Let There Be Light: Using Agrobacterium-Mediated Transformation Techniques to Produce Bioluminescence in Plants

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Bioluminescence is a natural phenomenon that enables the emission of light in living organisms and holds great potential in biotechnology. This study evaluated the functionality of an optimized bioluminescent pathway derived from Neonothopanus nambi, which includes the genes HispS, H3H, Luz and CPH, expressed through agroinfiltration in Nicotiana benthamiana and the floral dip method in Arabidopsis thaliana. In N. benthamiana, the transient expression of the pathway was assessed at 48 and 72 hours post-agroinfiltration. The plants exhibited efficient light emission, with no visually significant differences in intensity between the two time points, highlighting the rapid activation and functionality of the system. Conversely, in A. thaliana, the stable integration of the transgene resulted in persistent bioluminescence in both young plants and flowering plants. A homogeneous light pattern was observed in young plants, while specific localization in flowers and stems was evident in flowering plants, suggesting spatiotemporal regulation influenced by plant development. These results confirm the robustness and adaptability of the bioluminescent system across different experimental contexts. Furthermore, they underscore the potential of genetic engineering to create bioluminescent plants, paving the way for future applications in synthetic biology, such as sustainable light sources and tools for environmental monitoring. Future studies should address the regulatory mechanisms that influence the intensity and distribution of bioluminescence, as well as its implementation in agriculturally or industrially relevant species. (Words: 222).

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