Luminous Plants Offer New Path for Carbon Reduction and Biodiversity Protection

Luminous flowers and foliage plants glow at night while enhancing carbon capture, supporting UN biodiversity and climate goals.

TAIWAN, December 17, 2025 /EINPresswire.com/ -- A research team led by Professor Yen-Hsun Su at National Cheng Kung University has developed a technology that enables flowers and foliage plants to glow at night while increasing their capacity to absorb carbon dioxide. The project is supported by the Taiwan National Science and Technology Council's Engineering Division and aims to integrate sustainable horticulture with measurable carbon reduction. The technology uses non-genetically modified, bio-safe nanomaterials to extend the effective light cycle of plants, allowing them to continue photosynthetic activity after dark. While the Aurora Orchid has been a primary demonstration, the method is applicable to a wide range of ornamental flowers and foliage plants commonly used indoors and in urban environments.

> Our luminous plant technology boosts carbon capture while keeping flowers and foliage healthy and visually striking at night."
>
> *Shu-Mei Wang in National Taiwan University*

"Plants already provide one of the most efficient carbon capture systems on Earth through photosynthesis," said Professor Su. "Our approach enhances that natural process without altering plant DNA, enabling plants to remain healthy while increasing carbon fixation efficiency."

Carbon Capture Through Nighttime Activity

Photosynthesis converts atmospheric carbon dioxide into organic carbon using light energy. Conventional artificial carbon capture and utilization technologies often require months to convert CO□ into usable forms. By contrast, natural plants complete the process within days. The luminous plant technology allows plants to emit stored light at night, increasing opportunities for photosynthesis. Indoor trials conducted under the university's sustainability verification program showed that luminous plants captured approximately 0.213 kilograms of CO□ per month, equivalent to 43.1 percent of the emissions from one kilowatt-hour of electricity based on 2023 emission factors. The trials followed the Verra VM0018 methodology, an internationally recognized carbon accounting standard.

Broad Applications Beyond Orchids

While the Aurora Orchid demonstrates the technology's visual effect, the method is effective across multiple plant species. Successfully tested plants include orchids, variegated foliage, and other ornamental crops used in homes, offices, and public spaces. During the day, treated plants appear unchanged. At night, leaf veins and petals emit light in multiple colors, creating a "luminous variegation" effect. The nanomaterials degrade naturally as the plant tissue ages and comply with European Union safety standards (EN71-3:2019).

"This technology transforms ornamental plants into functional tools for carbon reduction while maintaining their aesthetic value," the research team said.

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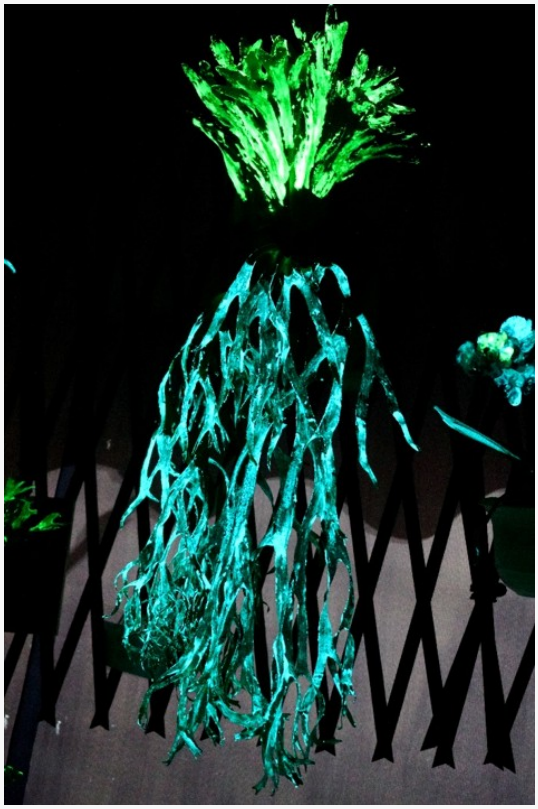
Aurora Orchid emitting light reminiscent of a starry night sky

