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- Higashide (2016) *Solanum Lycopersicum*: Production, Biochemistry and Health Benefits. Nova Science Publishers.

Outcome information

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- Ahn *et al.,* (2024) “Yield estimation program, yield estimation method, and yield estimation device.” P7557853 (JP)
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- Ando *et al.,* (2025) Effects of rejuvenation pinching on yield and its components of winter-spring lowering cultivation of cucumber (*Cucumis sativus* L.) in Greenhouse. Hort. Res. (Japan) 24(3) 231-240 (in Japanese)
- Homma *et al.,* (2025) Key factor and period affecting sweet pepper fruit size: Air temperature during anthesis. JASHS. 150(4) 226-236
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- Rachma *et al.,* (2025) Tomato production with organic fertilizer from soluble bonito fish waste in hydroponic cultivation systems. Horticulturae 11(4) 381
- Sugiyama *et al.,* (2025) Simulation of strawberry yield using dry matter distribution based on the potential growth of the sink-source organs. Front. Plant Sci. 16
- Homma *et al.,* (2024) Light-use efficiency and fruit dry matter content affect fresh yield of sweet pepper. HortScience 59(9) 1378-1385
- Itoh *et al.,* (2023) Prediction of soluble solids of tomato fruit grown in salinized nutrient solution based on the electrical conductivity of the drainage. Hort. J. 92 47-55
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- Wang *et al.,* (2022) Effects of elevated CO_2 levels on the growth and yield of summer grown cucumber cultivated under different day and night temperatures. Agronomy 12(8) 1872
- Maeda *et al.,* (2021) A review of Japanese greenhouse cucumber research from the perspective of yield components. Hort. J. 90(3) 263-269
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Contact us

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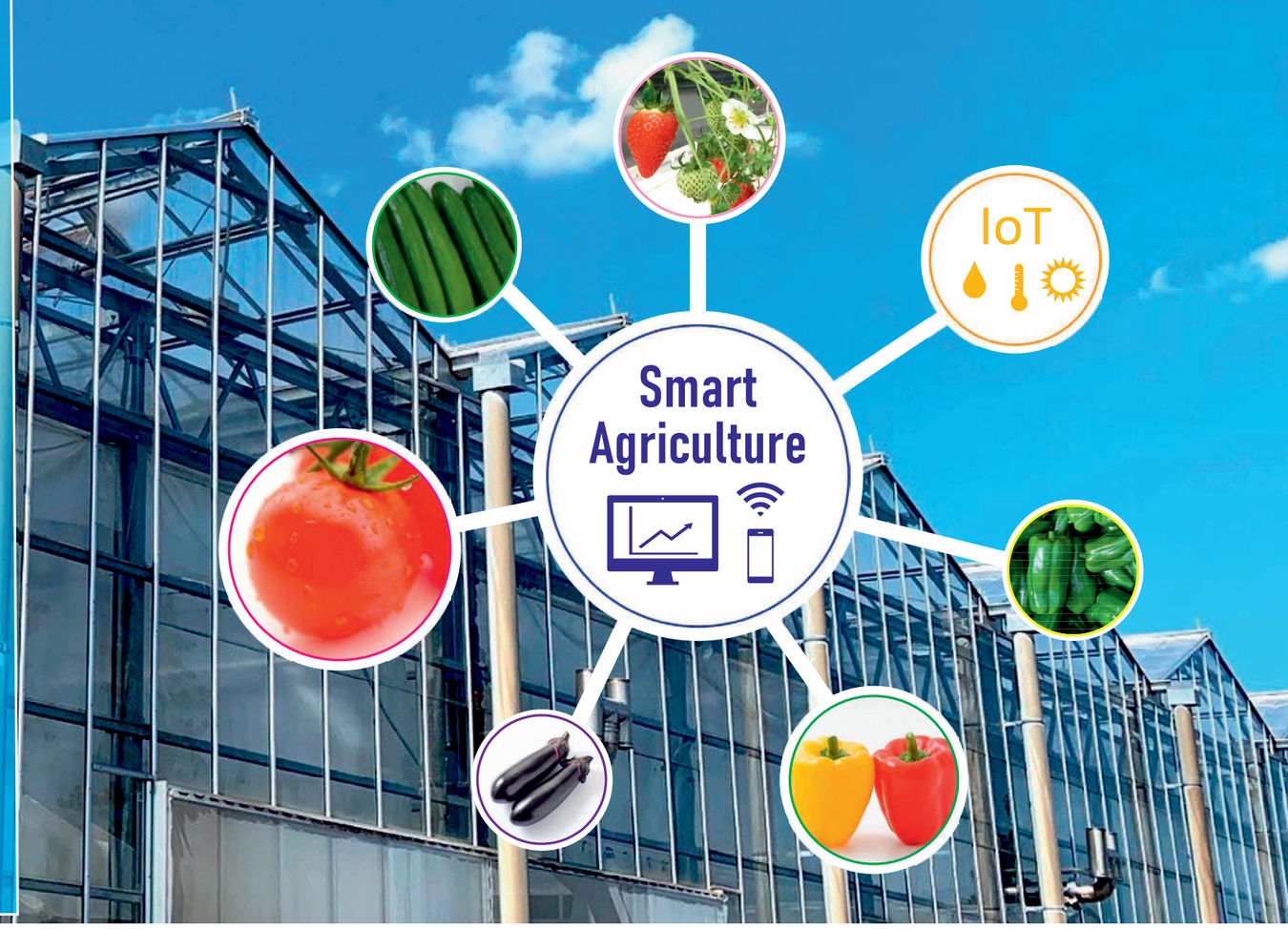
NARO
Tsukuba Plant Factory

