

JIRCAS Newsletter

for

INTERNATIONAL COLLABORATION



JIRCAS Social Sciences Division in action

Clockwise from top left : in Mongolia, Burkina Faso, Bangladesh, and Cambodia

(Photos by A. Hirano, S. Uchida, and J. Furuya)

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Information Literacy: A Key Activity of the Social Sciences Division



Recent remarkable progress in Information and Communication Technology (ICT) has made it possible for almost everyone, even farmers in rural areas of African countries, to possess mobile phones or smartphones and have access to a wealth of information and in a variety of genres. Information obtained through ICT provides useful and timely data that can be applied to improve the management of agricultural resources. For example, farmers may determine the cropping calendar or optimal planting dates according to the weather forecast (if sufficiently accurate) and would be able to employ timely and effective countermeasures against crop damage. In reality, however, most farmers do not fully understand the meaning of information and adapt it to their specific places of interest. This is the reason why information is often disseminated for general purposes and not for resolving individual cases. Moreover, farmers normally have not been trained and are unaware of the value and impact of information literacy capability. Information literacy is a terminology defined as “the ability to know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand” by the United States National Forum on Information Literacy. Therefore, farmers who would like to utilize existing information through ICT to successfully attain their own objectives should be required to have enough information literacy skills.

Researchers belonging to the Social Sciences Division (SSD) of JIRCAS have been dealing with various types of information in their research. The activities of the division are largely categorized into three groups: the first group manipulates spatial data such as satellite remote sensing and geographical data, the second group analyzes mainly agricultural statistics data, and the third group explores household data by field survey. However, any data indicated above show qualitatively different characteristics compared with measurement data from physical or chemical experiments, which follow standardized procedures. These data, in other words, are contaminated with values that were indirectly measured and also values obtained by non-standardized methods. Therefore, when extracting essential information, researchers should be very careful about the quality and reliability

of each data source. Indeed, SSD members consider the level of information literacy as a key qualification factor in implementing research studies.

Under the present mid-term research plan of JIRCAS (FY2011-2015), SSD members have participated in seven projects, namely, “Development of agricultural technologies in developing countries to respond to climate change,” “Development of resilient agro-pastoral systems against the risks of extreme weather events in arid grasslands in Northeast Asia,” “Development of technologies for sustainable agricultural production in the African savanna,” “Development of rice production technologies in Africa,” “Evaluation and utilization of diverse genetic materials in tropical field crops,” “Establishment of sustainable and independent farm household economy in the rural areas of Indochina,” and “Design and evaluation of a recycling-based agricultural production system in upland farming areas of Northern China.” As can be recognized from the list of projects, SSD members’ research coverage includes areas with wide geographic and climate ranges, from tropical rainforests to near deserts in Asia and Africa, as well as some topics that focused on global issues. SSD members then carry out their individual research responsibilities, which are often a core part in identifying actual problems or in disseminating developed technologies under each project scheme.

This special issue of the newsletter introduces the activities of SSD, with each member describing major project results of specific subjects and showing their own philosophy of treating research information. It is hoped that our readers will come away with a better appreciation and understanding of each SSD member’s contribution to the completion and success of JIRCAS research projects after reviewing this special issue.

Satoshi Uchida
Director
Social Sciences Division

Land Use and Land Degradation Features Extracted Using Satellite Remote Sensing Data and Geographical Information

Satellite remote sensing data is a useful information source as it enables the detection of land surface conditions anywhere in the world without conducting field investigations. Additionally, it allows the examination of temporal changes in land conditions up to the present using archived data. In recent years, physical factors that characterize locational agricultural conditions such as topography, soil, and meteorological elements have been processed and converted into geo-referenced information in various scales, from local to global. This automated system of capturing and interpreting spatial and temporal data, among others, is called Geographic Information System (GIS), and this technology has become a key element in visualizing and analyzing JIRCAS research projects.

I joined JIRCAS before its reorganization from the former Tropical Agriculture Research Center (TARC), and I have consistently implemented research studies relating to land use and land degradation using remote sensing and geographical data. My major study sites were located in various parts of Asia and Africa including Pakistan, India, China, Indonesia, Philippines, Ghana, and Burkina Faso.

Researches on land use were mainly focused on the spatio-temporal characteristics of planted areas of staple crops using satellite data. One case was about winter wheat in Huang-Huai-Hai Plain of China. I developed a method of extracting the distribution of winter wheat from multi-temporal satellite data, which showed a remarkable decrease in planted area around year 2000 at the downstream side of Huang River. Another case in China was the distribution of paddy fields in Heilongjiang Province in the northeasternmost part of the country. Results showed that the distribution of paddy fields was concentrated along some tributaries of Songhua River and that it extended remarkably toward the eastern part of the province in year 2007. Unlike the case mentioned above, some areas located in the tropical humid climate zone showed complex rice cropping patterns consisting of mixed-state domains within a small range of temporal scales. Accordingly, I developed a new method of extracting paddy fields applicable to Java Island in Indonesia, which is representative of climate conditions in tropical humid regions. In the case of Java, I estimated the planted time of paddy rice (mesh resolution = 250 meters) over an 11-year period using high temporal resolution satellite data. Planted time of paddy suggests certain spatially specific correlation with rainfall pattern of the year. Consequently, the risk of flood and drought was estimated from this relationship as shown in Figure 1.

