

Plant Factories in Japan: Latest Research Findings in 2009

➤ **Research Outline**

Yano Research Institute has conducted a study on the high-capacity capacitors market in Japan as described below.

1. Research period: July 2008 to July 2009
2. Research targets: Enterprises, universities and research organizations working on the plant factory business and research projects.
3. Research methodologies:
Face-to-face interviews with relevant personnel, supplemented by interviews via telephone and e-mail, and literature researches.

<What is plant factories market?>

A plant factory is a facility in which all the environmental elements for plant growth, such as lighting, temperature and humidity, carbon dioxide density, culture solution and so forth are artificially controlled for year-around, scheduled production of plants and vegetables. The plant factories market can be divided into 2 major categories, new plant factory construction market and plant factory products market (plants and vegetables produced in the plant factories). Studied in this research are the 2 types of plant factories, one with complete artificial lighting in a totally-enclosed environment, and the other with combined use of solar and artificial lighting. As to the future prospects, however, plant factories in a broader sense, highly automated, protected horticulture facilities which permits year-round scheduled plant production, are included.

➤ **Key Findings**

- ◆ **Plant factory construction market in fiscal 2009 is estimated to be 5,300 million yen, and the plant factory products market to be 4,242 million yen**

The plant factory construction market in fiscal 2008 was 1,680 million yen, which is expected to grow considerably in fiscal 2009 with the incentive subsidies of MAFF and METI, and to reach 5,300 million yen.

The plant factory products market (plants and vegetables shipped from the plant factories) in fiscal 2008 was 2,788 million yen. In fiscal 2009, the market is estimated to grow considerably to 4,242 million yen. As to the types of plant factories, factories with complete artificial lighting are expected to grow remarkably, close to doubling, while factories with combined use of solar and artificial lighting are also expected to grow considerably.

- ◆ **Domestic plant factory construction market in 2020 will expand to producing 230,000 heads per day, or 12,900 million yen in value.**

The plant factories market will go into an age of large-scale plant factories in 2016. In addition to the commercialization of flexible production lines, full-scale production of multiple plants and high or ultra high-value added plants are expected to start. The market will also expand into foreign countries, and the export, focusing on Middle East countries, China and Russia, will go into full swing.

- ◆ **Many manufacturers entering into the market**

In the past several years, many enterprises have been entering into the market one after another, and this trend is expected to continue for some time. A variety of companies are in the market, such as trading companies, major and mid-class construction companies, general engineering companies, equipment manufacturers in various corporate sizes, general food manufacturers and food related manufacturers.

➤ **Report format:**

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Contacts: Public Relations

Yano Research Institute Ltd. (URL: <http://www.yanoresearch.com>)

Phone: +81-3-5371-6912

E-mail: press@yano.co.jp

➤ Research Summary

1. Background and overview of the market

The plant factories market can be divided into 2 major categories, new plant factory construction, and plant factory products market (shipment of the plants and vegetables produced in the plant factories).

In recent years, plant factories have drawn increasing attentions, in relation with the issues, such as food safety and self-sufficiency in food. Plant factories can meet with these social needs of the day, by artificially controlling the interior environment, and achieving year-round, scheduled production of clean and safe plants and vegetables.

A few times in the past, a concept of plant factory drew public attentions and in each time many enterprises tried to commercialize but failed. Twenty some years ago when a term, plant factory first appeared, it seems that the society was not ready. At present, the environment surrounding the plant factory has changed for the better, with the increasing concern for the food safety among the consumers, and the activities for improving the self-sufficiency in food.

1-1. Plant factory construction market

The plant factory construction market was 1,529 million yen in fiscal 2007, and grew to 1,680 million yen in fiscal 2008 (increased by 9.8% compared to the previous year). In fiscal 2009, with the total budget of 14.6 billion yen allocated from the supplementary budget for plant factory related projects administered by MAFF and METI, the market is estimated to grow to the level of 5,300 million yen.

1-2. Plant factory products market (shipment of the plants and vegetables produced in the plant factories)

The plant factory products market in fiscal 2008 was 2,788 million yen, comprised of 1,340 million yen of the factories with complete artificial lighting and 1,448 million yen of the factories with combined use of solar and artificial lighting. In fiscal 2009, considerable growth of the market is expected, reaching to 4,242 million yen.

2. Issues and potentials for the plant factories

Although having attracted public attentions, plant factories have not yet become an established industry with its own market, mainly due to the fact that the products could not satisfy the needs of the market in quality and lineup of the products and their pricing. More specifically, only leafy vegetables such as lettuce could be produced on an economic basis, which are still expensive and their positioning compared to those produced in open field or greenhouse is not yet clearly identified.

In order to overcome these issues, introduction of the latest energy saving technologies such as LED lighting, solar power generation, heat pump and tri-generation* is being studied, and environment control systems suitable for Japanese weather conditions are being developed at various organizations. The progress is being achieved rapidly, in both cost reduction and production technology improvement.

The plant factory is an assembly of various elemental technologies, with extensive fields of related industries. In view of the “quality of technology”, the plant factory is a good and promising theme for the future, which is one of the technological fields Japan can be a world leader. Also, the plant factory has hidden potential to become a major export industry in the future.

*: One type of cogeneration systems, which utilize the carbon dioxide generated as by-product, as well as the power and heat. As carbon dioxide is an essential element for plant growth, it is said to be ideal for plant factories.

3. Future forecast

The plant factories market will go into a take-off period in or after 2012. Considerable progress will be made, especially in the fields of plant factories with combined use of solar and artificial lighting and existing protected horticulture, such as the popularization of ubiquitous environment control systems. Also, the diversification of cultivated variety will start, as well as nutriculture with solid medium in this time period in addition to the existing hydroponics.

