



Japan and the Netherlands
Horticulture Seminar Material

Current State and Challenges of Greenhouse Horticulture in Japan

Japan Greenhouse Horticulture Association

Chairman Hidenori Suzuki

Contents

- I Overview of the Japan Greenhouse Horticulture Association**
- II Current State of Greenhouse Horticulture in Japan
(Areas, equipment, crops, and management)**
- III Challenges and Support for Greenhouse Horticulture
in Japan
(Support from the Ministry of Agriculture, Forestry
and Fisheries of Japan for greenhouse horticulture,
and initiatives of the association)**

I. Overview of the Japan Greenhouse Horticulture Association

- Established: 1972
- Chairman: Hidenori Suzuki (Chairman of Daisen)
- Purpose: Conduct the necessary **research study and provide information** to modernize greenhouse horticulture management, and disseminate superior greenhouse horticulture materials.
- Members: 80 companies that are concerned with greenhouse horticulture including housing construction and manufacturing companies, film manufacturers, heating devices, hydroponics, and seedlings. Others include 11 support organizations and a number of individual members.

II. Current State of Greenhouse Horticulture in Japan

1. Areas of greenhouse horticulture in Japan

Source from the MAFF

- Greenhouse horticulture is essential for a stable annual supply of horticultural crops, such as vegetables, as they cannot be stored for a long period of time.
- Tunnels and greenhouses are used for greenhouse horticulture. In recent years, vegetable factories with advanced environmental control functions are also being used.
- Although 43,200 ha is used for glass rooms and greenhouses, the number is decreasing in recent years. 70% of them are for vegetation.
- Meanwhile, the number of greenhouse horticulture is decreasing due to aging. 107,000 farms are for vegetable cultivation and 25,000 for flower cultivation.

