

Sustainable Agricultural System in Asia: Student Development Towards Global Standard

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Introduction

This paper presents highlights of the general discussion on Student Development Towards Global Standard, a subtopic under the theme of the Satellite Forum on *Sustainable Agricultural System in Asia* held on 21 June 2002 at Nagoya University, Japan. I wish to express my appreciation to Professor Tetsuko Watanabe and Professor Akira Yamauchi who served as assistant moderators in this session.

The satellite forum had two objectives: *first*, to discuss sustainable agricultural production systems and biotechnology in Asia, with special emphasis on research and resource development; and *second*, to document the contribution of Nagoya University in general, and the Graduate School of Bioagricultural Sciences in particular, in research and identification of sustainable agricultural production systems. We wanted to recognize and discuss the school's accomplishments in terms of international collaborative programs as it continues to find ways to establish an active international academic consortium.

The purpose of the general discussion was to learn and share various experiences and teachings on how to improve our education so that our graduates would play more important roles in the international community in the agricultural sciences or related fields. The general discussion was composed of three parts: *first*, a summary of the three sessions, including research achievements, their consequence in education in the field of sustainability in agricultural sciences, and the future direction of research and education in agriculture; *second*, an overview of the goals of the university in research and education for agricultural sustainability in view of the establishment of an academic consortium; and *third*, suggestions and recommendations for strengthening the human resources development programs in education and research in Japanese universities in general, and at the Nagoya University Graduate School of Bioagricultural Sciences, in particular.

Highlights of Discussion

As a backdrop of this discussion, I must state that our national university currently faces a drastic change to a parastatal institution. The Japan International Research Center for Agricultural Sciences (JIRCAS) is now under this category of institution. In view of this recent development, the Japanese universities face the challenge of how to further enhance their research and education programs in order to be globally competitive.

1) Achievements, consequences and future directions in research and education in sustainable agriculture

Professor Yamauchi presented a summary of the five paper presentations as follows:

In the cultivation of rainfed lowland rice, Dr. Shu Fukai stressed the importance of thoroughly characterizing the environment where crops are grown. He cited that among the several traits considered important for crop production is drought resistance. Research agenda has been totally different during the time of the Green Revolution when basic studies in laboratories can be directly applied to the field. But after that, there is a need for a paradigm shift. There is an urgent need to consider sustainability now that high-output studies have been conducted. Thus, in order to study sustainability, the accomplishments of different fields of science must be integrated toward the creation of a new science.

Dr. Jose R. Pardales Jr. highlighted the unlimited potential of root crops, a very neglected less economically important crop. He emphasized the prospects of root crops for use as food and industrial material. He mentioned that research on these crops must consider the social science aspects, including technology transfer from the researcher to the end user. He stressed that

extension workers, researchers, and students, are important components of the research that must be working together to help provide solutions to food security problems.

Dr. Sri Nugroho Marsoem emphasized the importance of forest management and the value of wood and non-wood forest products. Exploring the full potential of these forest resources for food and income while aiming for forest sustainability is a big challenge. One area that needs to be further enhanced is the linkage of agricultural production and forestry management. Efforts to introduce agro-forestry as an alternative to sustainable forest development have increased, although many institutions still put little attention to this field. Marsoem stressed that networking of educational institutions in Asia for stronger cooperation is surely a welcome initiative.

Dr. Inkee Paik gave a very good example of the application of basic science to practice. Plant scientists consider nitrogen phosphorous as a nutrient; however, in this case as presented by Dr. Paik, nitrogen phosphorous can be a pollutant. By controlling diets, nitrogen phosphorous can control or prevent a serious problem on pollution caused by animal and livestock production in relation to environmental issues.

Dr. Osamu Ito talked about farming system and management of technology under diverse agro-ecosystems. In his paper, he clearly showed that, in order to attain sustainability, there must be a science that covers the various disciplines of soil science, crop science, forestry, aquatic science, and animal science.

