# Are current agricultural educational models suitable to meet global challenges? Case study: Japan

**Asanuma S.**

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# Are current agricultural educational models suitable to meet global challenges?
## Case study: Japan

**S. Asanuma**

International Cooperation Center for Agricultural Education, Nagoya University
Chikusa, Nagoya, 464-8601 (Japan)

**Abstract.** The farm workforce in Japan has decreased from 14 million to 2.6 million farmers over the last 50 years. Currently, older people (over 65 years) comprises of 60% of the total farm workforce in Japan. This is very high compared to the total population of Japan, where this age group represents about 20% of the population. Thus, food production in Japan may become threatened in near future unless the farming structure is changed or reorganized. In vocational high schools less than 15% of total students study agriculture, and at universities only 2.5% or 5% of all students study agriculture, at either undergraduate or postgraduate level, respectively. To promote the interest of young students in the actual conditions of agriculture, it might help exposing them to on-farm management and difficulties of farmers in their vicinity. This might help them to better understand real farming problems and their potential solutions. University teachers and researchers also need to acquire and maintain sufficient practical skill suitable for teaching a practical curriculum. Nagoya University started a capacity building program for undergraduate students providing overseas study tours, while the Japanese Government supports capacity building of graduate students and young researchers via the Science and Technology Research Partnership for Sustainable Development (SATREPS) program. These are new initiatives designed to encourage young people to study sciences to solve farming problems.

**Keywords.** Agriculture – Capacity development – Farming – Field study – Practical science – SATREPS.

***Les modèles éducatifs actuels relatifs à l'apprentissage de l'agriculture sont-ils adaptés aux challenges de la mondialisation ? Etude de cas : Le Japon***

***Résumé.*** *Le secteur agricole japonais a vu sa population décroitre de 14 millions à 2,6 millions au cours des 50 dernières années. Actuellement, 60% de cette population est âgée (plus de 65 ans) ; un taux très élevé si on le compare à celui de la population totale du Japon pour la même catégorie d'âge qui est d'un peu plus de 20%. Dès lors, le secteur agricole risque de faire face à de graves problèmes dans un futur très proche s'il ne change ou ne se réorganise pas. Seul 15% des lycéens présents dans les lycées techniques et professionnels suivent une formation aux métiers de l'agriculture, et au niveau universitaire ce sont seulement 2,5% et 5% respectivement qui participent aux programmes de premier et second cycle d'études agricoles. Exposer les jeunes étudiants aux réalités de la vie agricole et organiser des rencontres avec les agriculteurs pourrait être un moyen de susciter leur intérêt pour les sciences liées à l'agriculture et leur faire comprendre les problèmes à résoudre dans ce secteur. De même, les enseignants et les chercheurs doivent suivre une formation les mettant directement au contact du terrain qui leur permettra d'encore mieux éduquer leurs élèves. L'université de Nagoya a débuté un programme de formation des capacités destiné aux étudiants de premier cycle avec voyage d'étude dans différents pays étrangers et le gouvernement japonais apporte son soutien aux jeunes chercheurs et aux étudiants de second cycle à travers le programme de partenariat de recherches scientifiques et technologiques pour le développement durable (SATREPS). C'est ce genre de nouvelles initiatives qui incitera les jeunes générations à étudier directement au contact du terrain.*

***Mots-clés.*** *Agriculture – Développement des capacités – Travaux de ferme – Etude(s) au contact du terrain – Science pratique – SATREPS.*

# I – Introduction

Today, Japan is not an exception from the other most developed countries; fewer and fewer young people are interested in agricultural studies. In this report, I intend to clarify or explain the evolution of agricultural education figures in Japan and some attempts of Japanese universities to educate young students, aiming at the stimulation of those students to work in the agricultural sectors in some way in the future in order to assure the food security not just for Japan but also for the world. I will start with the overview of agricultural production and human workforce problems surrounding agriculture and vocational education of high schools of Japan.