○ Various forms of greenhouse horticulture



Tunnels



Pipe greenhouse



Steel-frame greenhouse

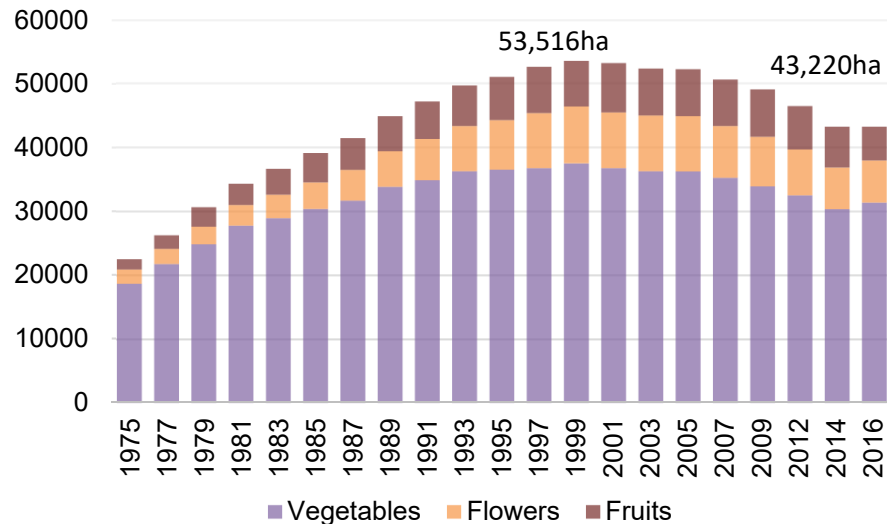


Sunlight vegetable factory

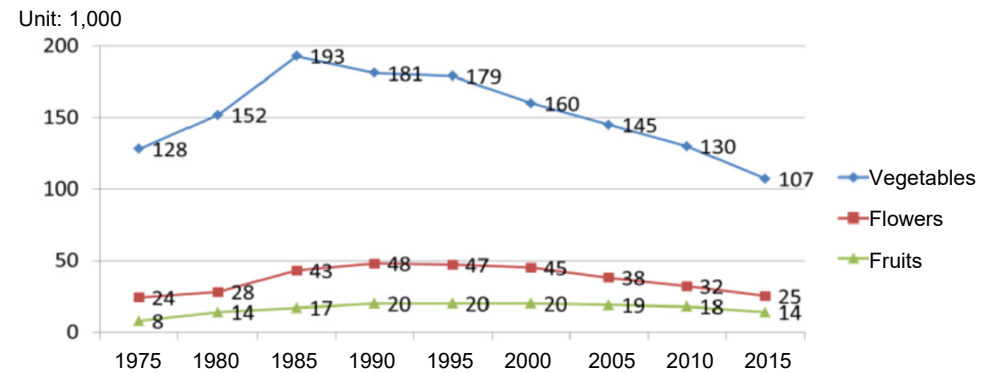


Artificial light vegetable factory

○ Change in the areas used for glass rooms and greenhouses



○ Change in the number of greenhouse horticulture farmers (market farmers)



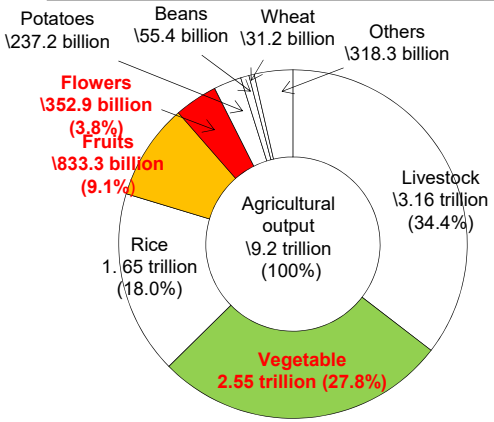
Source: "Census of Agriculture and Forestry," Ministry of Agriculture, Forestry and Fisheries of Japan

2. Importance of Greenhouse Horticulture

Source from the MAFF

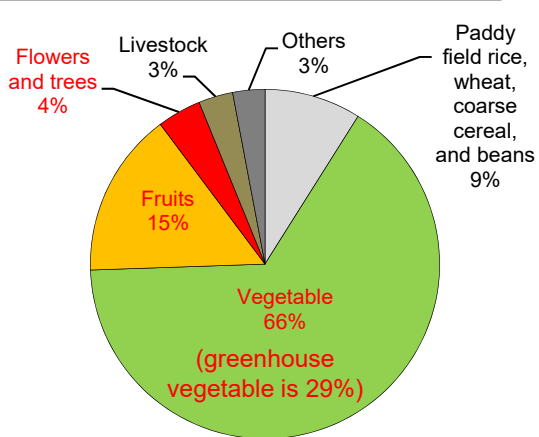
- Horticultural crops, such as vegetables, fruits and flowers, account for about 40% of the agricultural output in Japan. As farmers are also able to add high-value to these crops with ingenuity, 85% of new farmers select these crops as their main products, which are very important and attractive fields.
- Vegetables and fruits account for the largest portion in food spending and therefore they are important consumption items for Japanese people. Moreover, it is essential to supply crops stably all through the year through greenhouse horticulture to meet consumer needs.
- As the prices of vegetables vary greatly depending on the volume of supply, the stable supply of crops is important to protect the dietary lives of people through greenhouse horticulture.

○ Agricultural output of Japan



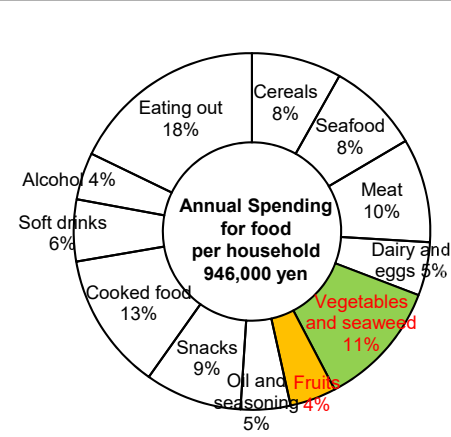
Source: "Income Statistics of Production Agriculture (2016)," MAFF