Researches on land degradation were mainly focused on soil erosion, i.e., the phenomenon of washing away or removing topsoil on sloping lands mainly through surface runoff caused by rainfall. There are a number of engineering techniques to control soil erosion; however, from a regional planning point of view, the location of high-priority areas must be indicated, especially areas with wide spatial ranges such as watersheds. Geo-spatial analysis employing GIS techniques and various sources of geographic information

is expected for this purpose. One example I have done was the case of a sloping area on the foot of mountains located in Java Island. Soil erosion hazard risk was correlated with land cover condition as well as other dominant factors such as rainfall and topography. In the study, land cover showing specific seasonal pattern according to land use was estimated using satellite remote sensing data. I also applied GIS analysis for Ghana and Burkina Faso in Africa. The objective was to produce a “zoning map” for identifying areas where common soil conservation technologies should be applied. The result is shown in Figure 2, where zone categories were defined by the cross relationship between length of crop growing period and risk of soil erosion.

Satoshi Uchida
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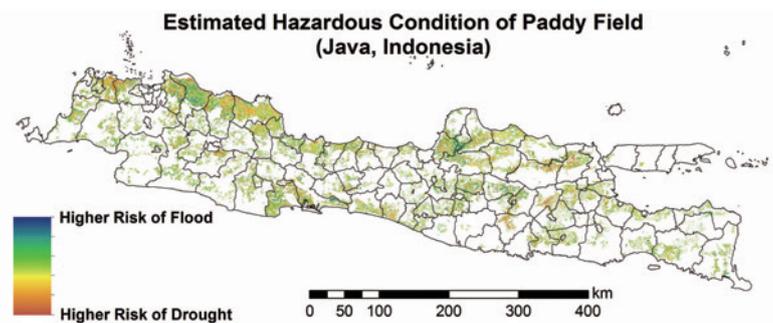


Fig. 1. Hazardous condition of paddy fields in Java, Indonesia, estimated from the relationship between rice planting time and rainfall pattern

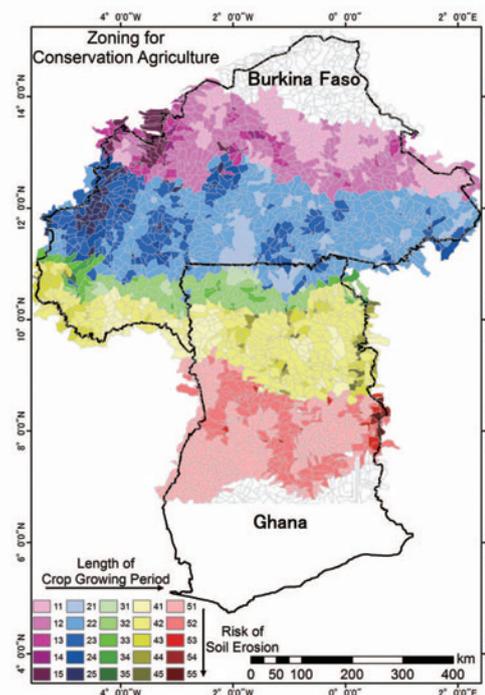


Fig. 2. Zoning map for disseminating soil conservation technologies for the semi-arid areas of Ghana and Burkina Faso

The Application of Geospatial Information Technologies to Promote Agricultural Research

Nearly everything that happens, happens somewhere—most likely somewhere on earth—and knowing where something happens can be very important. All “information” when associated with “location” in one way or another is considered “geospatial information.” It can simply be about the hamburger you just had for lunch at a restaurant across the street, or it can be about the tropical storm that has just formed near the equator. It can be about a photograph you just took with your smartphone which captured an image of your friend or scenery. Quite often such photographs record locations as well. Geospatial information can be just about anything. In agriculture, it can be about the yield from a specific plot, or the growing conditions of a vineyard. When properly used, geospatial information holds great potential to enhance our decision-making capabilities.

A geographic information system, commonly referred to as a GIS, is a collection of tools that enables us to handle all sorts of geospatial information effectively and efficiently. GIS is very powerful, but its usefulness is bounded by the availability of proper geospatial information being fed into the system. One of the most commonly faced challenges in many developing countries is the lack of reliable geospatial information. So, it is critically important to visit and observe the study area to collect reliable geospatial information and to gain insight into local issues on the ground. Geospatial data should be collected through intensive investigations of the study area; such data are usually associated with some coordinate system, like latitude and longitude using a global positioning system (GPS). Collecting a large number of geospatial data that cover an extensive area in a limited time can be challenging. This is where the science of remote sensing kicks in. Remote sensing is a unique technology that allows us to obtain information about objects or areas from a distance, typically from satellites, aircraft, or even from the much-talked-about drones. All these—GIS, GPS, and remote sensing—are collectively known as geospatial technologies, and they are the main tools I use for my research.