# II – Overview of farm workforce and food production in Japan

## 1. Population and farm workforce

In the 1960s, over 14 million Japanese and about 6 million Japanese households (2.3 persons/household) were engaged in agriculture (Fig. 1). The workforce declined gradually to 2.6 million workers in 2.5 million households (1.0 persons/household) in 2010. The ratio of farm workforce to total population of Japan was 9.9% in 1970 and decreased to 2.6% in 2010 (Fig. 2). During that period, the total population of Japan increased gradually from about 105 million in 1970 to 124 million in 1990 and then slightly to 128 million in 2010 (Fig. 2). This means that less and less farmers have been engaged in agriculture in the past 40 years. Furthermore, Fig. 3 shows that the aging rate (percentage of people aged over 65 years old against total population) is less than about 20% in the whole country although it increased gradually from 7.1% in 1970 to 23% in 2010. On the contrary, for the farm workforce, the rate was over 50% in 2000 and increased gradually to 63.7% in 2014. The declining of farm workforce and its high aging rate is becoming a serious problem in Japan, and this trend will get worse in the near future.

## 2. Agricultural production and food-self sufficiency rate

In the 1960s the farmland area was about 6 million ha and it decreased to about 4.5 million ha in 2012 (Fig. 4). Gross agricultural product in Japanese yens reached the peak in 1985 – 11,630 billion yen – then decreased gradually towards 2010 and has been recovering a little thereafter. Food self-sufficiency rate in calorie-base which is the rate of domestic food calories/capita/day against total consumed food calories/capita/day, was 73% in 1965 in Japan but was decreasing gradually since then and became smaller than 40% in 2010 (Fig. 5). Japan imports a large amount of foodstuffs, for example, 88% and 93% of total consumption of wheat and soybean, respectively, was imported in 2013 and feedstuff such as maize is also imported largely. Food self-sufficiency rates of several developed countries such as Australia, France, Germany, Spain, UK and USA, are also shown in the Fig. 5 as a reference. Since the 1980s Japan's self-sufficiency rate has been the lowest of all of these countries.

# III – Agricultural higher education in Japan

## 1. High school

Agricultural education is a part of the vocational education at Japan's high schools. Farm technologies as well as theory are taught to students through practical work. Agronomy, horticulture, animal science, food science, agricultural environmental engineering, gardening and bio-engineering are curricula commonly taught at agricultural high schools (Hyogo Prefectural Agricultural High School, 2015). Graduates get jobs related to agriculture in some sense and some of them go for further education. The number of students studying at the vocational high schools has been de-

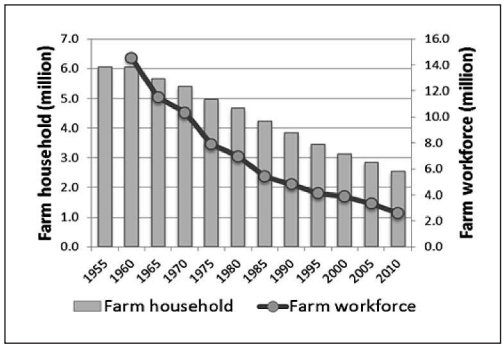


**Fig. 1. Farm workforce and farm households of Japan, 1955-2010.**

Source: Ministry of Agriculture, Forestry and Fisheries, Japan, Agricultural Census 1904-2010.

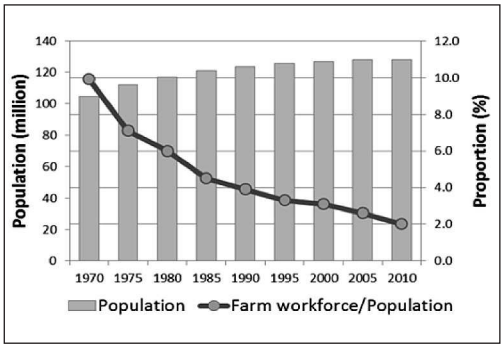


**Fig. 2. Population and farm workforce/population ratio of Japan, 1970-2010.**

Source: Ministry of Agriculture, Forestry and Fisheries, Japan, Agricultural Census 1904-2010 and State of Rural Area and Farm Villages 2011.

