Smart Agriculture to Nourish Japan's Future
---The f-seed.Lab experimental farm initiative---

The city of Sukagawa in central Fukushima Prefecture is located in a long east-west region with splendid views of nature stretching all the way from the Nasu Mountain Range in the west to Abukuma Highland in the east. In the Edo period (1603–1868) the city flourished as a staging-post town on the Oshu Kaido, one of the five major highways at that time, and it has prospered as a commercial town for ages. Lots of delicious fruit and vegetables, such as apples, pears, and tomatoes, are grown in Sukagawa. Year after year, however, the environment surrounding the city's agricultural industry has become increasingly severe due to such factors as the aging of farmers and shortage of successors. Until recently Sukagawa boasted Japan's highest production of cucumbers harvested in the summer and fall, but now that title has been taken over by the city of Date (also in Fukushima Prefecture).

Moves are beginning to break out of these doldrums and increase the farming population through the utilization of productivity-improving information technology and robots. In this article, I introduce the efforts of the Fukushima Seed Center, which, in cooperation with a couple of IT ventures, aims to reduce the amount of labor required in cucumber cultivation and make farming more attractive.

Cucumber cultivation inside the f-seed.Lab greenhouse

Turning farming into attractive work by utilizing IT and robots

In early October, when the harvesting of summer-fall cucumbers was just about over, I visited the f-seed.Lab experimental farm, which the Fukushima Seed Center launched in March of this year in cooperation with Benefic Co., Ltd., an IT firm, and MK Tech Co., Ltd., a manufacturer of robots. Here an experiment is taking place to improve labor saving and quality in the growing of Iwase brand cucumbers.

When I entered the greenhouse built on farmland in the Yoshimine district in Sukagawa, I saw a rather dandyish gentleman sporting a beard scrutinizing a line graph on a computer screen. This was Katsuyoshi Hashimoto, the president of the Fukushima Seed Center, who explained, "This data shows the temperature, humidity, amount of carbon dioxide, and so on inside the greenhouse. What I am doing now is monitoring this data."

Katsuyoshi Hashimoto scrutinizes data shown on a computer screen.

Unwittingly becoming an agricultural expert

Before his current position, Hashimoto worked in sales for a large food processing company. When his father, the founder of the Fukushima Seed Center, retired, he decided to take over the family business. The Fukushima Seed Center not only handles seeds but also sells agricultural equipment and materials and greenhouses. In addition, it is an

agricultural consulting company, offering advice and guidance to consultations from farmers.

At first, Hashimoto told me, he did not understand anything at all, but he picked up various know-how about agriculture from clients. Before realizing it, about 20 years after taking over the business, he is now working busily every day as an agricultural expert.

Desire to change the image of agriculture

"Over the last decade," Hashimoto said, "the volume of agricultural production in Sukagawa has been declining year by year. The reason is that there are few successors to carry on farming businesses. When the number of farms drops, agriculture-related trade declines too. As a result, the regional economy, which relies on agriculture, becomes stagnant and falls into a negative spiral. It's the same all over Japan, isn't it?"

The reason for the lack of successors is that farming is perceived to be hard, dirty, unprofitable, and unstable work. Hashimoto wants to change this perception, and increase the number of successors, by popularizing the image of agriculture as creative work; work that is not hard either physically or mentally; work that is stable and will never disappear; work that, depending on your approach, can be quite profitable; work that promotes mental well-being, because you are working with plants and nature; work that brings direct words of thanks and delight; and work that is going to be increasingly important in the future.

Hashimoto checks that the cucumbers are growing properly.

Utilization of the Iwase brand of cucumbers

The Iwase district of Sukagawa is famous as a major production area of summer-fall cucumbers. From 1971 to 2013, it boasted the leading production volume in Japan. There are various reasons why production has declined, but the most important one is the drop in the number of farms and people engaged in agriculture. In addition, the false rumors that spread after the accident at the Fukushima Daiichi nuclear power plant of Tokyo Electric Power Co. following the Great East Japan Earthquake and subsequent tsunami has had a heavy impact too.

Hashimoto decided to place his bet on Iwase cucumbers, which are already well-known nationwide as a brand product, as a means of winning back the title of Japan's top producing area and revitalizing the regional agricultural industry and economy. Iwase cucumbers are popular for their deep green color, softness, and juiciness. Hashimoto wanted to capitalize on this local gem.