Currently, I am working on a project that aims to efficiently evaluate the distribution and availability of pasture resources in the vast grasslands of Mongolia. Nomadic animal husbandry has been practiced for thousands of years in Mongolia and still is a major component of its agriculture. Therefore, knowing where and how much pasture is on the ground is very important. Of course, the best way is to cut and measure pasture vegetation everywhere, but that can be very laborious and time-consuming. Studies have shown that multispectral remote sensing data—recorded by capturing different portion of wavelength (spectral bands)—can be processed

to obtain such information effectively. The challenge is that the relationship between multispectral data and the actual weight of vegetation is often site-specific and vegetation-type-specific. Consequently, it is critically important to actually visit the study area and conduct field investigations to establish a valid relationship. I collaborate with Mongolian counterpart researchers to achieve this (Figure 1). The end product is a map showing the distribution of pasture resources in summer (Figure 2). Since vegetation stops growing in late summer, this map lays the foundation of available pasture resources in the upcoming bitterly cold winter; it is like a practical pasture forecast. Finally, I cannot emphasize more on the importance of actually visiting and observing the study area to put the research findings into context.

Akira Hirano
Social Sciences Division

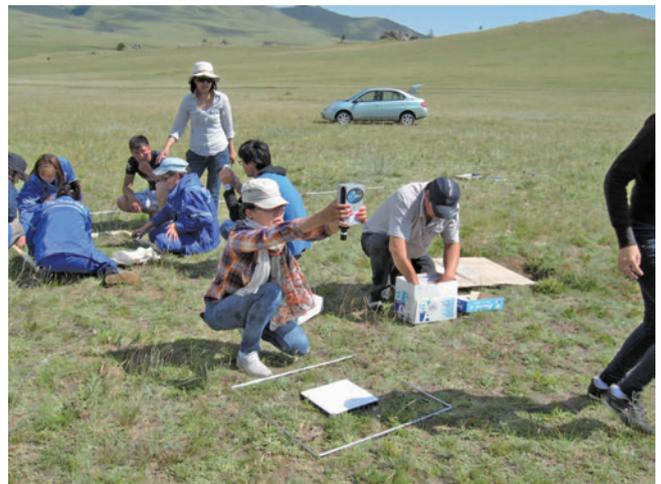


Fig. 1. Ground survey with Mongolian researchers

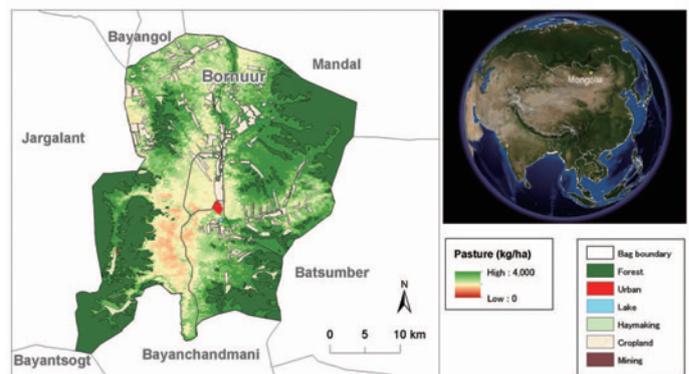


Fig. 2. Pasture distribution map of Bornuur District in Töv Province, Mongolia (Summer 2014)

Econometric Analysis of Impacts of Climate Change on Agriculture

While some people feel that boiling hot days and terrific downpours are increasing, others think that the earth will cool in the future. However, it is obvious that carbon dioxide (CO₂) concentrations have been increasing and that this general upward trend is the same everywhere in the world. In Japan, the increase in CO₂ level has been continuous, from 351.4 ppm in 1987 to 401.3 ppm in 2014. Even the CO₂ concentration in the southern hemisphere, where the concentration level is relatively low, has been increasing at a rate of approximately 1 ppm/year.

CO₂ is one of the major greenhouse gases and it may be argued that if CO₂ concentration increases, air temperature will also increase in the long run. When the weather changes during a year or over a longer duration, say 30 years, it could be a sign of climate change.

If CO₂ concentration rises, the rate of photosynthesis and subsequently, crop production (yield per acre), will also increase. Likewise, if temperature rises, crops in the low-temperature stage will grow well because cold-weather damage will decrease. However, if temperature exceeds the

optimum number, the nutrient will be absorbed back into the plant body and the yield will decrease. Figure 1 shows the relationship between temperature and yield of Indica rice as an example. This figure was drawn based on the output of a crop process model. Figure 2 indicates the impacts of higher temperature on maize production in the world in the 2040s using the yield trend function incorporated in the crop model. This figure declares that maize yields will decrease in low latitude countries, especially in Africa, and that the trend will be the same for rice, wheat, and soybeans.

In this case, how will the price of crops turn out? You know the results. If crop production decreases, the quantity put on the market will decrease and the rarity value will increase; therefore, the price of crops will rise, and if the price of goods increases, the consumers will have to decrease the purchase volume. However, food is necessary for daily life; therefore, a significant decrease in food consumption cannot be expected. Correspondingly, the food sellers will increase imports and ensure the supply of the goods. Furthermore, farmers will increase their production in response to the higher price, and they will expand the planted area in the next year resulting to an increase in the supply.

Econometric models, such as the world food model developed by economists together with crop scientists and meteorologists, reproduce movements in market supply and demand based on actual data. Invisible phenomena such as climate change affect the livelihoods of farmers and consumers, thus economic analysis using the world food model is very important.