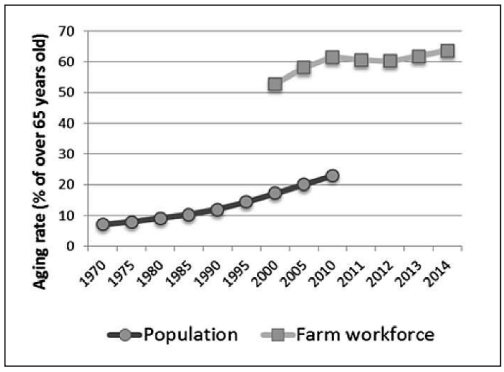


**Fig. 3. Proportion of aged people in population 1970-2010 and in farm workforce 2010-2014.**

Source: Ministry of Agriculture, Forestry and Fisheries, Japan, State of Rural Area and Farm Villages 2011 and Statistics of Farm Workforce 2014.

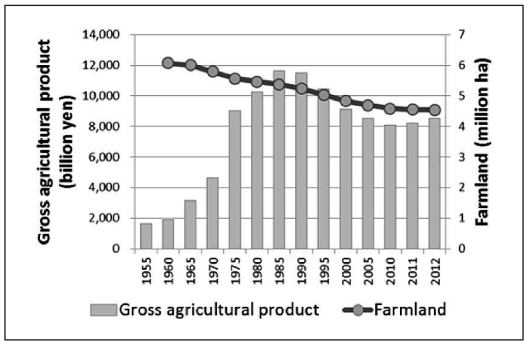


**Fig. 4. Farmland area and gross agricultural product, 1988-2012.**

Source: Ministry of Agriculture, Forestry and Fisheries, Japan, Statistics of Gross Agricultural Product 1955-2012 and Statistics of Farmland and Cultivated Area 1956-2012.

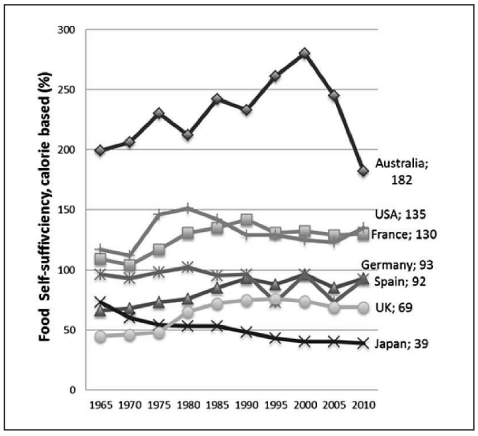


**Fig. 5. Food self-sufficiency rates of several developed countries, 1965-2010.**

Source: Ministry of Agriculture, Forestry and Fisheries, Japan, Food self-sufficiency rates of the world.

creasing in recent years and in 2014 just over 20% of the total students studied at vocational schools (Fig. 6). Most students prefer studying at the general or comprehensive high schools, hoping generally to go for higher education at the university, vocational college, etc. Agriculture is not a main course of vocational education; the ratios of students in agriculture, industry and commerce are about 13, 41 and 33%, respectively, of the total (Fig. 7). Figures 8 and 9 show the changes in number of high schools and their students, respectively, since 1955. It is surprising to note that the number of agricultural high schools (agriculture + fishery), decreased drastically from 1321 in 1960 to 353 in 2014 (73% decrease), whereas total number of high schools decreased to 7,227 in 2014, just about 18% less than that in 1960 (Fig. 8). The same tendency is observed in the number of high school students and the number of agriculture and fishery students which has stagnated at low levels, between 90,000 and 100,000, since 2005 (Fig. 9).