○ Main crops of new farmers



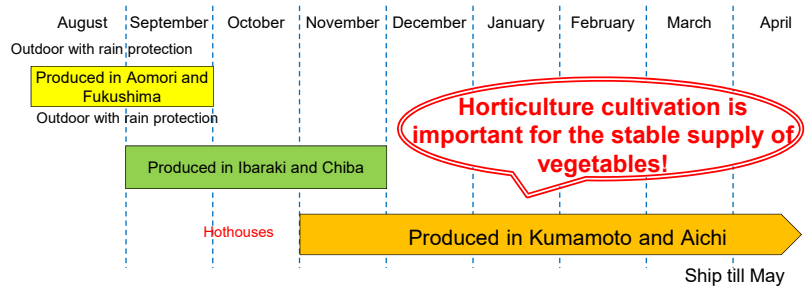
Source: "Research Result Concerning New Farmers and Their Status (2017)," National New Farmers Consulting Center

○ Annual spending for food per household

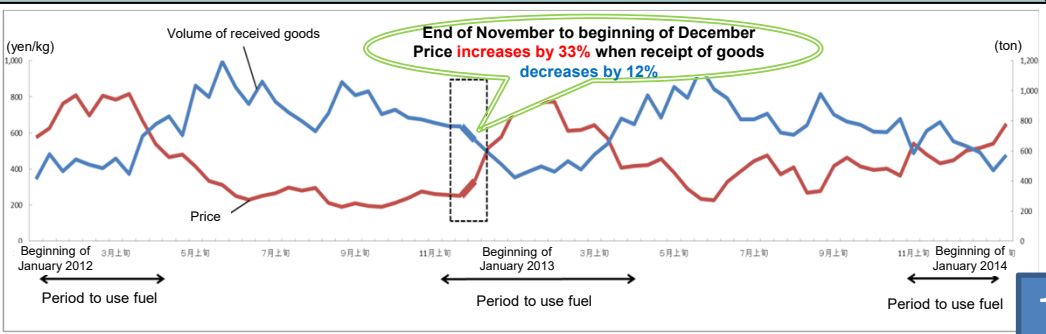


Source: MIC "Household Research (2017)"

○ Origin relay shipment status of tomatoes



○ Change to the wholesale price and delivered volume of green peppers at the Tokyo Central Wholesale Market



3. Installation Area for Different Types of Greenhouse Horticulture Facilities

Category	2007	2016	2016/2007
Glass rooms & greenhouses	50,608	43,220	85.4%
Steel-frame	10,207	9,702	90.1%
Metal pipe	40,401	33,518	83.0%
Glass rooms	2,157	1,663	77.1%
Vegetables	873	792	90.7%
Flowers	1,145	840	73.4%
Fruits	139	31	22.3%
Greenhouses	48,451	41,558	85.8%
Vegetables	34,364	30,548	88.9%
Flowers	6,935	5,750	82.9%
Fruits	7,153	5,260	73.5%

Source: "Research on horticulture facilities and agricultural waste plastics," MAFF

4. Installation and Cultivation Areas for Different Types of Horticultural Crops (2016, hectares)

Vegetables		Flowers		Fruits	
Total installation area 31,340		Total installation area 6,589		Total installation area 5,291	
Total cultivation area 44,698		Total cultivation area 7,264		Total cultivation area 5,206	
Tomatoes	7,083	Chrysanthemums	2,468	Delaware	738
(mini tomatoes)	(1,595)	Roses	323	Kyoho grapes	736
Spinach	6,911	Prairie gentians	349	Other grapes	1,170
Strawberries	3,856	Carnations	263	Satsuma mandarins	372
Cucumbers	3,735	Lilies (cut)	485	Other citruses	864
Melons	3,036	Statice	165	Yellow peaches	443
Watermelons	2,352	Other pot flowers	1,423	Peaches	61
Green onions	1,864			Loquats	56
Asparagus	1,306			Persimmons	31
Eggplant	1,088			Figs	99
Green peppers	949			Pears	220
Garlic chives	945			Mangos	399