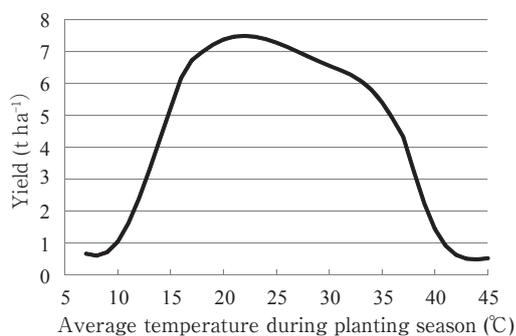


Fig. 1. Relationship between yield and temperature of Indica rice. (Figure refers to average climate data in India.)

Jun Furuya
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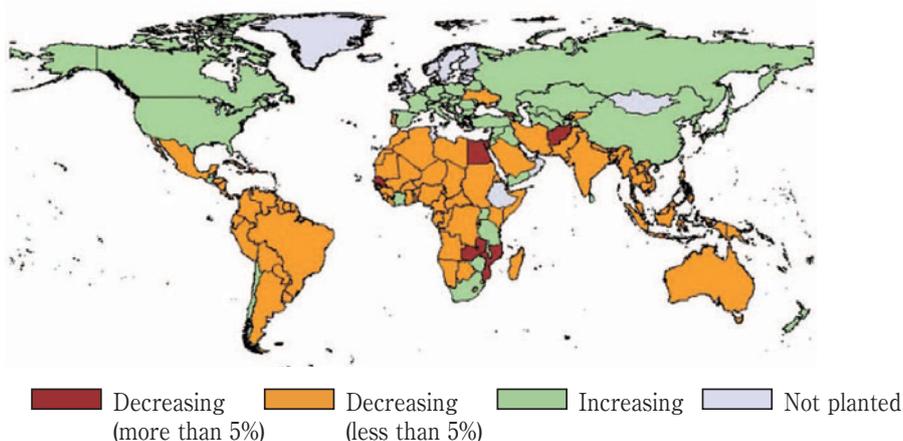


Fig. 2. Effects of climate change on maize yield. (Figure presents differences between RCP6.0 and baseline scenarios; climate variables fixed to 2010 level.)

A Study of a Technology Evaluation System to Support Research and Development

Impact projection or forecasting is one of the many important tasks of social scientists, though the task is not limited to social scientists. The ability to project the possible impacts of artificial or natural changes on an economy or society means that possible future problems can be detected and addressed. Technology evaluation or assessment is also an important task and is closely related to impact projection. Technology evaluation makes it possible to grasp the extent to which technology can improve a situation and to consider what kind of technology should be developed for possible future problems.

The importance of these interrelated tasks has been gradually recognized in coping with social problems such as those associated with environmental degradation. Impact projection and technology evaluation reflect important rules of thumb in environmental protection: the prevention principle and the precautionary principle. The former implies that social prevention cost is lower than social restoration cost. The latter implies that precaution against a problem with uncertain occurrence is reasonable if untold damage from the problem is projected.

A good example of use of these research tasks is the climate change problem. Global problems such as climate change take much time to prepare appropriate countermeasures. Accordingly, early impact projections and technology evaluations with long-term perspective are necessary to spare enough time for preparation. This need for a long-term perspective is a feature of global problems. One more important feature is the need for an interdisciplinary approach. The impact path from climate change to human society via agriculture and disaster encompasses many scientific fields. Accordingly, joint research activities under close cooperation among researchers from different scientific fields are necessary.

JIRCAS has been implementing a technology development project to respond to climate change, and we are currently working on impact projections. Our academic discipline is limited to positive economics using econometric models. However, climate change can be a research theme by jointly working with other researchers from different fields such as agricultural meteorology, geographical information, and crop science.

The outline of research methods so far is as follows: I. Developing econometric models of a region, a country, or an area including several countries; II. Assuming future climate scenarios; and III. Projecting climate change impacts on economies by changing the parameters of

agricultural productivities to be affected by climate change in an econometric model. In this process, we also conduct technology evaluation by incorporating a new technology in the model.

We expect our research achievements to be used as reference information for social decision-making and R&D strategy (Fig. 1). However, we have recently noticed that information from our achievements can also be used in another scenario. Many developers of agricultural and environmental technologies are very curious about the possible impacts of their new technologies on society. If we can supply the developers some information on the possible impacts of their new technologies, the information will facilitate consideration of appropriate technologies from a development perspective. Therefore, we have started a new endeavor to provide informative feedback to developers. The challenge includes two aspects: One is to set up a new framework of technology evaluation regarding how to collect information on respective technologies under development, how to evaluate many different technologies, and how to feedback the results. The other is to devise a method to evaluate a new technology that can produce multiple values. With this endeavor, we hope to develop a technology evaluation system that would support research and development in agricultural and environmental studies.

Shintaro Kobayashi
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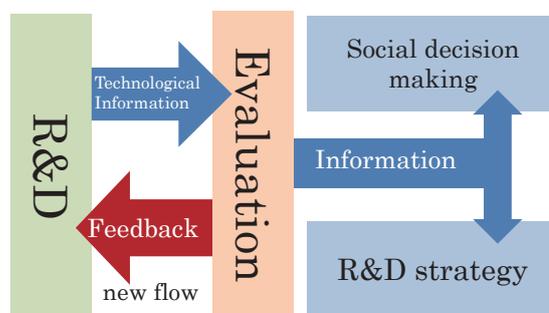


Fig. 1. Information provision based on technology evaluation

Empirical Studies on a Pastoral Economy in Asian Drylands

Agricultural and pastoral production in drylands is vulnerable to changes in weather conditions such as precipitation and temperature, making farm incomes unstable. In order to stabilize farmers' or herders' incomes and realize sustainable development in agriculture, technological and economic research on agriculture and pastoral production is essential. Drylands, especially Asian drylands stretching from Inner Mongolia in northern China to central Asia, are areas where accumulated research knowledge is lacking.

