



University of Tsukuba  
筑波大学



# 国際農学ESD シンポジウム 2013

～ 持続可能な未来のための農学ESDの推進～

UNESCO-APEID

2013 INTERNATIONAL SYMPOSIUM ON AGRICULTURAL EDUCATION  
FOR SUSTAINABLE DEVELOPMENT

The Role of Universities in Promoting  
Agricultural Education for Sustainable Development

農学ESD推進における大学の役割

2013  
Nov.25 (Mon) ~ 29 (Fri)

University of Tsukuba 筑波大学

主催: Organizer

Agricultural and Forestry Research Center, University of Tsukuba 筑波大学農林技術センター

共催: Cosponsor

Graduate School of Life and Environmental Sciences, University of Tsukuba 筑波大学大学院生命環境科学研究科  
International Cooperative Education Program for Creation of a Harmonious Asian Community  
アジア共生社会を創成するための国際連携教育プログラム委員会  
JICA Tsukuba International Center (TBIC) 国際協力機構筑波国際センター

後援: Auspices

MEXT Ministry of Education, Culture, Sports, Science and Technology Japan 文部科学省  
Japan National Commission for UNESCO 日本ユネスコ国内委員会  
College of Agriculture, Ibaraki University 茨城大学農学部



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Date: November 25 (Mon.) to 29 (Fri.), 2013

Venue: University Hall, University of Tsukuba

Tennodai 1-1-1, Tsukuba-shi, Ibaraki-ken, Japan

Main Working Language: English

Organizers: Agricultural and Forestry Research Center, University of Tsukuba

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# Background

The Agricultural and Forestry Research Center of the University of Tsukuba has been nominated by UNESCO as an Associated Center of the Asia-Pacific Program of Educational Innovation for Development (APEID) in the field of vocational and technical education, and has organized the Tsukuba Asian Seminar on Agricultural Education (TASAE) annually since 1979.

TASAE has gained a good reputation as an international agricultural program under APEID through the timely theme for each term. The themes of TASAE for each term were as follows:

- 1979-1981     【 The second term of APEID 】  
    Agricultural Education at the Secondary Level in Asia
- 1982-1986     【 The third term of APEID 】  
    Strategies for Innovation of Agricultural Education in Asian Countries
- 1987-1991     【 The fourth term of APEID 】  
    Education and Research for Higher Agricultural Productivity Conserving Nature Agro-ecosystem in Asian and Pacific Countries
- 1992-1996     【 The fifth term of APEID 】  
    Education and Research for Sustainable Development of Agriculture and Conserving Nature and Agro-ecosystem in Asian and Pacific Countries
- 1997-2001     【 The sixth term of APEID 】  
    Innovative strategies for linking agricultural and environmental education in Asian and Pacific Countries for the 21st century
- 2002-2007     【 The seventh term of APEID 】  
    The utilization and conservation of the water resources for human survival, bioproduction and the environment considering sustainable development, and the role of agro-environmental education
- 2008-2013     【 The eighth term of APEID 】  
    Promotion of Ag-ESD for the Development of a Sustainable Future

The 2008 International Symposium on Agricultural Education for Sustainable Development (Ag-ESD Symposium 2008) succeeded TASAE and the first annual symposium in the eighth term of APEID was held at the University of Tsukuba in November 2008. The eighth term of APEID is sponsored in collaboration with the Japan National Commission for UNESCO, JICA, Ibaraki University and the International Cooperative Education Program for Creation of Harmonious Asian Countries. The aim of Ag-ESD is to promote reform and improve agricultural higher education, especially considering environmental problems from an international viewpoint.

The Ag-ESD Symposium 2009 entitled “Food Safety and Food Security in Agricultural ESD” was held from November 9th to 12th at the university as the second annual symposium. Eighteen participants were invited from 7 countries: Philippines, Thailand, Indonesia, India, Malawi, Nigeria and Japan.

The Ag-ESD Symposium 2010 was held from November 8th to 11th at the University of

Tsukuba and focused on “Secondary and Higher Education for Sustainable Development: Agriculture and the Environment ”. Fifteen participants from 8 countries: Philippines, Thailand, Indonesia, Afghanistan, Bangladesh, Malawi, Ghana and Japan. A special session was organized for participation of high school teachers from Philippines, Thailand, Indonesia and Japan.

The Ag-ESD Symposium 2011 was held from November 7th to 11th and focused on “Appropriate Use of Biodiversity in Agricultural ESD”. Twenty-one participants from 9 countries: Philippines, Thailand, Indonesia, Afghanistan, U.S.A, Ghana, Kenya, Malawi, and Japan.