Iwase brand cucumbers

Freshly harvested cucumbers waiting to be shipped

Aiming for agriculture that anyone can do

In May,2020 the f-seed.Lab project team planted 2,000 cucumber seedlings inside the greenhouse. There are two ways of growing cucumbers. Instead of the bush-thinning method,[1] they opted for the vine-removal method.[2] While the bush-thinning method requires farmers to use all their five senses and skills to adjust vines and leaves, pay attention to humidity, and so on, the vine-removal method requires almost no such master skills. Since all they have to do is cut side-shoots and pluck some leaves in accordance with guidelines, even beginners can manage without worry. In addition, to remove as many uncertain factors in cultivation as possible, Hashimoto's team does not use ground soil but employs an isolated-bed-type hydroponic cultivation[3] technique.

In the bush-thinning method, chemical spraying consumes a lot of chemical and a lot of time, because the leaves are so crowded together. But in the vine-removal method, since the leaves are distributed evenly, little chemical or time is required. And the chemical spraying is done by an Auto Runner unmanned pest-control sprayer, so there is no worry about being exposed to pesticide either.

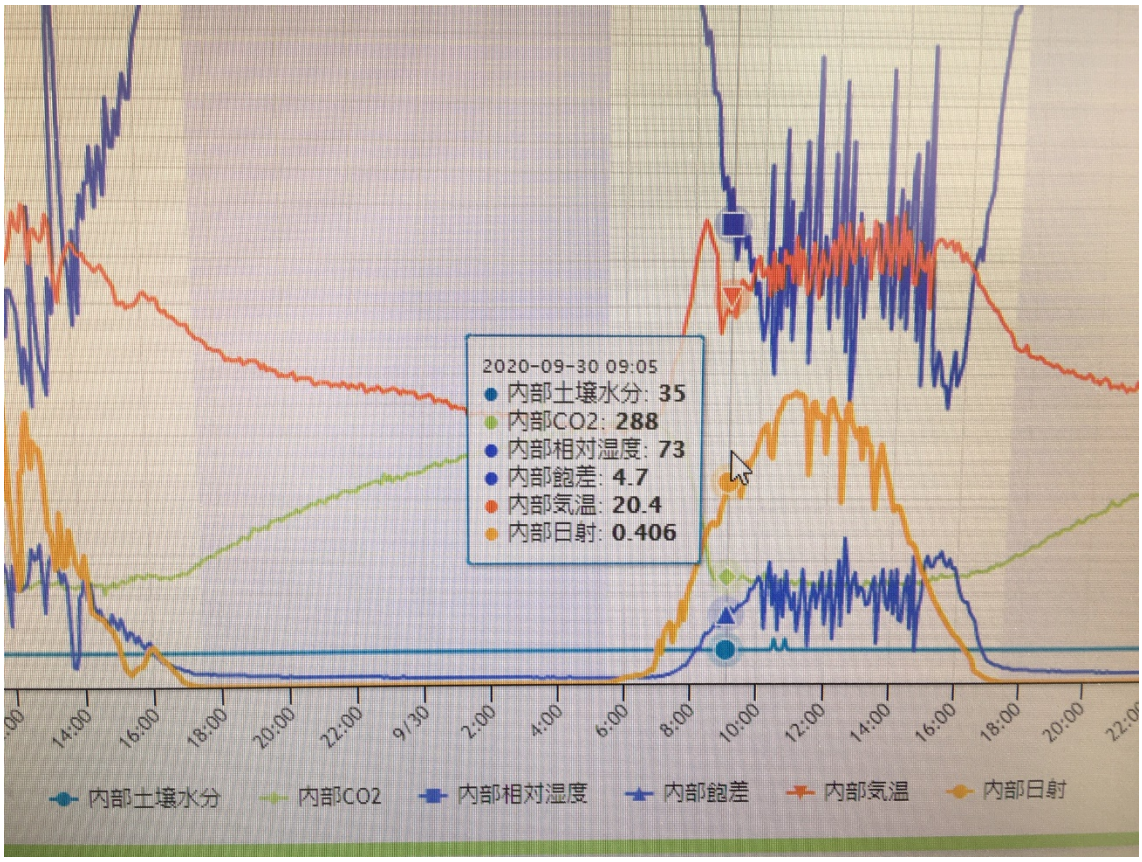
1. Bush-thinning method: The main stem of the cucumber is cut when it reaches about 60 cm, and many side-shoots spring from the main stem and secondary side-shoots from them. Fruit is harvested from the side-shoots.
2. Vine-removal method: The main stem of the cucumber is cut when it reaches about 60 cm, and about four side-shoots springing from the main stem are grown. Fruit is harvested from these branches.
3. Isolated-bed-type hydroponic cultivation: The crop is grown away from the ground, without using soil, by means of a nutrient solution produced by dissolving fertilizer in water. This method prevents soil and repeated cultivation damage.