In 2006, JIRCAS formally started an interdisciplinary research project on the drylands of northeast Asia in collaboration with the Mongolian University of Life Sciences and the Inner Mongolia Agricultural University. During the first five-year phase, we investigated the sustainable utilization of grasslands in Mongolian forest steppe areas, where the vegetation is relatively stable.

In 2010, unusually heavy snowfall and low temperatures caused massive damage, stimulating further demands to study and build resilience against natural disasters (Photo 1). We responded by implementing a research project for natural disaster resilience in steppe areas starting in 2011. This project is an interdisciplinary study encompassing the fields of animal science, grassland science, pasture management, remote sensing, and economics. On the part related to economics, we investigated the factors that promote resilience and herders' adaptation to disaster risks. We conducted household surveys every year and made a panel data set. The data set was used in performing statistical analysis on the effects of household characteristics on disaster damage and recovery. It was probably the first econometric study of herders' management before and after the winter disaster in Mongolia. Needless to say, surveys that involve nomadic herders, who move every season, can be very time-consuming. If some data are missing, we cannot easily go back to the respondents to do a repeat or a follow-up survey. Therefore, in order to conduct efficient and accurate surveys, we introduced the computer-assisted personal interview method (Photo 2).

To date, we have evaluated various development policies from the perspective of herder households. We have also examined the effects of the land tenure system on herders' risk management by comparing the situations in Mongolia and Inner Mongolia. We are also studying the factors influencing herders' purchase of index-based livestock insurance in Mongolia, the country being one of the pioneers that introduced index-based insurance to nomadic herders.

Little is known about the long-term impacts of pastoral policies in Asian drylands. Some policies seem profitable

in the short run but may deteriorate pasture conditions and reduce profitability in the long run. It is difficult to know what kinds of policies are useful for achieving both sustainable pastureland use and herders' income growth in the long run because experiments are likewise difficult to undertake. To this end, we developed a system dynamics model that integrates aboveground biomass, animal weight, and livestock management. Remote sensing technology is also used in animal grazing experiments. The model enables long-run simulations for various policy scenarios and combines the outcomes from different disciplines. JIRCAS has an advantage on such studies that integrate various disciplines.

In terms of pastoral economies in Asia, many arguments and myths without scientific evidence have prevailed. Empirical studies based on proper data and statistical methods are required to design effective and efficient development programs.

Shunji Oniki
Social Sciences Division



Photo 1. Animal grazing in winter in Mongolia



Photo 2. A household survey inside a Mongolian ger

New Insights from Past Innovations: Lessons of Diffusion Research on SRI

Usually, only formally authorized package technologies that have been developed in universities or research institutes are put on a diffusion process funded by national governments or international institutions. These technologies guarantee that everyone gets almost the same result by practicing exactly as the manual instructs.

But such is not the case with the environmentally friendly and pro-poor rice cultivation method called System of Rice Intensification (SRI). SRI was developed through some 20 years of trial and error by Father Henri de Laulanié, a French priest who had a background in agronomy, and his collaborative farmers in the mid 1980's in Madagascar, a major rice producing country in Africa.

The principles of SRI are as follows: 1) sparse transplanting of a single young seedling, 2) intermittent irrigation, 3) reduced use of chemical fertilizer and pesticides, 4) applying large volumes of compost and 5) elaborate and frequent weeding. These are agro-ecological approaches focusing more on preparing healthy soil and water conditions to facilitate plant growth resulting in high yields.

SRI is not a package technology but a mixture of several practices according to farmers' production environments. However, how each technology component functions and which combinations of components are effective on what conditions are not clearly elucidated yet. Some innovative farmers have been trying SRI in small areas first, expanding little by little while confirming its effectiveness and mutually learning with neighbor farmers. These features of SRI, with farmers rather than researchers taking the initiative to construct appropriate technologies that best match individual paddy field conditions, make it unique.

SRI began to spread in Asian rice countries from the late 1990s, some ten years after it was developed in Madagascar. It is interesting to note that Madagascar rice cultivation is said to have originated from immigrants who came from Southeast Asia, and, thanks to the widespread adoption of "Green Revolution" technologies, rice cultivation practices became highly modernized in Asia rather than in Africa, where modern technologies are more or less bypassed.

To disseminate SRI effectively, it must be noted that the technology is location-specific and farming skill-dependent, hence it is important to target suitable areas and to train farmers so they can systematize the best mix and even innovate their own technologies. To examine the

characteristics of SRI training participants and the effects of the training, an interview survey was conducted in 2012 at Alaotra Mangoro Region, which is a major rice-producing area in Madagascar.

