

**Department of Agriculture
Ministry of Agriculture and Marketing
Government of Maharashtra
India**

**Pilot Survey for Disseminating Small and
Medium Enterprises Technologies
for the Hydroponic Cultivation
of Horticultural Crops in India**

Summary Report

July 2016

JAPAN INTERNATIONAL COOPERATION AGENCY

GRA, Inc.

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Abbreviation

BOP	Base of the Economic Pyramid
EEC	Environmental Education Centre
ICA	The Institute of Cultural Affairs
MSHM	Maharashtra State Horticulture Mission
NPO	Non-Profit Organization
SME	Small and Medium sized enterprises
SPC	Special Purpose Corporation

1. Outline of the New Survey Scheme

JICA has started a new Survey scheme “Pilot Survey for Disseminating SME's Technologies”, which aims to verify the effectiveness of SME’s technologies in the developing countries and to enhance the development outcomes through dissemination of their Product.

JICA has been encouraging Japanese private companies to submit survey proposals for disseminating Japanese small and medium enterprise’s technologies to developing countries, thereafter, JICA employs proponents who submitted successful proposals to carry out the proposed surveys as a JICA Survey Team.

The summary of final survey report will be prepared by the Survey Team and handed over to the recipient Government. The Government can use it as basic material for (i) implementing a project by the recipient government, (ii) bidding for concession, and (iii) requesting JICA’s assistance for a project. And the Product which is expensed by JICA will be handed over properly to the recipient country.

2. Background and Necessity of the Survey

Yamamoto Town in the Miyagi prefecture had been flourished with its strawberry cultivation. However, Tsunami caused by Tohoku Big Quake destroyed 95% of strawberry farms in town. GRA, Inc. started to restore strawberry farming by the usage of hydroponic cultivation system because the soil was damaged by the salinization. GRA employed coco peat as strawberry’s new cultivation bed. One year later, GRA successfully achieved to cultivate high natural-sugar content strawberry.

These positive steps have encouraged GRA to aim at new markets overseas because they believe their hydroponic system could help farmers in other countries to increase their productivity and income. It also helps to strengthen the global competitive ability of Japanese agriculture system by exporting sweet and delicious Japanese strawberries.

In India, the experiment work of Japanese strawberry cultivation was successfully attained. It is found that Indian market is willing to accept Japanese strawberries because of its taste, size and high sugar content and Japanese strawberries have a great potential to be sold among emerging affluent consumers in India. Also this new cultivation system has a possibility to create job opportunity for women in farming areas. It can contribute to poverty eradication works in farming areas in India.

This project was implemented in a farming area near Pune City, Maharashtra State in India. Japanese strawberries have a possibility to raise income of farmers higher than ordinary crops because of its high yield capability in small farming spaces.

In this project, the cultivation process was remotely monitored in Japan by the usage of cloud system.

3. Survey Purpose

This project is related to JICA’s “BOP Business Promotion Survey” that started in 2012. The feasibility study of this BOP business program was implemented by NEC, GRA and ICA. ICA is a Japanese NPO that has been implementing agriculture development works together with local farmers in the suburb of Pune City.

The feasibility study was able to find a possibility to provide extra income for local farmers especially for women through cultivating and selling high-end strawberries in the Indian market.

It is of utmost importance to assist poverty stricken people in farming areas to improve their income, education, and health.

To achieve this, it is required to conduct a further feasibility study to pave the way for developing a year-round cultivation method, local equipments and marketing methods.

4. Target Area

GRA was to build two greenhouses for implementing this study.

A 1054m² greenhouse was constructed in the compound of the ICA's Environmental Education Center (EEC). It is located next to the greenhouse that has been built for the feasibility study of the "BOP Business Promotion Survey". The other greenhouse was to be built at Kamboli village, Mulshi district, 30 km west from Pune City. However, this plan was cancelled due to the security concern in the area.

Several women in Kamboli village who used to participate strawberry cultivation training courses at the ICA were hired to work for the strawberry cultivation work at the greenhouse in ICA's EEC.

Cultivated strawberries would be sold to five- star hotels in Pune and Mumbai. In this stage, six hotels have been requesting to purchase the products.

5. Target Group

As mentioned above, the purpose of this project is to provide extra income for rural farmers in Maharashtra state in India. At the above-mentioned BOP project, 30 women in Mulshi district have already participated in the strawberry cultivation training.

6. Information of Product/Technique to be provided

The following technique and equipments are provided to the facilities.

(1) Water Cooling Circulation System

This system can decrease the temperature in the greenhouse by 5 to 10 degrees. It has also a water recycling system not to waste water.