Source: "Research on horticulture facilities and agricultural waste plastics," MAFF

5. Use of Heating Devices and Hydroponic Facilities

● Use of energy-saving devices (2016)

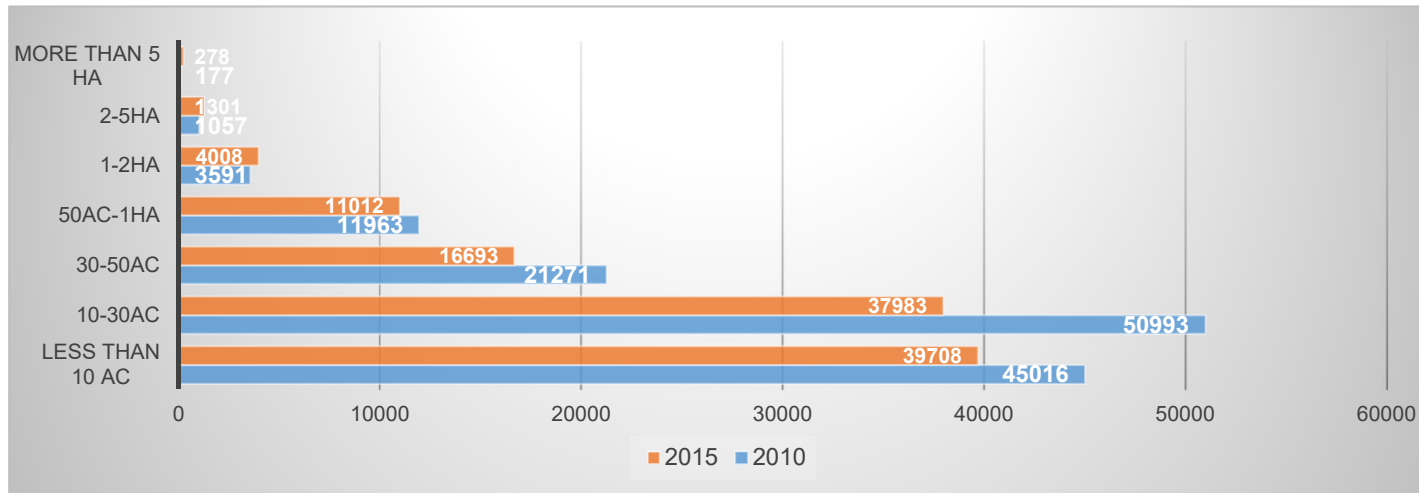
Category	Area (ha)	% against 5
1. Devices with a heating function	17,308	40.0
Devices in 1) with advanced environmental control	1,070	2.5
2. Devices that generate carbon dioxide	1,408	3.3
3. Devices with double or more curtains	5,936	13.7
4. Devices with fans and ventilation	6,818	15.8
5. Total installation area of glass rooms and houses	43,220	

● Installation area for different types of hydroponic facilities (for vegetables and flowers)

Category	2007	2016	2016/2007
Hydroponic culture	450	504	112.0%
Solid culture	1,035	1,195	115.5%
Other	201	308	153.2%
Total	1,686	2,004	118.9%

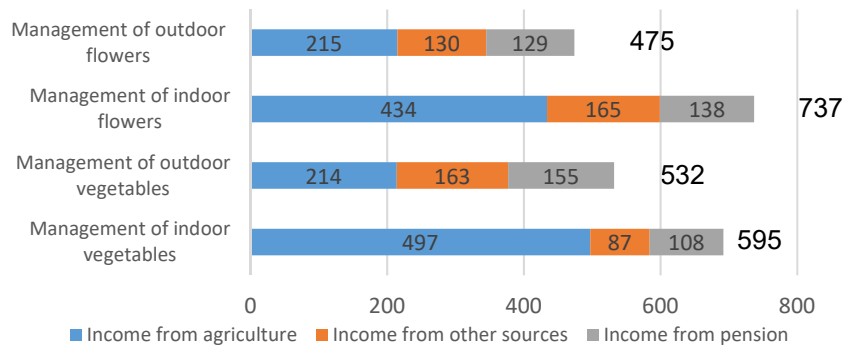
6. Greenhouse Horticulture Farmers' Management

