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A new approach to food production
Planned vegetable production a reality
Plant Factory

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Plants do not need all of the wavelengths in sunlight to grow. In fact, they only absorb certain essential wavelengths. Since light-emitting diodes (LEDs) can emit light at specific sunlight wavelengths, one would think that LEDs could be used to cultivate food. Tamagawa University's Dr. Hiroyuki Watanabe began his research with this idea. Everyone is astonished that he can not only optimize vegetable cultivation, but also control the vegetables' flavor, texture and nutritional value. JQR visited the research facilities to see the Plant Factory in its final stages of preparation for commercialization.

A clean room was installed in the Future SciTech Lab, which was built two years ago on the lush, expansive campus of Tamagawa University. The students are devoted to tending the vegetables here every day. The thriving plants stand in methodical rows under the dazzling light emitted by red, blue and purple LEDs. "LEDs were quite expensive until a few decades ago. When comparing the quantity of light produced to the cost, it was a hundred or even a thousand times more expensive than fluorescent lighting. The cost made it impossible to justify the use of LEDs as a light source for plants." Solving the cost issue was essential if vegetables were to be grown using LEDs. Watanabe, who began his research in 1991, explains that the introduction of blue LEDs in 1994

and the reduction in the cost of LEDs were boons to his research. "Blue light is vital for plants. I bought some as soon as they were released on the market. They were expensive at 3,000 yen each," he says, laughing. Lengthening the life of an LED was vital to lowering costs. The LED chip is an element approximately the size of a 0.3 mm poppy seed. 70 percent of the electricity it uses is released as heat, which burns out the chip itself. Constantly cooling the LED would extend its lifespan, so Watanabe devised a direct water cooling system. "The LED chip is held by resin, which is a heat insulator, so the heat is almost entirely contained. I then thought of directly welding the chip to the aluminum board. The LED lasted longer when we ran water below the aluminum board to cool the chip, keeping it powered it at almost 20°C. It was durable, and a strong electrical current could be produced. This is the core technology for our LED cultivation system." With these innovations the team could produce the ideal LED. They added this data to their accumulated cultivation knowledge and took on the challenge of applying it when the time was right. At this point, what products can they actually produce? "As well as leafy vegetables, we can grow strawberries, tomatoes, potatoes, sweet potatoes, ginseng, rice, soy beans - anything, in fact. We've even produced rice

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Doctor of Agriculture Hiroyuki Watanabe, Department of Life Science, College of Agriculture, Tamagawa University. Dr. Watanabe has been researching plant cultivation for 20 years, and is promoting the Plant Factory project.