Alignment with Global Biodiversity and Climate Goals

The project is part of the Satoyama Mace Initiative, which focuses on carbon reduction technologies consistent with the Satoyama Initiative and biodiversity. Methodologies developed follow standards from the United Nations' Clean Development Mechanism and the Climate Action Reserve, and align with the Kunming-Montreal Global Biodiversity Framework (KM-GBF) adopted at the 15th Conference of the Parties to the Convention on Biological Diversity (CBD COP15). Methodology submissions undergo internal and external review before being announced publicly. The Satoyama Mace platform aims to support projects in developing countries, small islands, and rural areas, offering a nature-based solution for economic transformation and climate mitigation. The initiative integrates carbon credit strategies with Socio-Ecological Production Landscapes and Seascapes (SEPLS) education and digital management, linking environmental restoration, sustainable agriculture, and climate finance to create a sustainable development economic chain.

Years of Research and International Recognition

Professor Su's team began research on luminous plants in 2009, achieving the world's first non-GMO luminous aquatic plant in 2010. The work received coverage from international media including Discovery, ABC News, Reuters, and the Royal Society of Chemistry. In 2015, the team extended the technology to terrestrial plants and received a U.S. patent. Today, the technology is also protected by patents in Taiwan, Singapore, and Japan. In 2022, the project received Taiwan's Future Tech Award, and in 2024 it earned a Gold Award in Light Design at the MUSE Design Awards, an international competition recognizing innovation in science and design.



Staghorn fern glowing at night, contributing to carbon capture

Nighttime glowing orchid demonstrating increased carbon capture.

Toward Nighttime Sustainability

The technology addresses a practical limitation of urban plant use: inactivity after dark. By allowing plants to glow and continue carbon fixation at night, indoor and public spaces can maintain both visual interest and environmental function. Researchers emphasize that luminous plants complement, rather than replace, large-scale carbon reduction measures. However, they offer a scalable, nature-based solution suitable for urban, indoor, and community-scale applications. As nations pursue net-zero goals and implement the KM-GBF through 2050, luminous plants represent a tangible example of integrating biodiversity, climate action, and daily life. The technology offers measurable carbon reduction, enhanced aesthetic value, and potential applications in both ornamental horticulture and food crops.

"By combining advanced nanotechnology with plant biology, we are creating a platform that links

art, science, and sustainability,” Professor Su said. “This approach not only enhances carbon capture but also provides a new model for green economic development and international cooperation.”

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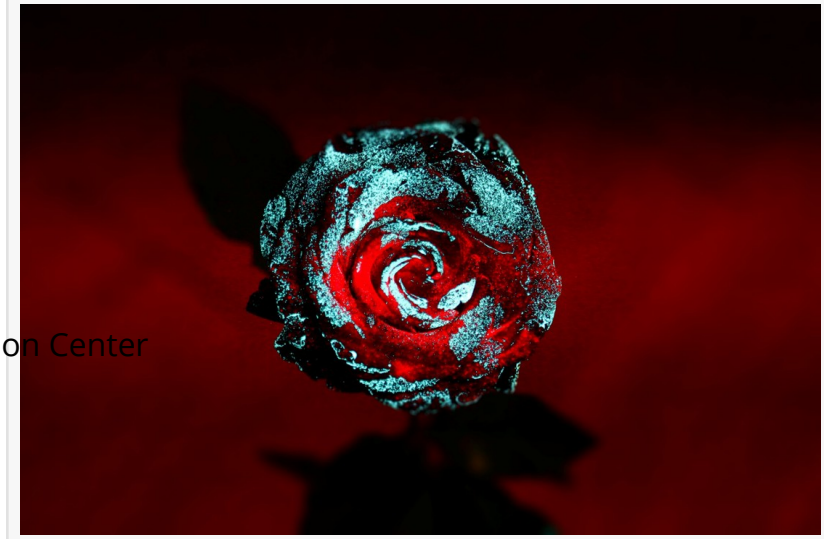

Glowing roses cultivated in collaboration with local residents, increasing carbon capture