The Ag-ESD Symposium 2012 was held from October 29th to November 2nd and focused on “Technological Innovations to Reduce Environmental Impacts in Agricultural Education for Sustainable Development”. Nineteen participants from 9 countries: Philippines, Thailand, Indonesia, Afghanistan, U.S.A, Ghana, Kenya, Laos and Japan.

## Theme and Objective

### 1) Theme

The Role of Universities in Promoting Agricultural Education for Sustainable Development

### 2) Objective

In the sixth year of the APEID 8th program term, we will focus on issues in the role of universities in promoting agricultural education for sustainable development.

## Outline of Schedule

Nov. 24 (Sun.)	Arrival at Narita Airport, Japan
25 (Mon.)	Registration, Opening Ceremony, Keynote Addresses Welcome Party
26 (Tue.)	Invited Lectures, Discussion with Students
27 (Wed.)	Invited Lectures, Poster Viewing Visit Agricultural and Forestry Research Center
28 (Thu.)	Poster Session, Awards Ceremony
29 (Fri.)	Young Researcher's Forum, Closing Ceremony
30 (Sat.)	Departure from Japan

## Accommodations

Nov.24 (Sun.)	ANA Crowne Plaza Hotel Narita (Phone) 0476-33-1311
Nov.25(Mon.) – 29 (Fri.)	University Hall Annex, University of Tsukuba (Phone) 029-853-2386

# Ag-ESD Symposium 2013 Program

Program of 2013 International Symposium on Agricultural Education for Sustainable Development

**November 24 (Sun.)** Arrival at Narita Airport [ ⇒ stay at ANA Crowne Plaza Hotel Narita ]

## **November 25 (Mon.)**

- 10:30 Leave ANA Crowne Plaza Hotel Narita for University of Tsukuba (UT)
- 12:00 Arrival at University Hall, UT
- 12:00-13:00 Lunch
- 13:15-13:30 Group Photograph
- 13:30-14:00 **Opening Ceremony** [ Special Conference Room, University Hall A ]  
Welcome Address
- Dr. Kyosuke NAGATA, President, University of Tsukuba
- Opening Address (1)
- Mr. Hiroaki MOTOMURA, Assistant Director-General for International Affairs,  
Ministry of Education, Culture, Sports, Science and Technology
- Opening Address (2)
- Dr. Atsushi TAJIMA, Director, Agricultural and Forestry Research Center (AFRC)  
(Associated Center of APEID) , University of Tsukuba  
【 \* Chairperson: Dr. DeMar TAYLOR 】
- 14:15-15:15 **Keynote Address**
- Dr. Noelle COCKETT, Utah State University
    - ◇ Topic: “Responsibilities of Being the Land Grant Institution in the State of Utah”
- 【 \* Chairperson: Dr. DeMar TAYLOR 】
- 15:15-16:15 **Keynote Address**
- Dr. Hiroshi GEMMA, Faculty of Life and Environmental Sciences,  
University of Tsukuba
    - ◇ Topic: “Our Experiences and Challenges in Proceeding of the Sustainable Rural Development Program as the Special Program in Master’s Course”
- 【 \* Chairperson: Dr. DeMar TAYLOR 】
- 16:15-17:00 **Registration and Orientation**
- 18:00-20:00 **Welcome Party** [ Restaurant Plaza, University Hall A ]