(2) Local Air Ventilated Cooling System Using Louvers

With the effective use of louvers, this system allows cold air to flow inside the greenhouse at a height of 90 cm above ground level. This technology can save energy and also maintain a consistent temperature around plants.

(3) Ultraviolet Transmission Plastic

To protect pollinizing bees, ultraviolet transmission plastic sheet, which is imported from Japan, is used as a covering material. This material also blocks out a sufficient amount of outdoor heat.

(4) Automatic Censor

Automatic sensors are set up at the greenhouse to provide required data via cloud system to GRA in Japan to monitor the interior climate.

(5) Ventilation Windows of the Greenhouse

To reduce the use of the electric fans and cut electricity bills, ventilation windows are attached on the roof and both sides of the greenhouse. These windows are opened during the evening to exhaust upper hot air.

(6) Crown Cooling System

To cool down the crown part of the strawberries, water tubes are laid on the surface of coco peats. Cold water is circulated in the tubes to maintain the temperature of the crown part low.

(7) Reverse Osmotic Membrane

To make sure the quality of water, it is found that the reverse osmotic membrane is the most effective for the improvement of water quality to compare with other filtering apparatuses.

(8) The Use of Natural Predators

During the survey, plant pests were found in the greenhouse. Those are diseases infected by viruses including mites, thrips, and powdery. To overcome these problems, a local agrimedical company is hired to implement a pest's control. Since pesticides may affect honey bees, natural predators are released inside the greenhouse and effectively control the plant pests.

(9) Double Decks

In order to increase the yield, a double-deck system for seedling beds is introduced. It is found that this increases the yield 1.5 times of a single stand.

7. Duration of the Survey

The duration of the survey is about 28 months from the first arrival of the Survey team in India, which is from March, 2014 to July, 2016.

Unfortunately, there was a considerable delay in conducting the survey mainly due to the following reasons:

- (1) Some strawberry seedlings were imported from Japan in 2014, but the Indian quarantine authorities did not release them for over 3 months. As a result, planting activities in 2014 had been delayed considerably.
- (2) The construction work of the greenhouse by local constructors was delayed for about two months.

8. Implementing Organization

Japanese Side: GRA, Inc, ICA Japan, ICA India

Indian Side: Agriculture Department, Government of Maharashtra.

The details of the above organizations are as follows:

(1) GRA, Inc.

It is established in January 17th, 2012 by Mr. Hiroki Iwasa. GRA's vision is "to establish 100

companies, and create 10,000 employees within ten years”. It is located in the southern part of the Miyagi prefecture and has three pillars as its activities, i.e. agriculture, education and cultural exchange. In its headquarters, 50 employees are working for various works including the brand-establishment works of “Migaki-Ichigo”. This is an agri-product from strawberries to boost and establish the local brand. In October 2014, Prime Minister Shinzo Abe visited GRA. After his visit, GRA’s products, including “Migaki-Ichigo” and “Migaki-Ichigo-Mousse”, were presented to world leaders who participated in the World Conference on Disaster Reduction held in Sendai City in March 2015.

(2) ICA Japan

The Institute of Cultural Affairs, Japan (ICA Japan) was established in Tokyo in October 1982 by Shizuyo Sato. It has implemented several developmental projects in the field of agriculture, education for children and women, environmental protection, and health in Africa, Asia, and South America. ICA Japan has also experiences in implementing a few projects in India. In Maharashtra, it has provided several villages in Mulshi district with irrigation facilities in cooperation with ICA India, which was financed by JICA.

(3) ICA India

ICA India is located in Talegaon of Pune district in Maharashtra state. Mr. Shankar Jadhav is the Executive Director. In partnership with ICA Japan, ICA India has been implementing development projects in the villages of Mulshi district for agriculture and women’s development. In 2015 it was awarded the Krushi Ratna Award, which is given to innovative farmers in Maharashtra.

(4) Department of Agriculture, Government of Maharashtra

The Horticulture Directorate of Department of Agriculture is in charge of horticulture in Maharashtra, looking after strawberry cultivation in the state. It is headed by the Director, supported by Joint Director. The Commissioner, Agriculture, who is located in Pune city, is the head of the department, who oversees agriculture in Maharashtra.

In Maharashtra, strawberry cultivation is assisted by Maharashtra State Horticulture Mission (MSHM) under the Department of Agriculture. Since most of strawberries in India are produced in the state, the role of MSHM is very important for promoting the hydroponic strawberry cultivation system.

The following Chart 1 shows the organization of implementing agencies.