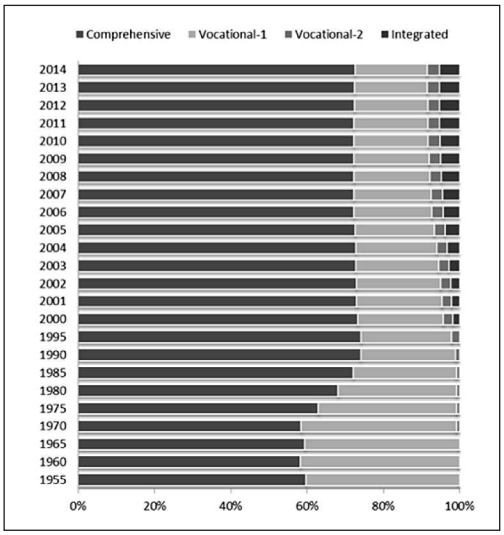


**Fig. 6. Education types of high schools in Japan, 1955-2014.**

Vocational 1: agriculture, engineering, commercial, fisheries, homemaking, nursery, information, welfare.

Vocational 2: science/mathematics, gymnastics, music, art, foreign languages, international relations, etc.

Source: Ministry of Education, Culture, Sports, Science and Technology, Japan, Basic Statistics of Schools 1948-2014.

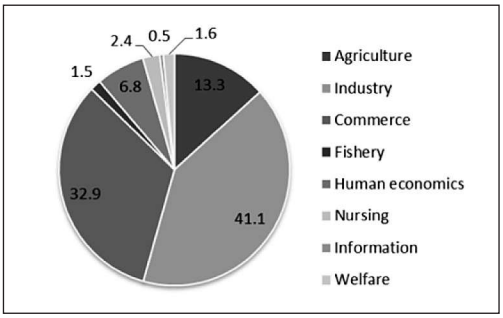


**Fig. 7. Students (%) in various vocational high schools in 2014.**

Source: Ministry of Education, Culture, Sports, Science and Technology, Japan, Basic Statistics of Schools 1948-2014.

## 2. Undergraduate and graduate university programs

The ratio of undergraduate students of agriculture declined from 4.5% in 1960 to 2.6% of all students today. The number of agricultural students is about 75,000 in these years out of a total of 2.9 million students at the university undergraduate programs (Fig. 10). On the other hand, in the recent years over 8,000 students study masters programmes on agriculture, and just below 4,000 follow agricultural doctorate programmes; this means only 5% of the total graduate students (Fig. 11). This increase in students ratio at the graduate school compared with that of the undergraduate school may be the result of universities' efforts. Around late 1980s to 90s, many national uni-

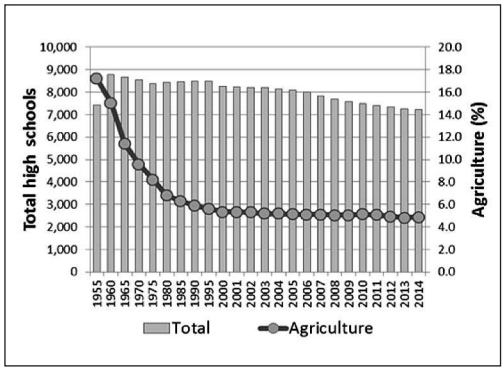


**Fig. 8. High school number and proportion of agricultural high schools, 1955-2014.**

Source: Ministry of Education, Culture, Sports, Science and Technology, Japan, Basic Statistics of Schools 1948-2014.

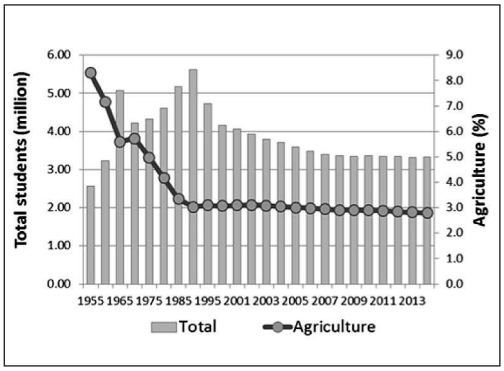


**Fig. 9. Total high school students and proportion of agriculture students, 1955-2014.**

Source: Ministry of Education, Culture, Sports, Science and Technology, Japan, Basic Statistics of Schools 1948-2014.