**November 26 (Tue.)**

- 09:20-09:40 **Address**
- Dr. Yoshihiko SEKOZAWA, Agricultural and Forestry Research Center (AFRC), University of Tsukuba
  - ◇ Topic: “Education for Sustainable Development in Agriculture at the University of Tsukuba”
  - 【 \* Chairperson: Dr. Ryozo NOGUCHI 】
- 09:40-10:20 **Invited Lecture (1)** [ Special Conference Room, University Hall A ]
- Dr. Tsuyoshi OKAYAMA, Ibaraki University
  - ◇ Topic: “Future Gardening System - Smart Garden -”
  - 【 \* Chairperson: Dr. Nakao NOMURA 】
- 10:20-11:00 **Invited Lecture (2)** [ Special Conference Room, University Hall A ]
- Dr. Nakao NOMURA, University of Tsukuba
  - ◇ Topic: “Activities for Global Education in the College of Agro-Biological Resource Sciences, University of Tsukuba”
  - 【 \* Chairperson: Internship Student 】
- 11:00-12:15 Break and Lunch ( Free )
- 12:15-13:30 **Discussion with Students** [Auditorium, University Hall A]
- Dr. Oscar B. ZAMORA, University of the Philippines, Los Baños
  - Dr. Buncha CHINNASRI, Kasetsart University
  - Dr. Kukuh MURTILAKSONO, Bogor Agricultural University
  - Dr. Noelle COCKETT, Utah State University
- 13:30-14:00 Break
- 14:00-14:40 **Invited Lecture (3)** [ Special Conference Room, University Hall A ]
- Ms. Kanjana KWANMUANG, Ministry of Agriculture and Cooperatives
  - ◇ Topic: “Farming Knowledge from Agricultural Training on Future Farms Investment Planning”
  - 【 \* Chairperson: Internship Student 】
- 14:40-15:20 **Invited Lecture (4)** [ Special Conference Room, University Hall A ]
- Mr. Kenneth K. KAGAI, Deputy Director Ministry of Agriculture, Livestock & Fisheries Transzoia County, Kenya
  - ◇ Topic: “Dissemination and Adoption of Normal and Nutritionally Enhanced Highland Maize Varieties in Transzoia County, Kenya”
  - 【 \* Chairperson: Internship Student 】
- 15:20-15:30 Break
- 15:30-16:10 **Invited Lecture (5)** [ Special Conference Room, University Hall A ]
- Ms. Mary W. NJINE, Ministry of Agriculture Mathira East Sub County
  - ◇ Topic: “Importance of Agriculture Training Centers in Promoting Sustainable Rural Development”
  - 【 \* Chairperson: Internship Student 】

**November 27 (Wed.)**

- 09:00-09:40 **Invited Lecture (6)** [Special Conference Room, University Hall A]  
• Dr. Kukuh MURTILAKSONO, Bogor Agricultural University  
◊ Topic: “The Role of Ag-ESD Program in Promoting Education for Sustainable Agriculture at Bogor Agriculture University, Indonesia”  
【 \* Chairperson: Dr. Ryozo NOGUCHI 】
- 09:40-10:20 **Invited Lecture (7)** [Special Conference Room, University Hall A]  
• Dr. Buncha CHINNASRI, Kasetsart University  
◊ Topic: “The Roles of Kasetsart University in Promoting Agricultural Education for Sustainable Development (Ag-ESD)”  
【 \* Chairperson: Dr. Kukuh MURTILAKSONO 】
- 10:20-10:30 Break
- 10:30-11:10 **Invited Lecture (8)** [Special Conference Room, University Hall A]  
• Dr. Oscar B. ZAMORA, University of the Philippines Los Baños  
◊ Topic: “Challenges and Opportunities for Sustainable Agriculture Education in the Philippines”  
【 \* Chairperson: Dr. Buncha CHINNASRI 】
- 11:10-11:50 **Invited Lecture (9)** [Special Conference Room, University Hall A]  
• Dr. Wakil A. SARHADI, Kabul University  
◊ Topic: “Study on Agricultural Education for Sustainable Development of Agriculture in Afghanistan”  
【 \* Chairperson: Dr. Oscar B. ZAMORA 】
- 12:00-13:00 Lunch (Box lunch) [Meeting Room No. 3, University Hall A]
- 13:00-13:50 Break and Poster Viewing [Lounge at 30<sup>th</sup> Anniversary Hall]
- 14:00-14:30 Leave University Hall A for Agricultural and Forestry Center (AFRC)
- 14:30-15:30 **Visit Agricultural and Forestry Research Center**  
• Explanation about AFRC • Tour of facilities, etc.
- 15:30-16:00 Leave AFRC for University Hall (Annex )
- 16:00 Arrival at University Hall (Annex )

**November 28 (Thu. )** 《 **Poster Session** 》 [Lounge at 30<sup>th</sup> Anniversary Hall]

- 09:00-12:00 **Poster Presentation**  
• Selected persons: Graduate students, etc.
- 12:00-13:00 Lunch ( Free )
- 13:00-15:00 **Poster Presentation**
- 15:00- **Awards Ceremony for Best Poster Presentation**