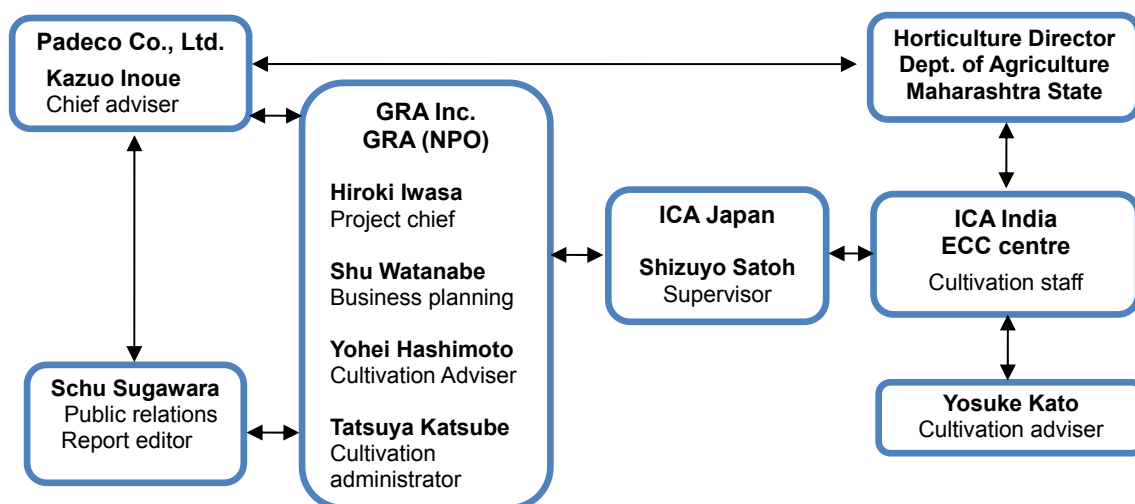


Chart 1: Organization Structure

9. Main Activities of GRA, Inc. under the Survey

The purposes of this project are as follows:

- To develop a greenhouse with required facilities for the hydroponic cultivation of Japanese strawberry in India.
- To test locally-available equipments and materials for the cultivation works in order to reduce the cost of hydroponic systems.
- To develop a viable business model of hydroponic strawberry cultivation with an aim to sell high-end Japanese strawberries to five-star hotels and wealthy Indian customers.
- To transfer the technology of the hydroponic cultivation to rural farmers who could employ the cultivation system in India.

The following main activities were conducted by GRA under the survey.

(1) To Set Up Hydroponic Cultivation Facility with the Latest Technology

Japanese strawberries, which are quite sensitive to heat, are cultivated in the greenhouse in the EEC. The temperature of inside the greenhouse is maintained below 25°C during the cultivation by the pad and fan cooling system. In addition, dry mist apparatus is introduced to cool down the air temperature during hot day time. At night ventilations windows are opened to exhaust hot air inside. The temperature of coco peat is also maintained below 25°C with the use of the crown cooling system, which circulates water in the tube. Hydroponic nutrients are given to plants automatically through tubes. In 2015 the cultivation was not so successful due to various reasons, but by learning many lessons and improving cultivation methods, the yield of 2016 is very successful, producing 81g of strawberries per plant, which compares with the yield of 43g in 2015.

(2) To Use Local Materials for Cultivation

Except for the ICT systems, all materials for building the greenhouse were obtained locally including Pad and Fan, Louver, irrigation equipment, nutrition infuser, crown cooling tube, multiple cultivation stand, and trays.

(3) To Market Japanese Strawberries in India

Since the cultivation cost of Japanese strawberries is quite high compared with local strawberries, the products will be sold to five-star hotels in major cities. In 2015/2016 the

Survey Team visited five-star hotels in Pune, Mumbai, Hyderabad and New Delhi to research the possibility of marketing Japanese strawberries. The team met procurement managers and executive chefs in each hotel. All of them liked the products and they were eager to purchase strawberries when they become available. In India, there are 160 five-star hotels and the number of five-star hotels may increase to 300 in the future. There would be sufficient market for Japanese strawberries in India.

For marketing the products, a catchy brand name will be very effective. It is decided to use “Ichigo Berry” as a brand name for marketing.

The government of India plans to deregulate the present restriction on foreign investment in large supermarkets. It is hoped that the branding would facilitate the sales of strawberries at these supermarkets.