Advanced technologies for Smart Greenhouse Production Systems in Japan



NARO

NARO

Realization of Smart Agriculture and Integration of Advanced Technologies into Next-Generation Horticulture in Japan

1 Welcome to NARO Tsukuba Plant Factory!

► We aim to enhance the sophistication and efficiency of Japan's greenhouse horticulture, contributing to its position as a global leader in agriculture.

► In response to a declining agricultural population and unprecedented climate change, we are conducting empirical research to systematize and disseminate technologies that can significantly improve yields in "plant factories" as smart greenhouses, while simultaneously reducing production costs.

You can watch the introductory movies of the Tsukuba Plant Factory here!

► The current state of Japanese agriculture and the future of greenhouse horticulture

► Introduction to the Tsukuba Plant Factory facilities

2 Our Facilities and Equipment

1 Plant Factory

- Dimensions: 63.0 m × 40.5 m, eave height 6.5 m
- Total Area: 2,551 m² (Cultivation area: 1,836 m²)
- Roof Covering: Fluorine-based film (matte finish)
- Side Covering: Glass
- Key equipment: Gas heater, heat pump, fine mist system, seedling nursery with LED lighting, and CO_2-controlled system

2 High-Eave Greenhouse

- Dimensions: 9 m × 27 m, eave height 6 m
- Floor Area: 243 m² (Cultivation area: 189 m²)
- Roof Covering: Fluoropolymer film
- Side Covering: Fluoropolymer film
- Key equipment: Gas heater, heat pump, fine mist system, and CO_2-controlled system

3 Pipe-Framed Greenhouse

- Dimensions: 7.15 m × 16 m, eave height 2.2 m
- Floor Area: 144.4 m²
- Roof Covering: PO film
- Side Covering: PO film
- Key equipment: Gas heater, heat pump, fine mist system, and CO_2-controlled system

3 Highlights of the NARO Tsukuba Plant Factory

Realization of high yield framework
→ Advanced technologies + Element integration

Achieving High Yields through Growth and Yield Simulation

Simulate growth and yield based on plant photosynthesis and under varying environmental or cultivation conditions

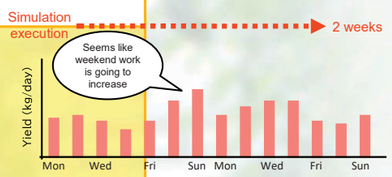


Illustration of Yield Simulation

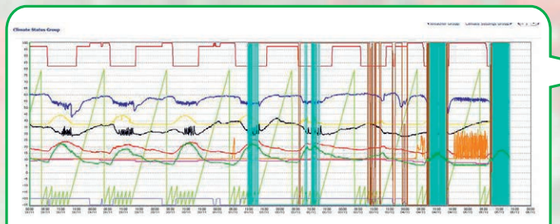
Development of Advanced Environmental Control System

- Develop an integrated environmental control system using the next-generation Ubiquitous Environmental Control System (UECS) and demonstrate its effectiveness
- Conduct training sessions and hands-on workshops on plant factories

Work Environment Optimization and Automation with Advanced Information Utilization

Systematization of work management and automation of tasks

Right photo: Operational testing of an automatic deleafing robot by Institute of Agricultural Machinery, NARO.



Efficient Production Management through Greenhouse Environmental Control

http://www.naro.affrc.go.jp/laboratory/nivfs/plant_factory/index.html

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