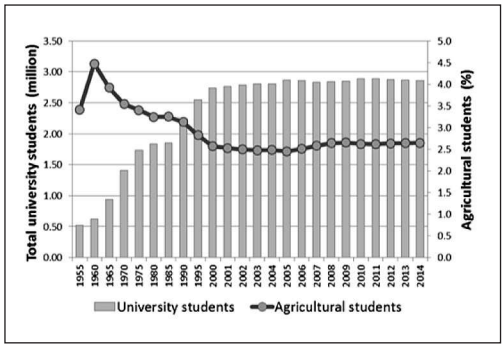


**Fig. 10. Total university students and proportion of agricultural students, 1955-2014.**

Source: Ministry of Education, Culture, Sports, Science and Technology, Japan, Basic Statistics of Schools 1948-2014.

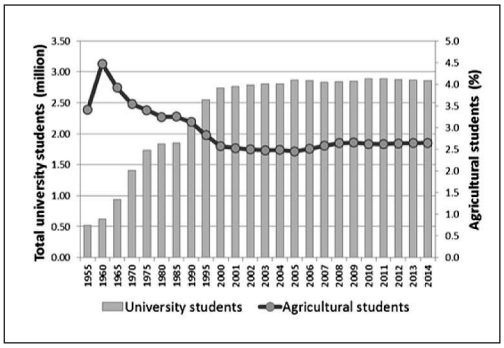


**Fig. 11. Agricultural graduate students and its proportions to total graduate students, 1955-2014.**

Source: Ministry of Education, Culture, Sports, Science and Technology, Japan, Basic Statistics of Schools 1948-2014.

versities changed their schools or faculties names from agriculture to agricultural science, applied biological science, life science, life and environmental science, bio-resources, bioagricultural science, bioenvironmental science, biosphere science, etc.; in a context a tendency of loss of interest in agriculture among high school students and decline in the number of children, this change probably intending to absorb more students by providing human society- and/or life-related sciences and rather basic science, more than an application in agriculture.

Nowadays, about 75% of agricultural graduates of Nagoya University go to the Master's program seeking for higher qualification for the job market (Fig. 12a). Only 14% of Master graduates go to doctorate programmes, while most of the others get jobs in the private or the public sectors (Fig. 12b). Doctor graduates, most likely PhD holders, start working as researchers at either private or public positions (Fig. 12c).

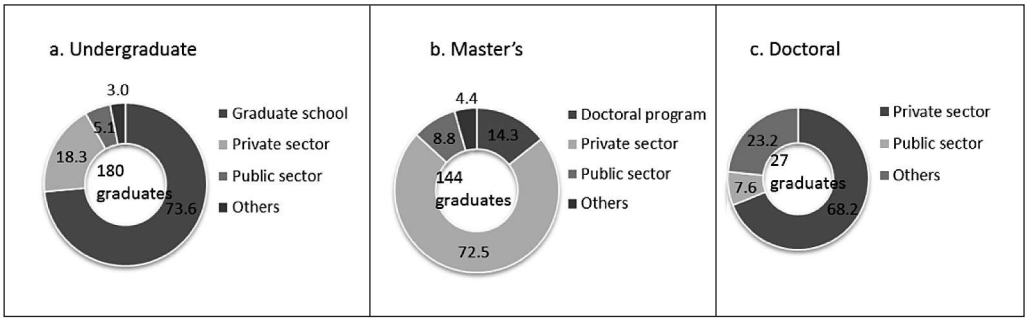


**Fig. 12. Various tracks for the graduates of agricultural undergraduate and graduate programs of Nagoya University (Percent (%) of means for 2005-2014) a. Undergraduate, b. Master's program and c. Doctoral program.**

Source: Graduate School of Bioagricultural Sciences, Nagoya University, 2015. Students Statistics 2005-2014.