(4) To Package and Transport Strawberries to Customers

Regarding product distribution works, the team asked the food sanitation authorities about the legal procedure of food packages. It is not required to obtain permission. However, a predetermined label should be pasted on the package of the products. The label should include product name, weight, lot number, name of the producer, and the address of the producer. To transport strawberries, cold boxes which were imported from Japan have been utilized to keep strawberries in good condition during transport. Similar cold boxes are also available in India. However, some materials including package cushions and transparent films are not available in India. Therefore, it is necessary to import those items from Japan for the time being. In India, the cold-chain transportation system is developing rapidly. In Mumbai, Kline Company is operating cold-chain delivery, and in Pune, Snowman Company is operating similar services. Therefore, there would be no problem to transport strawberries from farms to customers in big cities.

(5) Training of Local Farmers

Women workers from local villages have received the training in following area: the agriculture market, the use of equipments to increase the yield, the importance of sanitation, the importance of education opportunities for their children, and other changes that may improve the life of their families.

Mr. Yohei Hashimoto, who is a specialist in strawberry cultivation and vice President of GRA, visited India several times to conduct training for workers as well as to solve some problems including strawberry pests, the control of flowering, and the control of the sun-shine time. At the site, Mr. Yosuke Kato of GRA has stationed in India to look after cultivation activities in detail. In addition, all data was sent to GRA headquarters through digital devices in order to check the condition of strawberries every day.

One of the women workers had a surprising response to the team’s effort in encouraging women to work.

“This strawberry cultivation work gives us a kind of dignity. We don’t need to squat or kneel on the ground. We are able to do most of agricultural works while standing. This working style gives us pride and dignity. We are very lucky to be able to participate in this project. We realized that agriculture does not have to be miserable and difficult work.”

10. Progress Schedule

The progress of the survey, please refer to the following figure.

11. Implementation System

After the feasibility survey, the project should develop a viable business model for fulfilling the purposes of the survey. To develop this model in many areas of India for the purpose of creating farming jobs and to bring a higher income especially for women in villages, the most effective business model would be to separate cultivation entities and marketing entities (refer to Chart 2 below).

The cultivation entity would consist of villagers, agricultural corporate bodies, or agricultural companies. For the cultivation companies, GRA will assist the followings;

- (1) Assistance on business planning and greenhouse construction
- (2) Cultivation support
- (3) Purchase of the products

GRA will take initiative of the establishment of Special Purpose Corporation (SPC). To establish SPC, GRA forms consortiums together with local companies.

It will be difficult to sell strawberries directly from greenhouses that will be set up in villages. Therefore, SPC will play an important role in marketing the products.

To maximize productivity, each greenhouse needs local managers. To train local managers, SPC will use the facility of the EEC at ICA India. In addition, SPC will be able to collaborate with the Horticulture Training Centre near the EEC to conduct effective training programs.

The standard package of the cultivation business would be a 2,000 m² greenhouse. If the greenhouse contains a double-decker system, the estimated yield will be 9,600 kg. In this case, the business will break even after two years, and the payback of the initial investment costs will start after three years of the construction of the greenhouse.

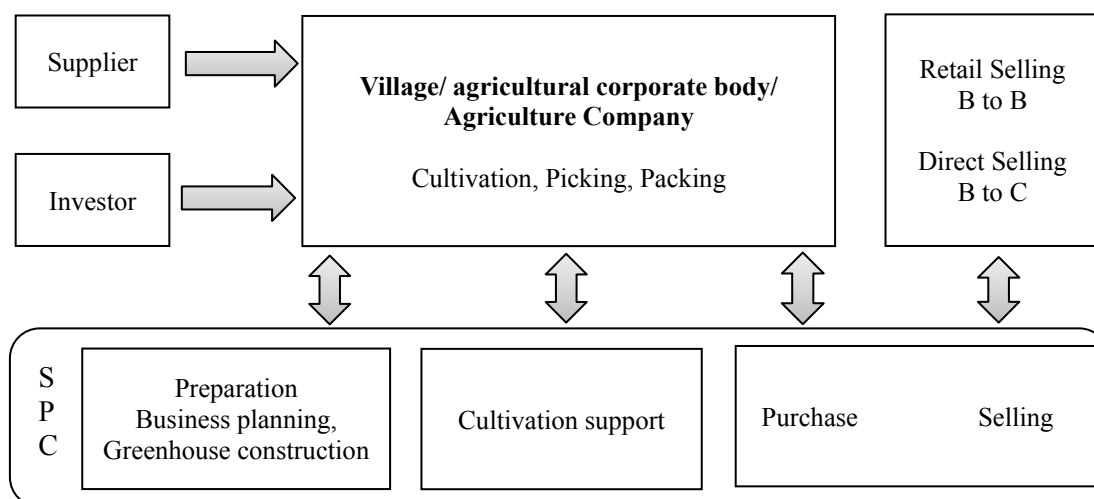


Chart 2: SPC Business Model