● Number of farmers for various areas (2015 and 2010)



Source: "Census of Agriculture and Forestry," MAFF

● Comparison of farmers' income for various farming types



Source: MAFF "Management statistic of various farming types in 2015"

● Management status of various farming types (2015)

Category	Land productivity (1,000 yen/10 ac)	Labor productivity (yen/h)	Reference: Labor time (h)
Single management of indoor vegetables	388	1147	5582
Single management of outdoor vegetables	167	871	3146
Single management of indoor flowers	616	835	7278
Single management of outdoor flowers	219	800	4919

Source: MAFF "Management statistic of various farming types in 2015"

7. Trends in Numbers of Large Greenhouses and Plant Factories

Research period	2011.3	2012.3	2013.3	2014.3	2015.3	2016.2	2017.2	2018.2
Sunlight	13	83	151	185	195	79	126	158
Combination of sun and artificial light	16	21	28	33	33	36	31	32
Artificial light	64	106	125	165	185	191	197	183

Report on regional promotion project of next-generation greenhouse horticulture in FY2017.

Note: Installation area of sunlight greenhouses after March 2016 is mostly larger than one hectare in size and limited to facilities with hydroponic devices (large greenhouses).

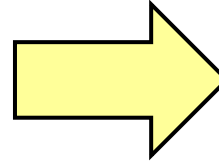
III. Challenges and Support for Greenhouse Horticulture in Japan

1. Challenges

Greenhouse horticulture in Japan is mainly conducted with pipe greenhouses on a small-scale management basis and is behind the Netherlands and South Korea in expanding the management scale and size of facilities.

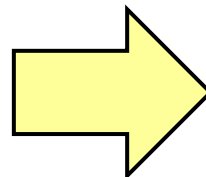
Why?

1. There is little flat land in Japan and the most of the flat land is used to grow rice. As plots are small and owned separately, it is difficult to consolidate them and they are also expensive due to competition with residential land.
2. As Japan is long north to south, vegetables are not harvested for a long time at the same place but are supplied in a relay from the origins. Therefore, pipe greenhouses are sufficient to adjust for short cropping seasons.

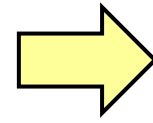


However, the situation is changing.

1. As farmers are aging, some farmlands are unused due to the lack of farmers and there is a requirement that farmland be used effectively. The government is working to sort the plots and consolidate farmland.
2. In the past, most crops were consumed by households and supplied through markets. However, there is greater demand for processing and professional use now with stable quantity, delivery, quality and prices. Therefore, long-term stable production with greenhouses is becoming advantageous.

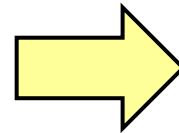


3. As most farms are family-run, it is difficult to make a huge investment at one time and therefore the farming scale is only gradually increasing.



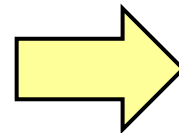
3. More individual farmers are increasing farm scale and farm management is becoming incorporated. There are fewer hurdles for companies to enter the farming industry.

4. Greenhouses use petrol as fuel and the price of oil is high as Japan imports oil and therefore only 40% of greenhouses use heaters. Although there are many forests in Japan, wood is not used as it is difficult to control as an energy source and the supply is not stable.



4. Energy saving and environmental control technologies are improving, and the wood biomass supply system and use technologies are also improving.