Based on the five paper presentations, Dr. Yamauchi concluded that there seemed to be an agreement on the importance of an interdisciplinary research in looking at the concerns for sustainable agriculture. And this would require not just the convening of soil scientists, crop scientists, breeders, and others to form a team of researchers but the creation of a new field of science that integrates all those fields of discipline. It is recognized that this is a difficult task because of the diverse academic backgrounds and experiences of the players involved; however, there is a need to start from the level of education, which requires the development of an integrated curriculum aimed at developing the mental faculty and skills of the student towards providing solutions to problems and concerns for sustainable agriculture in a more holistic point of view.

2) Goals of the university in research and education

Dr. Takabe summarized the next batch of paper presentations as follows:

Dr. Steven C. Huber shared his experience in producing a transgenic plant with an increased level of cartinine. Such an interesting work, he mentioned, shows that the university can truly function as an “architect of the new century” by assembling teams and providing the seed money to initiate programs and conduct fundamental research for applied problems that impact agriculture. So far, whether for the environment or to increase plant productivity, the focus of biotechnology is just on the gene level. Using the up-regulated gene, salt tolerant or more salt tolerant transgenic plants that make plant productivity a little bit higher than that of non-transgenic plant. Dr. Huber said that these achievements are partially successful, and pointed out that there must be more studies on protein levels and enzyme interferal localization in the enzyme degradation. He stressed that to fully understand the regulation of carbon metabolism, it is important to carry out efficient biotechnology.

Dr. Tatsuo Omata talked about the control of nitrogen uptake in a simulation and plant productivity. He mentioned problems caused by nitrates in the environment and in the plant body, which are becoming serious problems, even in Japan. Nitrates are used for agriculture, but extra nitrates are getting into drinking water and into the body. Nitrates converted to toxic nitrates are not good for health. Dr. Omata stressed the importance of finding ways on how to regulate the nitrate uptake system. He suggested two ways: one is to regulate the nitrate transporter gene, and the other is to just accumulate nitrates only in the root, not in the leaf, as in the case of the spinach. He said that spinach accumulates a lot of nitrates; therefore, eating spinach leaves in a salad might be dangerous. He emphasized the importance of basic research in order to successfully carry out genetic engineering.

In the field of food production and biotechnology for food production, Dr. Tsuneo Yamane presented interesting findings of the research on enzyme engineering of lipids. One of these findings is the effectiveness of phosphatidylserine, or PS for AAMI or age-associated memory impairment, which is wonderful news for middle and old-aged persons in the future.

Dr. Jeng-de Su discussed the protective role of

antioxidant compounds in oxidative stress, which occurs in the human body. He expressed that there may be a lot of new dietary antioxidants that can be found in the future and if the pathway to produce such antioxidants is clarified, this can be applied to biotechnology.

In Thailand, the general public has a positive attitude toward GMO (genetically modified organisms) based on the report of Dr. Tipvadee Attathom. Most of the Thais accept GMO since it is permitted. However, he saw the need to compare the toxicity of chemical pesticides to GMO and transgenic plants. This is also an issue in Japan where the people fear the effects of GMO on humans. This attitude might be partly due to the inability of the scientists to disseminate the right information about GMOs. Biotechnology is viewed as a very important and powerful tool for sustainable agricultural systems in Asia. Dr. Tipvadee expressed that there is a need to collaborate in this aspect.

3) Suggestions and recommendations for strengthening human resource development programs for sustainable agriculture

The papers in Session 3 mostly dealt with sharing of experiences of different institutions and presented suggestions and recommendations toward the strengthening of human resource development programs in education and research for sustainable agriculture.

Dr. Norihiro Tsukagoshi gave a perspective of the international collaboration for education and research at Nagoya University especially focused on the achievements of the Graduate School of Bioagricultural Sciences. He pointed out that one way to improve the educational learning experience is to create the conditions and provide opportunities for such experience in order to attract bright and competent students from both the developing and developed countries to come to Nagoya University to study. He noted the imbalance in the number of students from developing and developed countries and suggested an improvement of working conditions of staff who provide assistance in academic and foreign relations services in order to expedite and accommodate requests and monitoring of student programs.

Dr. Supat Attathom pointed out the university's role in developing technology in the advent of

globalization, which is providing newer conditions such as global standard, new rules on safety, ethics and the like. She discussed the relation between the development of technology and the development of science and stressed the importance of striking a good balance between the two. How to connect research and education in with the actual needs in developing countries poses a big challenge that need to be addressed.

