4. Expansion of programs for next-generation greenhouse horticulture (1) (direction of promotion)

○ As a basic direction, expansion of operations will be promoted while pushing ahead with the shift from greenhouse horticulture based on intuition and experience to environmental control-oriented horticulture.

○ To make greenhouse horticulture widely possible in a reproducible manner in places in addition to a base of greenhouse horticulture by analyzing and disseminating knowledge and know-how learned from the base. For core technologies such as advanced environmental control technology, which hold the key to solutions to challenges, demonstrations and training programs to learn about technologies matching local conditions will be promoted to expand programs for next-generation greenhouse horticulture.

○ Direction of promoting next-generation horticulture (diagram)

Practice of greenhouse horticulture to realize a stable supply and income increase!!

Model base

Next-Generation Type of GH

Year-round production by advanced environmental control
- Expansion of scale by hired labor and introduction of labor saving techniques
- Energy cost reduction by local energy sources

To develop knowledge from base and spread core technologies!!

GH with Environmental Control

- Carbon dioxide generator, nutrient cultivation system
- Cultivation method based on data obtained from GH environment.

Ordinary GH

- Mainly heater.
- Cultivation method based on farmers' experience and intuition.

Programs to stabilize management of greenhouse horticulture

- Cut in cost of erecting weather-resistant greenhouses
- Cut in use of fuel by energy saving

Cost reduction

Cost reduction

Overall process chart of next-generation greenhouse horticulture business

2013 supplementary budget | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

(1) Development of base of next-generation greenhouse horticulture (model base)

Development of 10 model bases

The model bases in Shizuoka Pref., Toyama Pref., Hyogo Pref., Kochi Pref., Oita Pref., Miyazaki Pref. completed

The model bases in Hokkaido, Miyagi Pref., Saitama Pref., Aichi Pref. completed

Practice of sustainable greenhouse horticulture capable of overcoming three challenges

(2) Analysis and verification of know-how of base of next-generation greenhouse horticulture and dissemination of information

Support for establishment of model base and analysis of know-how

Dissemination of information on know-how of model base and discovery of new technology to nurture human resources

Spread of model base's knowledge in reproducible manner

(3) Learning of key technologies for next-generation greenhouse horticulture

Advanced environmental control technology, employment-oriented production control technology, labor-saving technology, etc.

Collaboration with other policy programs
(subsidy for creating strong agriculture, project to reinforce production areas, public financing for policy implementation, etc.

Introduction of advanced environmental control equipment, etc.

Promotion of advanced environmental control equipment, etc.

4. Expansion of programs for next-generation greenhouse horticulture (2) (budgetary measures (1))

○ As for advanced environmental control technology, employment-oriented production management technology, and labor-saving technology including automatization, etc., which hold the key to productivity improvement and expansion of operations in greenhouse horticulture, support was provided for the creation of a mechanism to learn technologies, etc. through such measures as demonstrations matching needs in production areas and acceptance of training at a demonstration greenhouse.

○ In addition, support was provided for the development of a demonstration greenhouse needed to erect next-generation, large-scale greenhouse horticulture facilities and for analysis, orderly disposition and information dissemination of next-generation greenhouse horticulture and ways of lowering installation costs.

1. Promotion of productivity improvement and scale expansion in greenhouse horticulture

Project to support expansion of scale in next-generation greenhouse horticulture (project to support learning about next-generation greenhouse horticulture technologies)

Establishment of mechanism to learn about technologies for improving productivity and accelerating expansion of operations

○ Implementation of technical demonstration, training, etc. by consortium

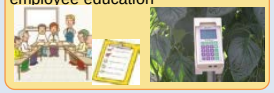
Members of consortium — Prefectural governments and producers are essential members

- Prefectural governments and municipal governments (administration, experiment and research institutes and promotion organs)
- Producers
- Actual users
- Producer organizations
- Makers of greenhouse horticulture equipment
- Farmland Banks

Technology demonstration and training

Advanced environmental control technology
Visualization and analysis of data and environmental control inside a greenhouse

Employment-oriented production management technology
Preparation of production and work plans, assignment of personnel and employee education



Labor saving technology
Automatization of work, etc. enable large area management by small number of people

○ Technological demonstration ○ Learning of technologies by acceptance of training at demonstration green house ○ Technological instructions ○ Preparation of manuals

Productivity improvement + Expansion of management scale

Consolidation of farmland and facilities
Focused support for consolidation of farmland and facilities via Farmland Banks, etc.