Statistical analysis showed that the SRI training participants tend to be old and highly educated, suggesting long experience in rice farming and the proper motivation to learn new things. Smaller farm sizes and short distances from their houses to the paddy fields allowed them to commute frequently to the fields to implement intensive farm operations. The more irrigated their farmlands are and the more farm machineries they own, enabling them to maintain appropriate field bunds and canals under good irrigation conditions, the more they participated in the training. Moreover, the training participants are more oriented toward rice farming than in growing other crops or raising farm animals, as indicated by the high ratio of paddy fields over total operational farmlands, the trend of renting fields in order to expand rice areas, and minimal livestock raising activities. Overall, farmers who participated in the SRI training were highly motivated, intellectually curious, and had favorable farming backgrounds to carry out agricultural operations in an accurate and timely manner. These findings suggest that they are highly skilled and productive by nature. Therefore, even if the rice yield of SRI trainees is higher than those of non-SRI trainees, such yield increase cannot necessarily be attributed to SRI training per se.

Thus, to elucidate the net effects of SRI training, the 'propensity score matching' method was applied to control the influences of the abovementioned characteristics of the participants. SRI trainees and non-SRI trainees were matched according to similar propensity scores, then the effects of SRI training participation were estimated. The results showed that the SRI training facilitated credit applications (for production purposes, increased fertilizer use, and more frequent weeding) and might have been responsible for the 2.89 t/ha increase in rice yield.

As a matter of fact, each of the component technologies of SRI is not new. Japanese farmers who have won in national rice farming competitions during 1949-69 were known to have employed technologies that are quite similar to SRI. Even earlier in the early 1900s, farmers in India, Myanmar, Sri Lanka, the Philippines, and Vietnam also practiced SRI-like technologies. Asian rice farmers in general tried hard to achieve efficient rice production despite limited resources. If so, where have these farmer knowledge and innovations gone? Indeed, thanks to

the “Green Revolution,” which started in the 1960s, the package technology with which anyone can achieve good yield by applying large amounts of chemical fertilizers and pesticides under irrigated conditions became widely disseminated. Green Revolution contributed much in solving food shortage at the time; however, it should not be denied that the standardization of technology also brought about the loss of diversity in local rice cultivation practices and of farmers’ indigenous knowledge.

The fact that an epoch-making technology such as SRI had been innovated in Madagascar was akin to a runner coming from one lap behind and leaping into the top position. It also provided important lessons to learn. During the 1960s-70s, when the popularity of Green Revolution technologies was high, there was little concern about the negative side of modern technology, such as water resource

constraints, environmental degradation caused by irrigation development, long-term effects of wide-spreading cultivars with low genetic diversity on local flora, emission of greenhouse gases from irrigated paddy fields, and threats to cultural heritage and traditional rice production systems, among others. These agro-ecological approaches were initially developed for resource-poor farmers who cannot afford modern inputs, and it turned out to become future-oriented technologies that promote resource-saving and environmentally sound methods. SRI appeals to farmers because it imparts historical and modern knowledge learned from the wisdom and ingenuity of local farmers who have lived and struggled under limited resource conditions.

Shigeki Yokoyama
Social Sciences Division



Rice terraces (Madagascar, November 2013)

China's Food Supply-Demand Issues that Affect the Global Market

Import liberalization of soybean started in 1995, and since then its import volume has been growing at an annual rate of 27%. At present (2014), China imports 71.4 million tons (Ministry of Commerce data), which accounts for 63% of the world total (Fig. 1). In contrast, domestic soybean production is shrinking, with cultivation areas declining since 2002 and domestic production in 2014 dropping to 12 million tons. Moreover, soybean's self-sufficiency rate has been declining dramatically from the initial rate of 100%+ when import liberalization started, all the way down to 15% in 2014 (USDA data). The rise in domestic demand is a factor in this sharp increase in import. Due to rapid economic growth since 1990, people's diet improved and has caused an increase in meat consumption, resulting to a high demand in cooking oil, especially vegetable oil, and feed meal ethers, which in turn caused the rise in soybean import.

Like soybean, import of other products has also increased. China became a net importer of agricultural products in 2004, and the increasing import volume has been impacting the world market's food prices and supply-demand balance. Especially in recent years, China, once an exporter of grains, has been importing over 2 million tons each for rice, wheat, and corn.

In 2014 (Fig. 2), China's grain import volume amounted to 7.98 million tons. The global market is watching its move as a stable domestic food market in China leads to a stable global market. Japan is understandably cautious about China's move because they have a number of competing items including soybean, corn, and wheat. China is regarded as a promising market for food exports because of its food import volume and the recent trend reflecting consumers' interest in safe and high quality products.

The biggest issue for China is the imbalance in the supply-demand relationship among grain products, which can be characterized by the following three points. Point 1 is the insufficient supply of food. Point 2 is the imbalance in the supply-demand structure or the regional gap in items. Point 3 is the incompetence in acquiring the minimum food required due to poverty.

The past research focused mainly on the first two points. It captured the fast movement and transformation of the Chinese market by applying economic analytic methods to determine the economic, social, and natural factors that caused the changes. For instance, it focused on the supply-demand and distribution structure of major food items like rice and corn, the changes in consumption patterns (in rice, soybean, dairy products, meat, etc.) due to the growth in economy, and the livestock raising and feed supply-demand trends. Regional supply-demand prospective analysis, which considered the effects of climate change and chemical fertilizer, was also conducted for rice and corn.