Dr. Villareal talked about the role of SEAMEO SEARCA in human development in Southeast Asia. As he mentioned, SEARCA's experiences have proven that investment in human resource development is vital to the well-being of the agricultural sector. He pointed out the need for investment, not only in degree and training programs, but also in research and development, infrastructure, and information sharing.

Mr. Mosgoya shared the experiences and prospects of AICAD, whose mission is to foster south-south collaboration as supported by developed countries, such as Japan. He pointed out that south-south cooperation, as well as north-south cooperation, could provide an important role for human development, especially in low technology and in the building and spreading of a self-support sphere. He stressed the importance of establishing an effective farmer-researcher-extension linkage.

Mr. Sugino introduced new aspects of the new JIRCAS structure and activities, especially concerning human resource development cooperation with other organizations, including universities. Such information should provide directions on how national universities should revise or modify their activities, including cooperation with other institutions.

The culture of evaluation as exemplified in the evaluation system of ODA, according to Dr. Koichi Miyoshi, was introduced to Japan by other developed countries, such as the United States. He pointed out that external evaluation has an important function, such as providing management tools for creating and learning for all interested organizations. He also indicated that universities are expected to participate in these kinds of evaluation activities, and showed the achievements of evaluation activities in international work.

Dr. Tetsuo Matsumoto introduced the mission, functions and activities of ICCAE at Nagoya University, which is one of the core centers serving in the field of agricultural sciences, engineering,

research and education. He emphasized the important role that ICCAE has to play in research and education and encouraged the graduate schools and other interested institutions whose mandates are similar to those of ICCAE to collaborate with the Center for their activities. ICCAE continues to explore possible linkages with international institutions to promote international cooperation in agriculture. It pursues the strengthening of existing collaborations to efficiently and effectively carry out activities in Asian and African regions. The case study of ICCAE's ODA in Cambodia is an example of collaboration between ICCAE and JICA. SEARCA and ICCAE are now looking for collaboration in its project to assist the Royal University of Agriculture in Cambodia.

General Recommendations

After lengthy discussions and exchange of ideas during the open forum, the following were the general recommendations set forth by the participants in the forum:

1. It would be best for JICA to consider reclassifying or reengineering the evaluation and approval process in awarding grants for a project at the institution level and select only those that are ready to go into research to shorten the process and eliminate too much competition, sometimes for just a single grant. In this case, alumni groups or institutions that may be interested in conducting the research may have better chances of winning the grant.
2. Results of discussion in this forum should be considered when evaluating the present curriculum in the context of Asia.
3. Higher education institutions should take the following roles in the promotion of sustainable agriculture:
 - a. Continuously generate knowledge;
 - b. Develop and produce high-quality manpower at the undergraduate and graduate level, or in non-degree training programs equipped with the proper skills to undertake researches and projects that promote sustainable agriculture;
 - c. Continuously perform advocacy work on environment and natural resource conservation, seeing to it that the core philosophy is sustainable agriculture.
4. Higher education institutions should be able to assist weaker universities to gain the concept of sustainable agriculture and biological equilibrium through discourse of agriculture and related sciences in conferences, symposia, training programs and curriculum development projects.
5. The following strategies are recommended for adoption in strengthening agricultural R & D in Asia:
 - a. Forging of strategic alliances with partners for complementation of programs and activities;
 - b. Implementation of a sandwich program- a very important innovation in education;
 - c. Implementation of joint projects in as many areas as possible.
6. Institutions must remember three very important elements of collaboration:
 - a. Common interest to enrich the knowledge of staff;
 - b. Willingness to share resources;
 - c. A mechanism to stipulate such a relationship so that activities will succeed.
7. Since the environment that surrounds the university is becoming more complex, the following factors need to be considered:
 - a. The discipline issue, whether it is interdisciplinary issues, and academic versus practical issues;
 - b. The various roles of the public and the private sector, the non-state sector; the universities, research organizations, aid agencies, and other stakeholders.
 - c. The issue of globalization versus localization;
 - d. A concrete framework and system to set the direction of the University, which may consist of three things, namely: a network, a knowledge creation system, and a knowledge accumulation system.
 - e. Utilization of various resources in the creation of a new field of science
 - f. Management framework to consider any change in rules
8. Universities must provide activities that would

allow exposure of students to other countries and gain experience on how things are done in other countries. The example of Japanese students going to Thailand, and vice-versa for immersion in the farm or to do extension work in a community, and at the same time learn the culture of the people in the host country is good model. The spirit of collaboration can also be found in this model because of the sharing of resources as demonstrated by both host universities taking care of the living expenses of the students whenever it is their turn to host the foreign students.