<b>November 29 (Fri.)</b>		<b>《 Young Researcher's Forum 》</b>	
09:00-09:30	<b>Presentation (1)</b>	[ Special Conference Room, University Hall A ]	
	• Mr. Yusuke TAKASHIMA, Ibaraki University		
	◇ Topic: “Conservation of Endangered “Lower” Plant in the Tropical Area. - A Study of Fungal Symbiosis with <i>Huperzia</i> spp. in Indonesia -”		
	【 * Chairperson: Mr. Kenji TAKISAWA 】		
09:30-10:00	<b>Presentation (2)</b>	[ Special Conference Room, University Hall A ]	
	• Mr. Prima J. OSLY, Bogor Agricultural University		
	◇ Topic: “Land Optimization of a Sugarcane Plantation (East Seram County)”		
	【 * Chairperson: Mr. Yusuke TAKASHIMA 】		
10:00-10:30	<b>Presentation (3)</b>	[ Special Conference Room, University Hall A ]	
	• Mr. Md. Samim H. MOLLA, Kasetsart University		
	◇ Topic: “Ameliorative and Detrimental Consequences of Nitrogen and Water on Maize Varieties under Short and Prolonged Drought”		
	【 * Chairperson: Mr. Prima J. OSLY 】		
10:30-10:40	Break		
10:40-11:10	<b>Presentation (4)</b>	[ Special Conference Room, University Hall A ]	
	• Ms. Joan Pauline P. TALUBO, University of the Philippines Los Baños		
	◇ Topic: “Sustainable Agriculture Production Systems for Food Security in a Changing Climate in Batanes, Philippines”		
	【 * Chairperson: Mr. Md. Samim H. MOLLA 】		
11:10-11:40	<b>Presentation (5)</b>	[ Special Conference Room, University Hall A ]	
	• Mr. Kenji TAKISAWA, University of Tsukuba		
	◇ Topic: “Overview of Biodiesel Production from Microalgae”		
	【 * Chairperson: Ms. Joan Pauline P. TALUBO 】		
11:40-13:00	Lunch and Break		
13:00-14:00	<b>Closing Ceremony</b>	[ Special Conference Room, University Hall A ]	
	( Includes Awards Ceremony for the Best Presentation )		
14:00-18:00	Free Time		
18:00-20:00	<b>Farewell Party</b>	[ Restaurant at Administration Center ]	
<b>November 30 (Sat.)</b>			
07:00-18:00	Departure from Japan		

# List of Participants

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## **【Welcome Address】**

**Kyosuke NAGATA**  
President  
University of Tsukuba

## **【Opening Address】**

**Hiroyuki MOTOMURA**  
Ministry of Education, Culture, Sports, Science and Culture

**Atsushi TAJIMA**  
Director, Agricultural and Forestry Research Center, University of Tsukuba

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## **【Keynote Address】**

**Keynote Speaker**      **Noelle COCKETT**  
Vice President, Utah State University

**Keynote Speaker**      **Hiroshi GEMMA**  
Emeritus Professor, Faculty of Life and Environmental Sciences, University of Tsukuba

## **【Address】**

**Speaker**                      **Yoshihiko SEKOZAWA**  
Assistant Professor, Agricultural and Forestry Research Center, University of Tsukuba

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## **【Invited Lecture】**

**Invited Lecturer**              **Oscar B. ZAMORA**  
Professor, University of the Philippines, Los Baños      **【Philippines】**

**Buncha CHINNASRI**  
Assistant Dean for International Affairs, Faculty of Agriculture  
Kasetsart University      **【Thailand】**

**Kukuh MURTIKUSONO**  
Professor, Bogor Agricultural University      **【Indonesia】**

**Wakil A. SARHADI**  
Professor, Kabul University      **【Afghanistan】**

**Nakao NOMURA**

Associate Professor, Faculty of Life and Environmental Sciences  
University of Tsukuba 【Japan】

**Tsuyoshi OKAYAMA**

Associate Professor, Agricultural Department  
Ibaraki University 【Japan】

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**Kanjana KWANMUANG < Graduate of University of Tsukuba SRD Course >**

Plan and Policy Analyst, Office of Agricultural Economics,  
Ministry of Agriculture and cooperatives 【Thailand】

**Kenneth K. KAGAI < Graduate of University of Tsukuba SRD Course >**

Deputy Director, Ministry of Agriculture, Livestock & Fisheries Transzoia County,  
Kenya 【Kenya】

**Mary W. NJINE < Graduate of University of Tsukuba SRD Course >**

District Agricultural Officer, Ministry of Agriculture, Karatina, Kenya 【Kenya】

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**【Young Researcher's Forum】**

**Presenter**

**Yusuke TAKASHIMA**

Master Degree Student  
Graduate School of Agriculture  
Ibaraki University 【Japan】

