Photosynthesis 2.0: From UPM Research To A Global Agritech Breakthrough

Universiti Putra Malaysia

2026 Better World Project Award Winner

If photosynthesis efficiency has remained largely unchanged for millions of years, could nanotechnology unlock a new layer of performance? This clear scientific question led to an innovation born from the research of Prof. Dr. Suraya Abdul Rashid at the Universiti Putra Malaysia (UPM) Institute of Nanoscience and Nanotechnology (ION2) and the Department of Chemical and Environmental Engineering. With QarboGrow, farmers see higher crop yields without requiring alterations to their existing growing practices.

When one of the early farmers tried QarboGrow on his field, he simply reported, “The leaves look greener — different from before.” To most, it was just a casual field remark. To the research team, it suggested an early shift in plant response; a field-level indication that enhanced photosynthetic activity might be taking place beyond controlled trials and into real farming conditions.

With a PhD from Imperial College London, Abdul Rashid believed that carbon-based nanomaterials could move beyond academic research and become practical agricultural tools for farmers. Her team developed carbon quantum dots (CQDs) from natural agrowaste. When applied to plant leaves, these nanoscale particles converted ultraviolet (UV) light spectrum that plants cannot utilize for photosynthesis, into photosynthetically active radiation (PAR) spectrum that plants can utilize. The increased amount of PAR drives more photosynthesis to occur within the leaves. This marked the emergence of what the team termed Photosynthesis 2.0; a next-generation approach to light-use efficiency in plants.

Field studies recorded up to 30% improvement in crop yield, including under low-light and water-stressed conditions. Importantly, the technology did not require farmers to change their cultivation practices. QarboGrow could be mixed directly with existing agriculture inputs, allowing farmers to apply it using their usual routines without any added labor or steps, which was a key factor of its acceptance.

This transition from research to application was made possible through UPM’s InnoHub program, which pairs researchers with commercialization strategists under the guidance of Putra Science Park (PSP). In August 2018, Abdul Rashid incorporated Qarbotech as a spin-off company. After three years of being a solo founder, in 2021 she finally met her co-founder who became the CEO, and together, they grew the company. Early batches of QarboGrow were produced on campus in small volumes, marking the first commercial deployment of the innovation.

Qarbotech received its first early-stage investment in December 2021, followed by an angel round in January 2023. A few months later, Qarbotech secured its first USD 500K seed round, followed by a USD 1.5 million seed-extension round in 2024, backed by 500 Global, Better Bite Ventures, ID Capital, and the EQT Foundation. With this support, production scaled to a

capacity of 100,000 liters per month or 50,000 hectares per month, and distribution expanded from Malaysia into Thailand and China. In September 2025, Qarbotech completed the full acquisition of the intellectual property from UPM. This marked a clear milestone in academic technology transfer; a university-developed invention transitioning into an independent commercial venture.

Qarbotech's work gained recognition through international platforms. It won the Climate Impact Innovation Challenge, EQT Impact Challenge, and Future Food Asia competitions. The company was also the first Malaysian venture accepted into the Creative Destruction Lab (CDL) accelerator program, and more recently the Breakthrough Energy Fellowship founded by Bill Gates. These recognitions positioned a Malaysian university innovation within the global agritech and climate-tech arena.

Reflecting on the journey, Abdul Rashid said, "UPM gave us a launchpad; the support, the mentorship, and the belief that our research could extend beyond the lab. Qarbotech is proof that innovation thrives when science meets purpose."

From a single observation of greener leaves to deployment across multiple countries, QarboGrow illustrates how Photosynthesis 2.0, developed within UPM, has now taken root in regional and global agriculture. This is the story of advancing productivity, resilience, and the transformation of a Malaysian homegrown science into a global agritech breakthrough.

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