Furthermore, due to the fact that China is still an incomplete market economy, policy analysis was conducted

as well since agricultural policy heavily affects food production. Industrialization and urbanization progressed with economic development. However, with an insufficient area for agriculture and limited water resources, some of the basic conditions for agriculture like arable land and water resources were taken away, resulting to harder restriction on agricultural resources. This restriction in resources is a factor in the rise of food imports, but at the same time, it plays a key role in stabilizing domestic food production. Although economic reforms increased food production, it also caused an overuse of chemical fertilizer and pesticides. Therefore, as for the ongoing project, the focus is placed on clarifying the regional use of organic resources to reveal the trend that lies in the major food supply-demand structure. The aim of the study is to show the possibility of improving the economic conditions with an integrated policy approach towards sustainable food production.

Hsiaoping Chien
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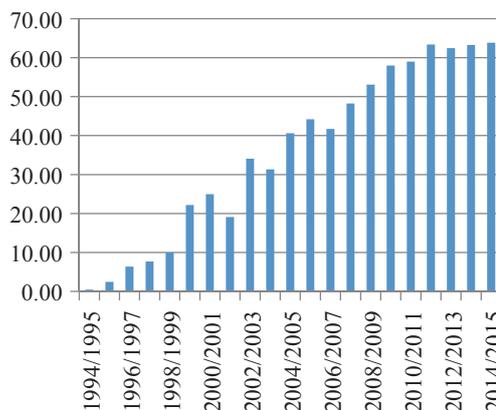


Fig. 1. Changes in China's share in world soybean import volume (%), USDA data)

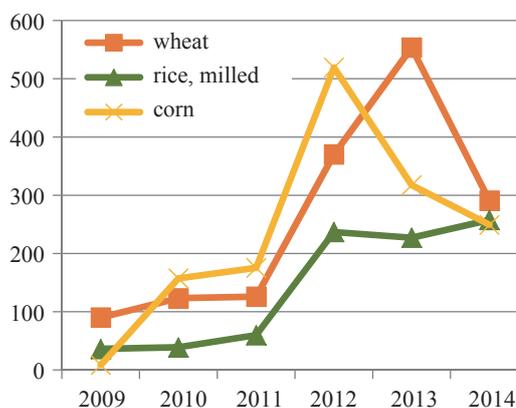


Fig. 2. Changes in China's grain import in recent years (10000MT, Agrotrade data, MOC)

Resource Circulation System Based on Farmers' Knowledge

We are currently conducting a joint study of a resource circulation system based on farmers' knowledge in China. Although participatory learning and action research (PLAR) is the commonly used approach in such studies, its main targets are stakeholders in development areas. In this study, ideas are sought from different areas or other sectors that have no direct relationships with stakeholders, and its feasibility is evaluated from the viewpoint of management before ideas are put into practice.

So far, we have carried out the following: One, we adopted an idea from a rice-producing area in Heilongjiang Province to improve alkali-saline soils, specifically, by cultivating alfalfa on alkali-saline soils and by intercepting capillarity rise using chaff as coarse layer. Two, we adopted an idea from the livestock and vegetable sectors in Inner Mongolia, specifically, the multi-functional organic vegetable cultivation system, which generates heat from cow dung.

In China, the demand for high quality and safe agricultural products is increasing as proven by organic vegetables being sold in Beijing at prices equal to or more than three times higher. However, transportation cost is high in remote production areas. In semi-arid regions such as Sunitayouqi, Inner Mongolia, where we set up our experimental station, farmers find it difficult to earn sufficient income because of restrictions on the use of water resources and harsh environmental conditions such as low temperatures and sandstorms in early spring and strong sunlight in mid-summer.

A multi-functional cultivation system that uses cow dung effectively can cope with multiple problems such as low temperatures and strong winds at seedling stage, thus decreasing production costs. Using this system, we determined that mini pumpkins not only gave much higher incomes than dent corn, it also conserved more irrigation water per unit area and prevented wind erosion. Mini pumpkins harvested under this cultivation system have a good reputation based on consumer surveys in Beijing.

Recently, we have found ways to lower the costs associated with the cultivation system and have also considered adopting the resource circulation system to cover a wide range of possibilities. The big initial investment required of the cultivation system (Fig. 1) was one factor inhibiting its widespread adoption; thus, an improved cultivation system (Fig. 2) was established. It consisted of another ridge with cow dung buried during ridging. Wild millet and soybean were planted in the furrows on both sides of the ridge, and irrigation tubes ran between this ridge and two other ridges, which were planted with mini pumpkins.

In the first year, millet was used as a gathering spot for natural enemy insects. It also served as a salt removal

plant and a shade plant. In the second year, mini pumpkins were planted on this ridge, and the dried millet was used as organic mulch for the mini pumpkins.

Compared to the system in Fig. 1, this "improved" cultivation system was inferior in terms of windbreak function, plus the seedlings and transplanting activities entailed additional costs. However, it reduced initial investment costs and avoided problems with using vinyl tarpaulins, which disintegrated under prolonged ultraviolet light exposure and were prone to being blown away by strong winds.

Regarding the adoption of the resource circulation system for use over wide areas, farmers in semi-arid regions demonstrated a labor-saving technique, dispersing organic materials in the form of floating sheep dungs into the paddy fields.

To sum up, our studies on resource circulation system have generated some interesting results; for example, we found out that there is a trade-off between putting farmers' ideas into practice and widening the target areas, as explained above.