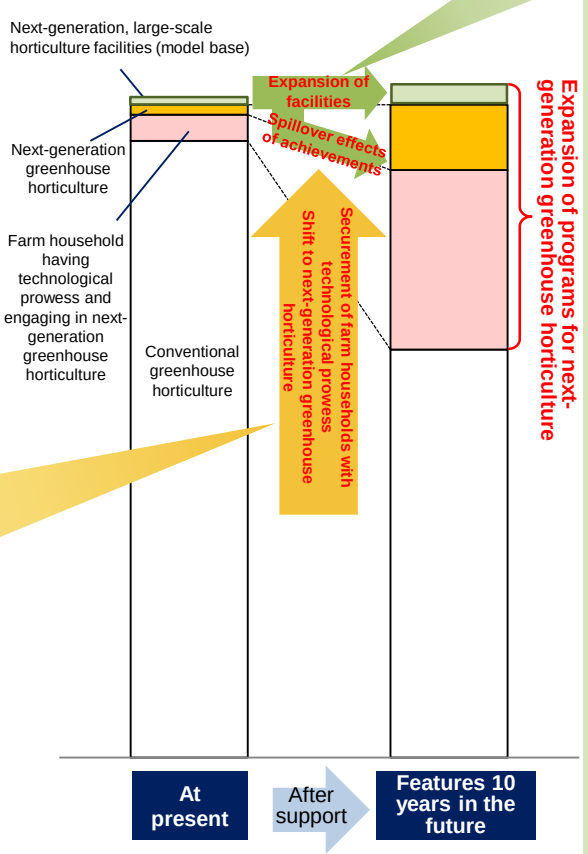
*In particular, preferential adoption in case of utilizing Farmland Banks

Greenhouse cost cutting
Support also for the development of a demonstration greenhouse, utilizing cost reduction technology

*Collaboration with a subsidy program to create strong agriculture

Dissemination of achievements of demonstrations to various regions by consortium

Diagram of expansion of programs for next-generation greenhouse horticulture



2. Promotion of next-generation greenhouse horticulture, etc.

Subsidy program to create strong agriculture (preferential quota for next-generation greenhouse horticulture)

○ Support for next-generation, large-scale horticulture facilities, combining advanced environmental control technology, utilization of local energy and utilization of energy-saving technology and for a development demonstration greenhouse needed to learn about technologies

Accumulation of facilities from production to shipment

Project to support expansion of scale in next-generation greenhouse horticulture (project for promoting the expansion of areas for next-generation greenhouse horticulture)

○ Support for preparation of a guidebook analyzing and sorting out know-how of model bases of next-generation greenhouse horticulture and ways of cutting installation costs and for hosting of nationwide forums, etc.

4. Expansion of programs for next-generation greenhouse horticulture (2) (budgetary measures (2))

○ To promote a shift to a production technology system capable of accurate environmental control, based on the monitoring of environments and growth, as well as form production technology based on intuition and experience, support is provided for the introduction of low-cost, weather-resistant greenhouses, environment control equipment, etc. in projects covered by the subsidy program to create strong agriculture and the program to reinforce production areas.

○ Subsidy program to create strong agriculture

Subsidies provided for the following:

Development of core facilities, etc. in production areas

Facilities for collection, shipment and storage, facilities for processing of agricultural products, facilities for advancement of production technologies (low-cost, weather-resistant greenhouse, advanced environmental control horticulture facilities, etc.), improvement of small-scale land base, facilities to protect agricultural products from damage, etc.


Plant factory


Greenhouse equipped with compound environmental control equipment


Low-cost weather-resistant greenhouse

Subsidy rate :
Fixed amount for prefectures (no more than 1/2 of project cost for primary project undertakers)

Principal project undertakers :
Organizations, etc. formed by prefectures, municipalities and farmers

Destination of subsidies :
State - prefectures - primary project undertakers

○ Program to reinforce production areas

Subject to subsidies :

(1) Expenses to develop facilities and lease machinery and equipment, etc. needed to attempt a shift to production of highly profitable crops and cultivation system, based on plans to reinforce production areas, expenses needed for replanting, expenses to introduce materials, etc. needed at time of conversion, etc.
(2) Programs to promote effects of programs of (1) (Expenses needed for preparation of plans)


Environment control board


Control of temperature, solar irradiation and other environments


Heat pump

Subsidy rate:
No more than 1/2 for development of facilities, no more than 1/2 the price for leasing agricultural equipment, etc.

Principal project undertakers:
Farmers, farmers groups, etc. positioned in "plans to reinforce production areas" prepared by regional agriculture revitalization council, etc.

Destination of subsidies :
(Development projects) state - prefectures - principal project undertakers
(Funding projects) state - fund management organizations - prefectures - principal project undertakers

4. Expansion of programs for next-generation greenhouse horticulture (3) (technological development)

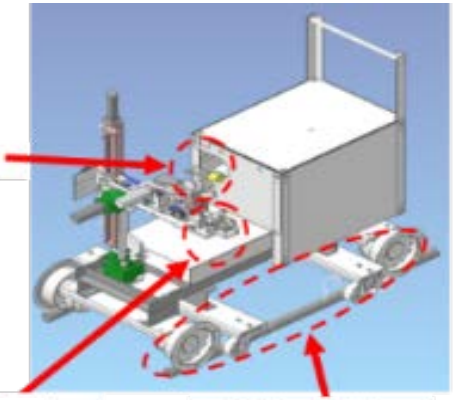
- New technological development, incorporating AI, robotics and others, is important for improving productivity in greenhouse horticulture and expanding operations.
- Programs to develop, among others, an image processing device enabling precise environmental control and growth prediction thanks to the development of tomato harvesting robots and visualization of photonic syntheses are underway.

