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Design of a Simple Smart Greenhouse for Optimized Pak choi Cultivation in Rural Tropical Areas

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Abstract : This study presents the design and development of a smart greenhouse prototype tailored to optimize Pak choi (Brassica chinensis L.) cultivation in tropical rural climates. Pak choi, a high-demand leafy vegetable in Indonesia, often experiences suboptimal growth due to elevated temperatures and humidity. The objective of this research is to design and develop an intelligent greenhouse to optimize pak choi cultivation in tropical rural climates. The design of a smart greenhouse provides a controlled environment to stabilize these conditions, but managing fluctuating temperature, humidity, and light in tropical regions remains challenging. This system regulates critical environmental factors, including temperature, humidity, irrigation system, and light, creating optimal conditions for Pak Choi. The prototype's effectiveness was evaluated by monitoring growth indicators such as leaf weight, freshness, and moisture content, alongside the consistency of the internal climate compared to external conditions. Results indicate that the smart greenhouse supports superior crop growth, enhances yield quality, and reduces environmental resource consumption. The irrigation control system test was carried out for 40 days. Researchers observed the results of the automatic system working according to the sensor value readings. The results of the temperature control system test work: when the air temperature in the greenhouse is more than 33 degrees, the condensation pump will turn on, and when the temperature is below 32 degrees, the pump will automatically turn itself off. The cycle repeats continuously. The results achieved pak coy can live up to 40 days. As part of our ongoing research, we are actively considering integrating double-layered roofs to improve insulation and reduce external temperature fluctuations, which could further enhance the effectiveness of the smart greenhouse.

Keywords : smart greenhouse, horticulture, rural tropical climate, sustainable agriculture
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