5. A lot of damage is caused by disasters in Japan from typhoons, snow, earthquakes and other causes, and it is costly to maintain facilities. As land area is small and has various shapes, these facilities need to be tailor made, making it difficult to reduce the cost.



5. Weather-resistance of facilities is being reviewed for each area as it does not have to be the same. However, a certain level of strength is necessary as the climate changes drastically.

2. How MAFF is Tackling the Challenges (Direction of next-generation greenhouse horticulture)

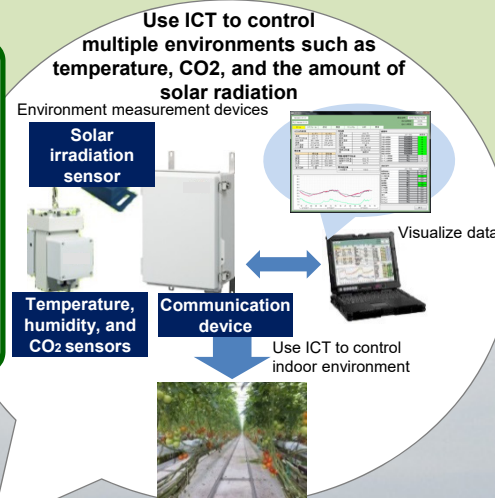
Source from the MAFF

With reference to Dutch greenhouse horticulture, MAFF is to establish the top runner model (next-generation greenhouse horticulture) that solves the whole challenges with greenhouse horticulture in Japan by 1) introducing advanced environmental control, 2) increasing the farming scale through hiring, and 3) using local energy that suits the natural conditions in Japan.

1. Improve productivity by introducing advanced environmental control technologies

Improve yield amount dramatically by using ICT to combine and control several environments, and to achieve annual production plans in a greenhouse that is highly weather-resistant to the Japanese climate.

E.g.: Achieved a yield of approx. 30 – 40 t/10 a of large tomato: (national average: 10 t/10 a)



3. Departure from fossil fuels by using local energy

Fuel accounts for a large portion of greenhouse horticulture running costs and fuel prices greatly affect management. Management can be stabilized by using local energy to depart from reliance on fossil fuels.

Utilize local energy



Waste energy from factories



Wood biomass



Geothermal heat

2. Large scale management by leveraging labor force

Formulate and review the optimal work plan, allocate employees appropriately, and standardize work to achieve efficient production by leveraging the labor force and increasing scale of management.

Necessary labor management to increase scale



Create production and work plans, and assign staff



Educate employees for efficient work

Reference: Differences in natural conditions between Japan and the Netherlands

	Japan	The Netherlands
Temperature	Hot and humid in summer	Cool in summer
Snow	Yes	Almost none
Strong wind	Typhoons	No hurricanes
Main fuel	Imported heavy oil	Natural gas from North Sea oil field

2. How MAFF is Tackling the Challenges (Direction of next-generation greenhouse horticulture)

Source from the MAFF

- **Locate 10 model locations nationwide** to establish next-generation greenhouse horticulture that suits the natural conditions in Japan, which is long from north to south.
- **Collect data**, such as environment, growth, and work plans, in model locations and **rotate PDCA cycle to review yield per 10 a, reduction rate of fossil fuels, and yield per farmer**, and test technical elements for next-generation greenhouse horticulture.
- **Accumulate evidence** that contributes to solving the challenges that face greenhouse horticulture in Japan and improve yield.

Data to be collected at model locations

Daily activities

- Check indoor environment, growth of crops, and fuel usage
- Plan work and implement

Benchmarks

- Yield per 10 a
- Reduction rate of fossil fuels
- Yield per farmer

Ascertain challenges and improvements (PDCA cycle)

Improve management profit (PDCA cycle)

1. Hokkaido (Tomakomai City)
Completed in October 2016

Product: Strawberry (4 ha)
Target yield: 7.5 t/10 a
Local energy: Wood biomass

2. Miyagi (Ishinomaki City)
Completed in August 2016

Product: Tomatoes (1.1 ha), paprika (1.3 ha)
Target yield: 34 t/10 a (tomato)
20 t/10 a (paprika)
Local energy: Wood biomass, geothermal heat