Automatic Tomato Harvesting Robots

Harvesting has depended on manual work as each tomato needs to be picked without damaging it after confirming its harvesting period.

Amid the escalating labor shortage, the development of an automatic harvesting robot, which will work day and night, is underway to promote labor saving.

(2) Sensor unit



(1) Harvesting unit (3) Mobile unit

Utilization of AI in robots

Image recognition and functions to acquire proficiency in movements enable robots to recognize red tomatoes, etc., which are ready for harvest, and pick them without damaging them, in the same way that humans work, by repeating the acquisition of proficiency.

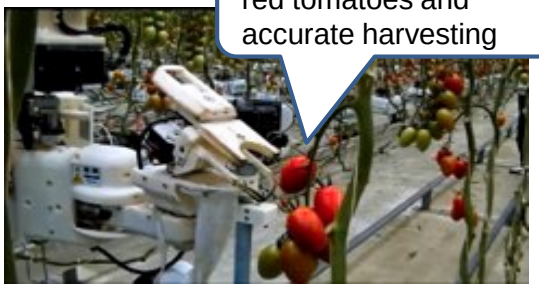
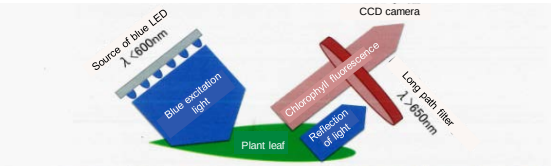


Image processing device for crops

Image measuring mechanism for chlorophyll fluorescence

- Chlorophyll fluorescence is measured at night as it is mixed with other light invisible during daytime.
- In measurement, a blue LED is shone on the plant and the blue light reflected by the leaves via a long path filter is eliminated before a CCD camera captures only chlorophyll fluorescence.
- The method is suitable for measuring plants before harvesting as it can measure photonic syntheses in a non-destructive and non-contact manner



Measuring part Source of blue LED CCD camera

Visualization of plant's photonic synthesis and analysis of relativity with growth environments

(Reference) Technologies put to practical use to date

○ Addressing high temperatures and typhoons in summer and snow is an important challenge facing greenhouse horticulture in Japan, in comparison with the Netherlands. Various studies have generated new technologies useful in work sites.

○ While the Netherlands has been going ahead in environmental control systems, Japan has developed products with upgraded functions thanks to aggressive entry from other sectors, based on high-level technological prowess.

○ Measures to address high temperatures in summer

Development of materials that make environmental control possible in summer when the amount of insolation is large and the temperature and humidity are high, in order to practice greenhouse horticulture all year round.

Mist cooling

Lowering temperatures without moistening crops and at low cost has become possible by improving the shape of nozzles to spray misty water and spraying pressure.

Efficient vaporization by cyclical fan and fine mist nozzle

Heat pump

Application of Japanese home-use air conditioning technology, highly efficient by global standards, to agriculture. In addition to cooling and dehumidification, an air conditioner, combined with a boiler in winter, is expected to generate energy-saving effects.

○ Measures to address typhoon and heavy snowfall

Development of a greenhouse that can be erected at lower cost than a conventional greenhouse built with reinforcing bars, and a highly durable covering material that maintains strong resistance to typhoons and snowfall

Low-cost weather-resistant greenhouse

Utilization of thin but strong steel material fostered in the automobile industry. Securement of durability by reinforcing pillars and foundation

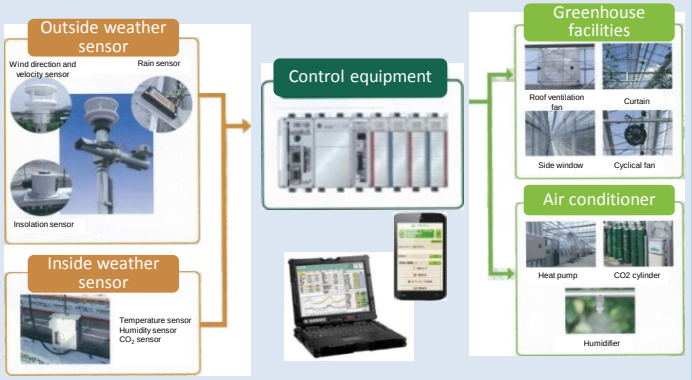
Covering materials for greenhouse

PO film
Lighter and more durable than vinyl and replacement is unnecessary for 5 years (2-3 years in case of vinyl)

Fluorine film
As sunlight-permeable as glass and highly durable. Long-term use of more than 10 years possible.

○ Environmental control system

System for environmental control in response to multiple environmental conditions that include not only temperature but also humidity, CO2 and amount of insolation. While Dutch and other overseas makers had been ahead, efforts to improve functions have been underway in Japan in recent years due to electronics makers' active entry.



Various sensors and monitoring equipment to measure environmental data

Visualization of environmental data facilitates improvements from cultivation based on intuition and experiences, making comparisons with outstanding farmers' skills.

Sensor box