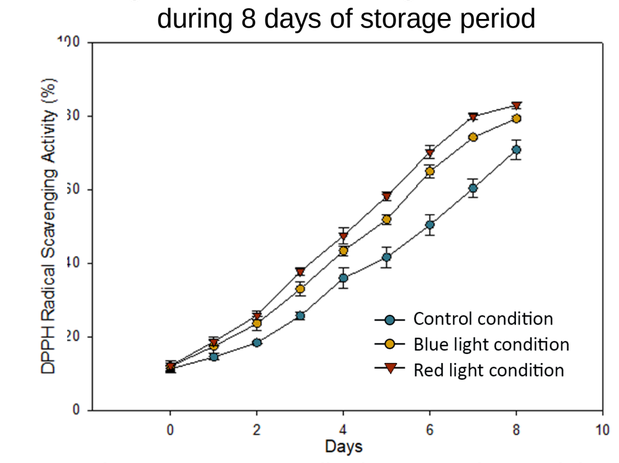

Figure 5. DPPH radical scavenging activity (%) changes of bananas during 8 days of storage period

CONCLUSION

When we assessed the peel color of 'Puwalu' bananas, we found significant differences, with the control group having the highest hue values, followed by the red light treatment, and the blue light treatment showing the lowest values. This research advances our knowledge of using LED lighting to improve banana postharvest management, thereby increasing their market appeal and nutritional content, with the most significant impact observed in the blue light treatment, followed by the red light treatment, as compared to the non-illuminated control group.

FUTURE WORK / REFERENCES

Huang, J.Y., Xu, F. and Zhou, W., 2018. Effect of LED irradiation on the ripening and nutritional quality of postharvest banana fruit. *Journal of the Science of Food and Agriculture*, *98*(14), pp.5486-5493.

Nassarawa, S.S., Abdelshafy, A.M., Xu, Y., Li, L. and Luo, Z., 2021. Effect of light-emitting diodes (LEDs) on the quality of fruits and vegetables during postharvest period: A review. Food and Bioprocess Technology, 14, pp.388-414.