3. Saitama (Kuki City)
Completed in January 2017

Product: Tomatoes (3.3 ha)
Target yield: 30 t/10 a
Local energy: Wood biomass

4. Shizuoka (Oyama Town)
Completed in January 2016

Product: high sugar content tomato (3.2 ha), high sugar content mini tomato (0.8 ha)
Target yield: 7.0 t/10 a (high sugar content tomatoes)
3.0 t/10 a (high sugar content mini tomatoes)
Local energy: Wood biomass

5. Toyama (Toyama City)
Completed in June 2015

Product: High sugar content tomatoes (2.9 ha)
Flowers such as prairie gentian (1.2 ha)
Target yield: 17.7 t/10 a (high sugar content tomato)
120,000/10 a (flowers such as prairie gentian)
Local energy: Waste fuel

6. Aichi (Toyohashi City)
Completed in March 2017

Product: Mini tomatoes (3.6 ha)
Target yield: 21 t/10 a
Local energy: Hydrothermal from sewage discharge

7. Hyogo (Kasai City)
Completed in August 2015

Product: Tomatoes (1.8 ha), mini tomatoes (1.8 ha)
Target yield: 35 t/10 a (tomatoes)
20 t/10 a (mini tomatoes)
Local energy: Wood biomass

8. Kochi (Shimanto Town)
Completed in March 2016

Product: Tomatoes (4.3 ha)
Target yield: 38.4 t/10 a
Local energy: Wood biomass

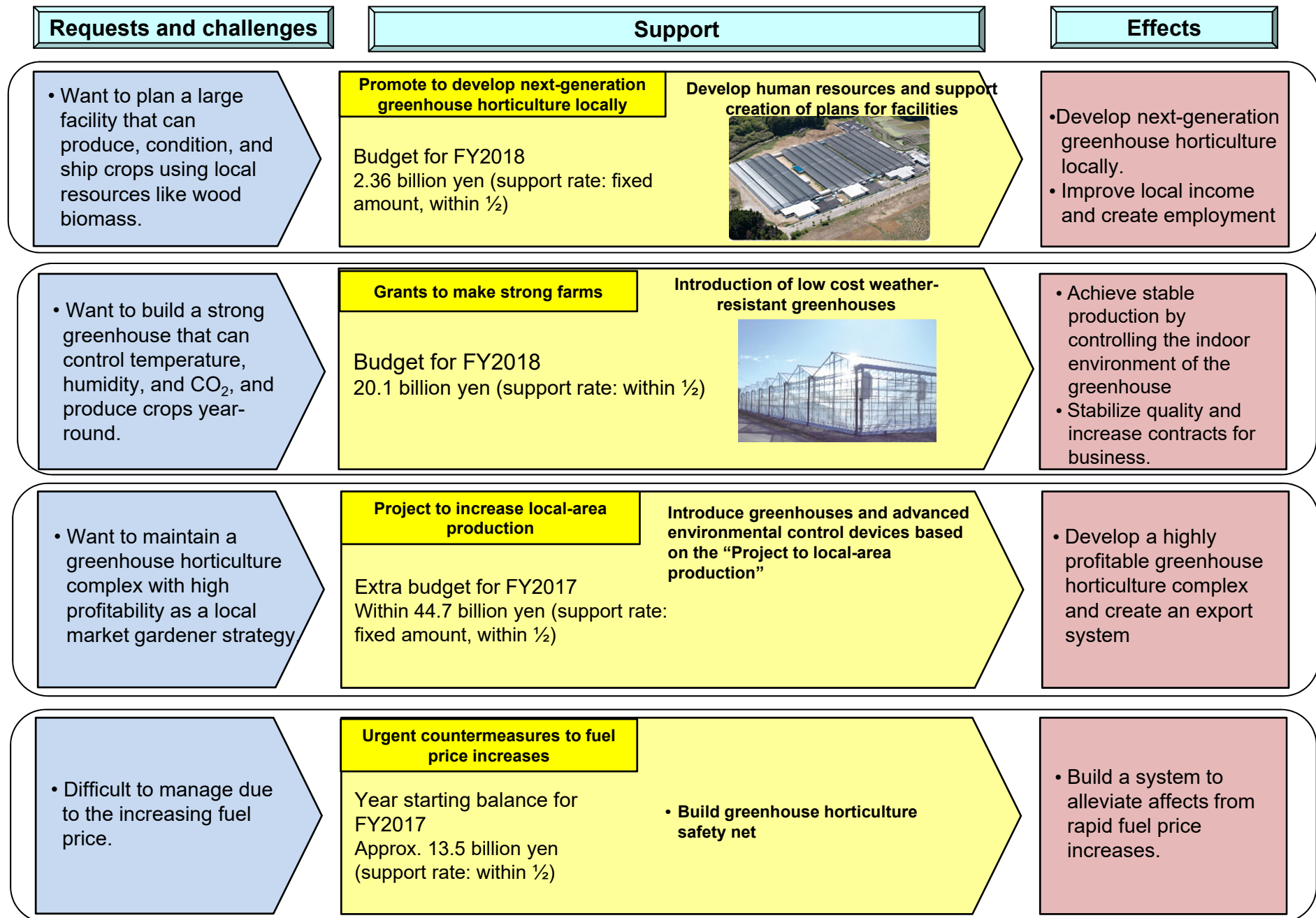
9. Oita (Kokonoe Town)
Completed in March 2016