9. In organizing conferences on topics pertaining to agriculture in Asia, organizers should see to it that a balance of views would be obtained by ensuring that participants come from different disciplines so there would be a better understanding of what Asia needs for the development of agriculture within the region.
10. It would be beneficial to developing countries if JICA, JIRCAS and other funding agencies in Japan could consider supporting researches and re-entry programs/projects of fellows who graduate from Japanese universities to be conducted when they go back to their respective countries. These researchers or re-entry programs should address problems confronting the home countries of the fellows. The reason why most developing countries suffer from brain drain of technical people is oftentimes because of the absence of opportunity for fellows to establish follow-up researches in their own countries because of financial constraints. As a result, most of them go to developed countries in order to pursue their research interests. Since Japan is a very powerful country in Asia, Japanese funding agencies may wish to consider supporting foreign student alumni of Japanese universities to establish research in respective countries.
11. To prepare the students to face the challenges of globalization, universities must come up with a program that would hone the skills of the Japanese as well as other Asian students, especially the research students, to learn to speak and write their research reports and thesis in English. It is advisable to do comprehensive literature search on related topics during the initial three months of the student's stay in a foreign university, thus exposing oneself to new findings while gradually learning to write his or her thoughts and ideas in English.
12. The establishment of academic and alumni societies in each country such as the one in Thailand would be a good strategy for both development and linkages.
13. The small farmers who comprise about 60% of total farm families in the world have been left out from the mainstream of the agricultural development process. Because these small farmers always practice the traditional farming, they are usually not interested to adopt the modern technology in farming because of lack of information on the benefits of modern technology, or they may lack the capital to apply new technologies in the farm. It is therefore recommended that information on new technologies be extended to the field level to educate the small farmers, and some development programs be made available for the benefit of these small farmers
14. There is an urgent need for a new integrated field of science that would provide the students and faculty the knowledge and skills for integrated agricultural development that can functionally link agriculture crop production and livestock industry, forestry, and other sciences. This new field of science should allow an interdisciplinary team to teach and do research on sustainable agricultural system grounded on the principles of sustainable agriculture development, as well as expose the students to practical experiences in sustainable agriculture in Asia.
15. Universities should encourage an academic exchange program that would allow students to do relevant research in their own countries on problems specific to their respective countries and their advisers to see how they are going about in their researches. The student exchange program implemented by University of Queensland in Australia, and the one by Kasetsart University, Thailand with Ethiopia are good examples. The faculty adviser also needs to see and monitor the research of the student, although local faculty supervisors are assigned.
16. It would be advantageous to the students

and university faculty if JIRCAS would disseminate information on the guidelines, procedures and requirements to enable the students to avail of opportunities to do visit or do research with the JIRCAS foreign scientists in the specific research sites of JIRCAS projects. In this way, students get exposed to problems associated with the different agricultural systems in different countries which could serve as very good inputs to the improvement of their own researches when they go back to their respective universities.

17. Since universities are one of the eligible institutions to participate in contract-based projects with JICA, Japanese universities are encouraged to avail of this opportunity by submitting proposals to JICA.
18. Universities can certainly play a role in providing the venue for scientists from different disciplines to work closely together, and for the training of students who have an appreciation for very fundamental and applied aspects of science.

Closing Statement

In his closing remarks, Dr. Shohei Yamaki stressed that the main questions and important points in relation to sustainability in agricultural science, the role of universities, and the future direction of education and research programs presented by the different resource persons and participants in the forum are valuable contributions that should be documented. The proceedings of the forum should be able to reflect all the points raised, the highlights of discussions, and recommendations made. This publication should be able to provide initially the direction towards organizing an academic consortium in the field of agricultural science. Dr. Yamaki expressed confidence that the universities, together with the students and faculty, will certainly play an important role in the international communities of agricultural science in the near future.

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