## 3. Situation of present agricultural education at most universities in Japan

It is important to emphasize that a part of the education at the university is performed through conducting research. Therefore, the level or content of the research, basic science or practical science, will definitely influence the education. The word 'agriculture' has two meanings that are 'practice of farming' and 'science of farming' (Longman Advanced American Dictionary, 2000) or 'the science or art of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation of these products for man's use and their disposal (as by marketing) (Webster's New Collegiate Dictionary, 1979). Thus, agriculture is supposed to be a practical science led to the development of agricultural technologies and so it is expected to solve the practical farming and livestock problems, aiming to improve plant and animal performance and ultimately improve profitability and sustainability of the entire enterprise. It was true in the past but since considerably long time ago, agriculture has extended from practical science to rather basic science and nowadays more and more researchers of universities and agricultural research institutions, particularly in Japan as well as in other developed countries, tend to engage in basic science research. As a result, students will most likely be educated with the basic science of agriculture, which might be one of the reasons why students lose interests or could not intrigue interests in agricultural studies. However, students need to be exposed to the agricultural practices or actual conditions of farmers to understand the problems to be solved by research.

## 4. How can students have interests in agriculture?

First of all, students need to be exposed to the reality of agricultural production through farmers' field observation and interview or discussion with farmers and villagers so that they could understand the problems in agricultural production and village life and eventually the purpose of agricultural research as a practical science. Then, as a result, they could be expected to find interest in the study of agricultural.

However, in reality, at Nagoya University, laboratory techniques such as molecular, biological, chemical analysis, instrumental analysis and many other techniques commonly used in agricultural research are being taught presently. Some students are obliged to take a curriculum, farm practice (1 year) at the university farm, to learn field experiments to grow and take observations of rice, livestock and other crops. However, until very recently, they did not have a chance to go to farmers' fields to take observation of what is going on there and interview or discuss with farmers on their life

or problems of farming. There were not many teachers/researchers who had interests in such a curriculum as well. Consequently that subject was not included in the curriculum, and resulted in producing students being rich in analytical techniques and knowledge but having poor idea of agriculture in terms of food production, crop and livestock protection, soil fertility management and so on.

## IV – New approaches towards education of practical agricultural study

### 1. Overseas study tour of undergraduate students

Nagoya University started a new curriculum for the undergraduate students in 2009. Students visited the Royal University of Agriculture (RUA) of Cambodia and the Kasetsart University of Thailand, under the guidance of accompanying teachers/researchers who have long experience in working in the fields of education of those countries, and exchanged experiences with RUA and Kasetsart University students. They visited villages with teams of students of those countries for taking observations, interviews with farmers and made their own considerations after knowing the facts of farmers and farming. Even though the tour was not long, just about 10 days at first, it was a big surprise for the accompanying teachers/researchers to find students opening their eyes to agriculture and becoming more interested in the study of agriculture than before. We noticed that giving chances to Japanese students to be exposed to real agriculture and agricultural problems would be really helpful to drive students towards the agricultural study. This program has continued until now and more and more students are willing to participate recently.

In addition, since a few years ago, RUA and Kasetsart University students from Cambodia and Thailand, respectively, have started visiting Nagoya University and similarly villages and farmers in Japan, which means that the mutual student exchange has started. Nowadays, to attend and guide the students, more and more teachers/researchers are required and expected to make positive participation and to do that they need to train themselves first so that they are able to find problems and solutions in the fields, an important entry point to field science or practical science. Teachers first, then students will learn.