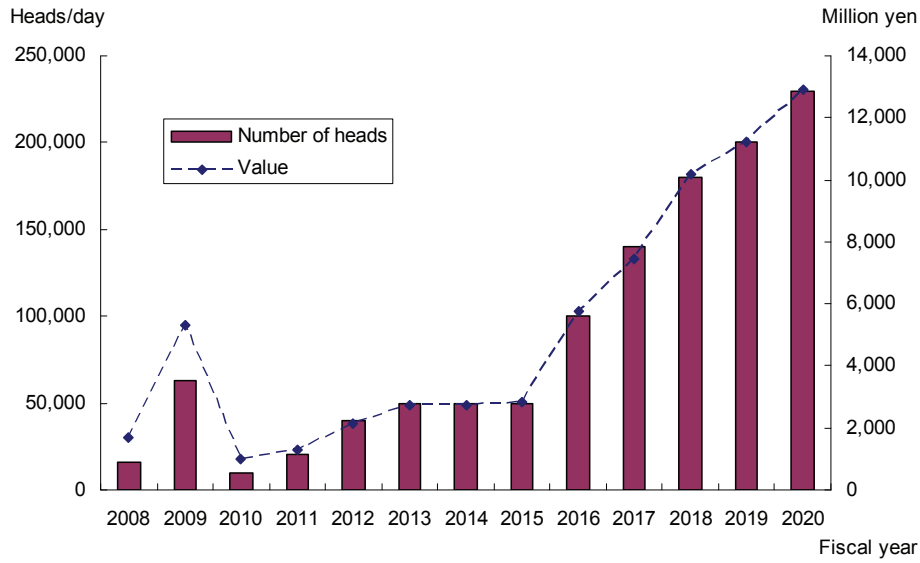
Further, it is expected that large-scale plant factories will start prevailing in or after fiscal 2016. In fiscal 2017 or so, flexible production lines will become available for commercial production. At the plant factories with complete artificial lighting, the diversification of cultivated variety will progress, and full-scale production of high-value added, or even the ultra high-value added plants or vegetables will start.

The plant factory construction market, as small as 1.68 billion yen in fiscal 2008, is expected to exceed 10 billion yen in fiscal 2018, and reach to 12.9 billion yen in fiscal 2020.

The plant factory products market, in the meantime, which was 2.788 billion yen in fiscal 2008, will exceed 10 billion yen in fiscal 2013 and reach to 20 billion yen in fiscal 2018, then to 28.8 billion yen in fiscal 2020. These forecast figures, however, are based on the leafy vegetables focusing on lettuce. In the actual operation in the future, the ratio of lettuce and leafy vegetables will become lower than half of the total production in 2018 or so, replaced by expensive products, such as high or ultra high-value added products, tomatoes or strawberries. Further, the market for ultra high-value added products for bio or pharmaceutical applications will grow in the future.

Note 1: Networked computer control system

Fig. 1: New Plant Factory Construction Market Size Forecast in Japan

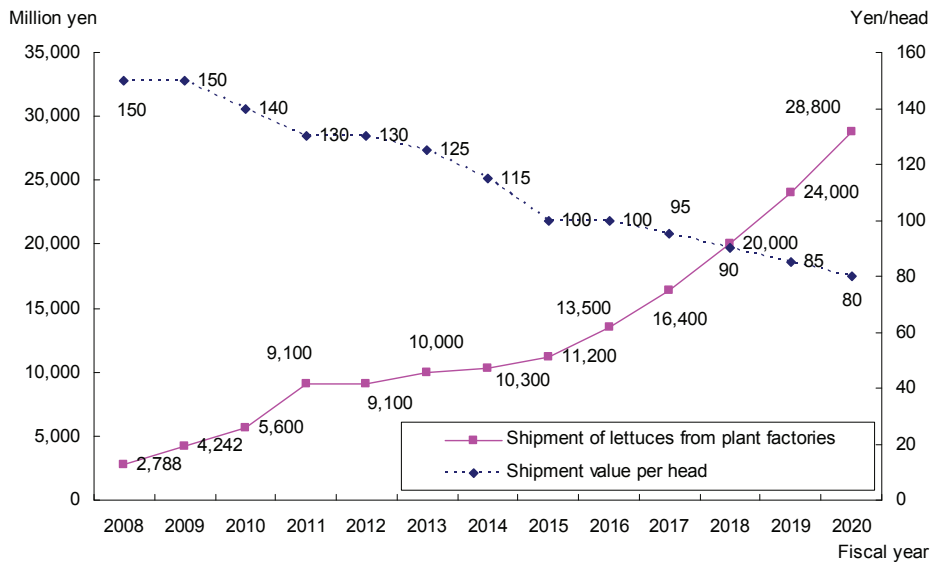


Fiscal year		2008	2009	2010	2015	2020
Newly developed market size	Plant production volume (heads/day)	16,400	62,800	10,000	50,000	230,000
	Factory construction in value (Million yen)	1,680	5,300	1,000	2,820	12,900

Estimated by Yano Research Institute

Note 2: The left side axis shows the production volume (heads/day) produced by the newly constructed plant factories, while the right side axis shows the new plant factory constructions in value.

Fig. 2: Plant Factory Products Market Size Forecast in Japan



Estimated by Yano Research Institute

Note 3: Based on the production capacity of the domestic plant factories, the production is estimated based on the assumption that leafy vegetables such as lettuce are raised in all plant factories.

Note 4: The left side axis shows the shipment of the lettuces produced at the plant factories, and the right side axis the unit price per head.