**Prima J. OSLY**

Doctoral Student  
Graduate School, Bogor Agricultural University 【Indonesia】

**Md. Samim H. MOLLA**

Doctoral Student, Tropical Agriculture  
Department of Agronomy, Faculty of Agriculture  
Kasetsart University 【Thailand】

**Joan Pauline P. TALUBO**

Assistant Professor  
Department of Community and Environmental Resource Planning, College of Human Ecology  
University of the Philippines, Los Baños 【Philippines】

**Kenji TAKISAWA**

Doctoral Student

Graduate School of Life and Environmental Sciences

University of Tsukuba 【Japan】

**Summaries**  
**for Keynote Address,  
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# Contributors

## **【Keynote Address】**

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[ Invited Lecturers from the Universities sharing Academic Exchange Agreements  
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- **Kukuh MURTIKUSONO** < *Bogor Agricultural University* >  
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**Dr. Noelle E. COCKETT**

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## **Responsibilities of Being the Land Grant Institution for the State of Utah**

In 1862, Abraham Lincoln, the 16th President of the United States (US), signed the Morrill Act, which created the US land grant institution system. Under this act, at least 30,000 acres of federal land was awarded to each state to support public institutions of post-secondary education. Revenue from the land was used to establish and support the institutions so that tuition would not be out of reach of the “industrial classes”. The Hatch Act, passed in 1887, established the Agricultural Experiment Stations (AES) within the land grant institutions and currently supports research in agricultural-related areas as well as rural community development. The Smith Lever Act, passed in 1914, mandated outreach to the public through Cooperative Extension, another component of the land grant institutions. Both state and federal funding supports the AES and Extension programs across the system of land grant institution. The ratio of state to federal funding for these two programs ranges from 95:5 in California to 5:95 in Guam.

Today’s land grant institutions reach far beyond their original mandates of education in “agriculture and mechanical arts”. However, a common theme for the land grant institutions is the application of basic research supported by AES that contribute solutions to state-wide issues. In addition, Cooperative Extension has established a deliver system of research based information to inform the public in each state. In contrast to extension in other countries, Cooperative Extension is not involved in policing state or federal regulations and programs are delivered free or on a cost-recovery basis.

The Utah Agricultural Experiment Station (UAES) supports faculty at Utah State University through salary, operating funds, student stipends, grants for travel, equipment and research projects, access to livestock and agronomic farms, and analytic and molecular laboratories. Faculty supported by UAES are encouraged to convey research outputs to the public, including federal and state agencies, with an emphasis on measurable outcomes. Around 140 USU faculty members with Extension assignments are housed in 13 academic departments and in 29 offices located across Utah. Extension programs cover a wide range of topics, from traditional programs in agronomy, livestock production and horticulture to family finance, nutritional information and youth leadership. Examples of recently developed programs include Master Gardeners, Power Pay (a debt reduction program), Stepfamily Relationships, and 4-H robotics clubs. While rural communities understand the outreach mission of Extension, reaching audiences in urban communities has been challenging. Use of social media has increased awareness of the quality programs delivered by Extension faculty. It is essential that Cooperative Extension evolves over time in both programming and delivery modes in order to address public needs.



**Dr. Hiroshi GEMMA**

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Faculty of Life and Environmental Sciences  
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Specialty: Pomology, Postharvest Physiology

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## **Our Experiences and Challenges in Proceeding of the Sustainable Rural Development Program as the Special Program in Master's Course**

Ms. Malala Yousafzai known as teenage girl shot calamitously on her way home from school in 2012 by Taliban in Pakistan stated the following message toward all the young people in the world at U.N. “We will continue our journey to our destination of peace and education” then “Our words can change the whole world” attracting the biggest number of audience, and eventually concluded as “Our books and our pens, they are our most powerful weapons”. On the basis of the same principal, we, the faculty members under the agricultural science related institutes, set up the Sustainable Rural Development program as a special program in master's course aiming at fostering a leader for rural area development in 2006. With previous reflection on international collaboration in developing countries, the manner of participatory approach has been adopted instead of technology transfer methodology. Moreover, we thought a novel approach which could get over this idea on rural area development practically and holistically, or post participatory approach. For the objective above, the program was provided practical and theoretical training at graduate level in relation to stable food production and supply, and alleviation of poverty in the participant's own country under the collaboration between our university and JICA ( the Japan International Cooperation Agency) as a special 14-month course. The participants of this training program were requested as follows; 1. earning of 30 credits of the university, 2. approval of technical report by the university, 3. submission of approved job implementation plan authorized by his/her organization, 4. accomplishment of other necessary tasks of the training program, and 5. good attitude and participation in the training program. We also had many constraints such as language barrier in order to create the subjects which comprised four categories: basic, preparatory, depth and selective matters in English. Under our own efforts, these constraints had been resolved and all the subjects are still continued in the G30 program even though the SRD course ended in 2012. From view point of internationalization, the commencement of this program brought about the cue for the faculty member. Our experiences and challenges on the last seven years will be introduced as a case of implementation on the role of university for ESD action.