### 2. Education through the overseas research collaboration between Japan and developing countries: SATREPS

Agricultural technologies which are commonly and widely used in the developed countries may not always be adopted in the developing countries for various reasons. This means that agricultural productivity in those countries remain comparatively low despite the many technologies available in developed countries. That is to say, the potential in improving agricultural productivity and enhancing agricultural production is likely to be high in the developing countries in general if technologies are shared. Agricultural technology is locality-specific by its nature and so the development of new adaptive technologies in the locality or the adaptation of available technologies to that particular locality must be tested in the developing countries. The Japanese Government has been supporting the research collaboration between Japanese researchers and counterpart researchers of developing countries, aiming at solving the global scale problems such as bio-resources and its utilization, environment/energy, disaster prevention and mitigation and infectious diseases control. Through this program, human capacity development is highly expected, that is to educate young Japanese researchers as well as counterpart countries' researchers to solve the problems on the ground. The program is called the Science and Technology Research Partnership for Sustainable Development (SATREPS) the outline of which is as follows:

*SATREPS is a Japanese government program that promotes international joint research. The program is structured as a collaboration between the Japan Science and Technology Agency*

*(JST), which provides competitive research funds for science and technology projects, and the Japan International Cooperation Agency (JICA), which provides development assistance (ODA). Based on the needs of developing countries, the program aims to address global issues and lead to research outcomes of practical benefit to both local and global society*. *(http://www.jst.go.jp/global/english/index.html).*

## V – Towards human capacity development for meeting global challenges

To enhance food security not only of Japan but throughout the world, we must give priority to capacity development. To solve the problems requires knowledgeable people with passion and a clear sense of purpose. To do so, it is urgently needed to educate young students towards practical science of agriculture. For promoting and supporting such education, teachers/researchers of the university need to make efforts to promote interest in the field science and train themselves to find the problems and solutions by being exposed to agricultural fields in general but particularly in farmers' fields the first. Japan is now ready to support such education by promoting international research collaboration with developing countries.

## References


**Graduate School of Bioagricultural Sciences, Nagoya University, 2015.** Student Statistics 2005-2014. (Personal communication).

**Hyogo Prefectural Agricultural High School, 2015.** (http://www.hyogo-c.ed.jp/~kenno-ahs/), accessed on 1st May 2015. (in Japanese).

**Ministry of Agriculture, Forestry and Fisheries, Japan, 2011.**.Agricultural Census 1904-2010, (http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001047487&cycode=0), accessed on 1st May 2015 (in Japanese).

**Ministry of Agriculture, Forestry and Fisheries, Japan, 2011.** State of Rural Area and Farm Villages 2011. (http://www.maff.go.jp/j/wpaper/w_maff/h23_h/trend/part1/chap4/c4_2_01.html), accessed on 1st May 2015 (in Japanese).

**Ministry of Agriculture, Forestry and Fisheries, Japan, 2012.** Statistics of Gross Agricultural Product 1955-2012 (http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001040801&cycode=0), accessed on 1st May 2015 (in Japanese).

**Ministry of Agriculture, Forestry and Fisheries, Japan, 2012.** Statistics of Farmland and Cultivated Area 1956-2012. (http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001024925&cycode=0), accessed on 1st May 2015 (in Japanese).

**Ministry of Agriculture, Forestry and Fisheries, Japan, 2013.** *Food self-sufficiency rates of the world 1961-2013* (partially estimated) (http://www.maff.go.jp/j/zyukyu/zikyu_ritu/013.html), accessed on 1st May 2015 (in Japanese).

**Ministry of Agriculture, Forestry and Fisheries, Japan, 2014.** Statistics of Farm Workforce 2014. (http://www.maff.go.jp/j/tokei/sihyo/data/08.html), accessed on 1st May 2015 (in Japanese).

**Ministry of Education, Culture, Sports, Science and Technology, Japan, 2014.** Basic Statistics of Schools 1948-2014. (http://www.e-stat.go.jp/SG1/estat/NewList.do?tid=000001011528), accessed on 1st May 2015 (in Japanese).