Kazuo Nakamoto
Social Sciences Division

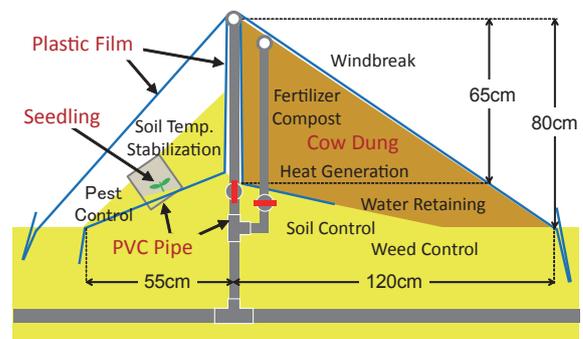


Fig. 1. Multi-functional vegetable cultivation system



Fig. 2. Improved lower-cost cultivation system

JIRCAS TODAY

○JIRCAS Visitors

*Vice Minister of Science and Technology, Vietnam

On 29 May 2015, Deputy Minister Tran Viet Thanh, together with four others from the Ministry of Science and Technology, Vietnam, visited JIRCAS.



A discussion of JIRCAS's research

After viewing JIRCAS's introduction video, the visitors were given a tour of the research facilities, including the biotechnology and shrimp aquaculture laboratories. Agricultural activities that reduce greenhouse gases in the Mekong Delta were introduced, and the project on the advanced application of local food resources in Asia was presented.

*Ambassador of the Republic of Benin to Japan and the ECOWAS delegation

On 18 June 2015, His Excellency Mr. Zomahoun D.C. Rufin, ambassador of the Republic of Benin to Japan, together with 10 others from seven member countries of the Economic Community of West African States (ECOWAS), visited JIRCAS.



With visitors from West African states

The visitors were shown the JIRCAS introduction video and given a quick summary of research activities under programs A and B (Environment & Natural Resource Management and Stable Food Production, respectively).

*Ambassador of the Federal Republic of Nigeria to Japan

On 1 July 2015, His Excellency Ambassador Godwin Nsude Agbo, together with four others from the Embassy of Nigeria in Japan, visited JIRCAS.



With visitors from the Nigerian Embassy

Ambassador Agbo and staff watched the JIRCAS introduction video. Afterwards, they were given an overview of research programs B and C (Stable Food Production and Rural Livelihood, respectively) and were shown the diorama exhibit at the first floor of the main building.

○Workshop on the JIRCAS Program C flagship project

On 4 June 2015, JIRCAS, together with the National Agriculture and Forestry Research Institute (NAFRI-Laos) and the National University of Laos (NUOL), conducted a workshop in Vientiane City, Lao PDR, on "The Establishment of a Sustainable and Independent Farm Household Economy in Lao PDR," a research that has been carried out since 2011 as the flagship project of JIRCAS's Program C (Rural Livelihood), encompassing agriculture, livestock, forestry, and fisheries.

Opening statements were delivered by Deputy Minister Phet

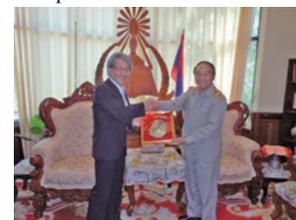
Phomphiphak of the Lao Ministry of Agriculture and Forestry (MAF), Minister Ryotaro Suzuki of the Embassy of Japan in Laos, Director General Bounthong Bouahom of NAFRI, Deputy Director Koeda Makimoto of JICA Laos, and President Masa Iwanaga of JIRCAS.

A large number of researchers from institutes under NAFRI and from the engineering and agriculture faculties of NUOL joined the workshop. The outcomes of the research during the past four years were announced, and the research challenges in agriculture, animal husbandry, forestry, and fisheries were discussed.

Furthermore, prior to the workshop, JIRCAS received certificates of appreciation from MAF and NUOL for spearheading the project.



Workshop participants



JIRCAS President Masa Iwanaga receives the certificates of appreciation from Vice Minister Phet Phomphiphak of the Lao Ministry of Agriculture and Forestry (left photo) and Vice President Lammai Phiphakhavong of the National University of Laos (right photo).

○Joint research agreement with IKE-Japan and KMUTT-Thailand

On 20 May 2015, JIRCAS concluded a joint research agreement with IHI Kankyo Engineering Co., Ltd. (IKE) and King Mongkut's University of Technology Thonburi (KMUTT) to promote the commercialization of biogas production technologies from agricultural wastes in Southeast Asia. The agreement was signed by JIRCAS President Masa Iwanaga, IKE President Masayuki Hagino, and KMUTT President Sakarindr Bhumiratana.

This research is expected to provide a more environmentally friendly energy supply option in the future, in contrast to the current system that relies heavily on fossil fuel.

○JIRCAS 6th in Japan for most number of journal citations in plant and animal science

Thomson Reuters, a US-based global information services company, recently published a study ranking JIRCAS in sixth place among Japanese institutes in terms of most number of journal citations in the field of plant and animal science. This achievement signifies major impact on subsequent research.

Journal papers authored by Japanese researchers are highly cited, mainly in the fields of materials science, chemistry, immunology, biology, biochemistry, physics, and plant and animal science. In the field of plant and animal science, JIRCAS placed high among Japanese organizations with its often cited papers in molecular biology, proving its dedication to doing cutting-edge research that will hopefully have great global impact in the future.