Product: paprika (2.4 ha)
Target yield: 16.3 t/10 a
Local energy: Geothermal heat

10. Miyazaki (Kunitomi Town)
Completed in July 2015

Product: Green peppers (2.3 ha), cucumbers (1.8 ha)
Target yield: 15 t/10 a (green peppers)
25 t/10 a (cucumbers)
Local energy: Wood biomass

Major Support from MAFF for Greenhouse Horticulture



3. Initiatives of the Japan Greenhouse Horticulture Association 1

The Japan Greenhouse Horticulture Association is promoting the following activities together with member companies based on the support and cooperation from MAFF, farming organizations, research organizations, and universities.

MAFF Subsidiary Projects

1. Promote next-generation greenhouse horticulture nationwide

- Instruct and advise on cultivation and management at 10 locations, report the outcomes and disseminate the method.
- Create instructions for areas and farmers who are tackling next-generation greenhouse horticulture.
- Develop instructors of next-generation greenhouse horticulture.

2. Countermeasures to sharp rises in fuel costs

- Supply financial aid to farmers who are tackling energy saving when the fuel price increases.

3. Initiatives of the Japan Greenhouse Horticulture Association 2

<Original Association Initiatives>

1. Proposals to promote greenhouse horticulture

Ideal support and safety management that suit the Japanese climate and conditions for large facilities

2. Formulate and review safety structure standards for horticulture

Considering the review of standards so they are easier to use for farmers and suit the regions

3. Disseminate new technical information

Greenhouse Horticulture & Plant Factory Exhibition/Conference (GPEC) at Tokyo Big Site (once every two years) and hold comprehensive seminars and regional seminars (annually)

3. Initiatives of the Japan Greenhouse Horticulture Association 3

4. Improve member technical standards

Issue the publication “Greenhouse Horticulture,” hold greenhouse horticulture technical lectures (elementary and intermediate levels), certify greenhouse horticulture technical instructors, training overseas and in Japan

5. Promote measures for plastics used for agriculture

Advise and support to strengthen the system for optimal treatment created by the committee that consists of academic experts and concerned parties for optimal treatment of agricultural plastics

Thank you for your attention.

The Japan Greenhouse Horticulture Association is looking for companies that agree with our goals (regular members) and individuals (supporting members).

For details, see <http://www.jgha.com>.