Left: Isolated-bed-type hydroponic cultivation
Right: Auto Runner unmanned pest-control sprayer

Encouraging young people to take up farm work through smart agriculture

As a result of the recent progress of technology, people's lives and work are evolving dazzlingly by the day. Much work is approaching a turning point, with jobs that were previously done manually now being carried out by artificial intelligence and robots. Hashimoto argues that agriculture must jump on this bandwagon too.

The red line on the graph displayed on the computer screen shows the temperature inside the greenhouse. The blue line shows the humidity, the green line shows carbon dioxide, and the other blue line shows the saturation defict,[4] which indicates whether photosynthesis is taking place efficiently. The ideal greenhouse environment for growing cucumbers is a temperature of 25℃, a humidity of 75%, and a saturation deficit of 3–6 g/m^3.



Data on the environment inside the greenhouse is shown on a monitor.

Using this environment-control system, the project team manipulates the greenhouse climate to get as near to the optimum figures as possible. If it rains, the sensors operate according to the set rainfall and open and close the roof automatically. If the wind speed rises to 7 m/s or more, the windows can be set to close automatically. In addition, the important process of watering is done by an automatic watering device, and fertilizer management is carried out by the Dosatron (French-made) pump, which links with a pipe carrying water and supplies fertilizer automatically. If these systems of watering and fertilizer management are used, almost no elbow grease is required.

Remote control is possible, so theoretically, as long as you have a computer, you could do the work from overseas as well. “Workation” (a combination of “work” and “vacation”), which has been attracting a lot of attention of late as a new workstyle option, is possible too.

At present harvesting is done by temporary workers, but, in cooperation with MK Tech, the project team is currently developing a robot that can automatically sort and harvest the cucumbers using image recognition technology. Hashimoto hopes that through the introduction of IT, agriculture will take on a smart image, and more young

people will find employment in this field.

4. Saturation deficit: This is an indicator of how much more water vapor can be released into the air at a certain temperature and humidity. It shows the available capacity for water vapor (g) per one m^3 of air (g/m^3).

Left: The windows can be opened and closed by remote control too.
Right: Dosatron fertilizer-supplying machine

Regional vitalization through agriculture

This pioneering initiative has been reported on television and in newspapers, and Hashimoto has been invited to talk on the subject of "agriculture as a job" at junior high schools in Sukagawa. Apparently the project also has attracted attention among companies in other industries, which have come to inspect it with the idea of adding this field as one of their businesses. They have a variety of reasons. One maker, for example, said that it wanted to use this business as one means of employment for employees aged over 60, and the owner of a retail business was thinking of agriculture as one line of diversified management, because sales had fallen. Undoubtedly agriculture is an important industry that, whatever the age, is never going to disappear.

Left: Mr. Hashimoto talks about his ambitions for the future.
Right: Mr. Hashimoto is thinking of using this house in front of the greenhouse as a lodging for visitors.

Finally, I asked Hashimoto about his future ambitions. “At present,” he replied, “the greenhouse covers 1,300 m^2, but over the next five years I plan to expand the area to 10,000 m^2. In front of the greenhouse there is a house that staff use for their breaks. In the future, I am thinking of turning this house into a lodging for tourists, including travelers coming from overseas. I think increasing people-to-people exchange is important for regional vitalization. This work is a joy, so I intend to continue until I am 80 or even until the day I die. After all, agriculture is my true calling!”

Fukushima Seed Center
http://f-seed.co.jp/ (Japanese site only)