**Yoshihiko SEKOZAWA**

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Specialty: Pomology

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## **Education for Sustainable Development in Agriculture at the University of Tsukuba**

The Agricultural and Forestry Research Center of the University of Tsukuba (AFRC-UT) has developed a number of international programs to improve agricultural education. As an Associated Center of the Asia-Pacific Program of Educational Innovative Development (APEID) nominated by the United Nations Educational, Scientific and Cultural Organization (UNESCO), AFRC-UT annually sponsored the Tsukuba Asian Seminar on Agricultural Education (TASAE) since 1979. TASAE has brought together more than 250 scientists and administrators from Asian countries for discussions on various agricultural, educational and environmental conservation issues facing the Asia-Pacific region. From 2008, the International Symposium on Agricultural Education for Sustainable Development (Ag-ESD Symposium 2008) succeeded TASAE. The aim of Ag-ESD is to promote reform and improve agricultural higher education, while considering environmental problems from an international viewpoint. In addition, a one credit Ag-ESD internship course is offered to graduate students so they can experience international programs. Another key factor to sustainable development of agriculture and education is effective dissemination of information between researchers and scientists. Therefore, AFRC-UT publishes the *Journal of Developments in Sustainable Agriculture* (JDSA). JDSA, a J-Stage based on-line journal, is an excellent medium for distribution of information on sustainable agriculture because it can be freely accessed from anywhere in the world.

The AFRC-UT has also participated in a new graduate program in Agricultural Education for Sustainable Rural Development (SRD) established in the Graduate School of Life and Environmental Sciences in collaboration with Japan International Cooperation Agency (JICA) since April 2006. This graduate program provides practical technical training relevant to sustainable food production and supply, and alleviation of poverty to regional agricultural extension agents and administrators in Asian and African countries. Graduates from this program can contribute to the alleviation of poverty in rural areas of their home countries. In addition, from September 2011, AFRC-UT began a new short stay “Farm Training Program” for undergraduate students from Kasetsart University (Thailand), Utah State University (USA), University of the Philippines Los Baños (Philippines) and Bogor Agricultural University (Indonesia) to receive training and technical experiences in Japanese field management and production systems for a period of several months.

Through the above and other programs, the AFRC-UT emphasizes internationalization of education for the development of sustainable agriculture as a major goal of the center.



**Dr. Tsuyoshi OKAYAMA**

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## **Future Gardening System - Smart Garden -**

What do you think about gardening in the future? Recently, most people have a smartphone which is a palmtop size but is a very powerful computer. The future gardening system must utilize these kinds of devices and wearable computers.

Now we have been struggling to develop an advanced gardening system, “Smart-Garden (SG)”. SG supports growers’, especially beginners’ decision with large amounts of information based on collected data by sensors and simulation results using the data. Home gardening is becoming popular in Japan. Because Japan is entering into an unprecedented aging society, many retired people have abundant leisure time. Home gardening is one of options for consuming their time. Younger generations also have interest on gardening for hobby, health foods, and children’s education. However, it is difficult for beginners to manage their own home garden, because of enormous factors which a grower has to or should consider, such as plants’ condition, soil condition, weather, climate, etc. SG will help to solve these difficulties.

The objectives of SG are 1) to collect “big data” from the field, 2) to simulate the future situations of the field with the data, and 3) to visualize observed information and the results from the simulations for supporting a grower’s decisions intuitively.

In order to be used by everyone, SG should be inexpensive and open source project. In this presentation, two key technologies in SG will be explained. One is a low-cost depth (3D) sensor for collecting plant growth data three-dimensionally. Kinect™ sensor which is used in our system features an RGB camera and a depth (3D) sensor and can collect three-dimensional data from objects. The other is Augmented Reality (AR) technology. AR is a variation of Virtual Environment (VE) or Virtual Reality (VR). VE technologies completely immerse a user inside a synthetic. While immersed, the user cannot see the real world around him/her. In contrast, AR allows the user to see the real world with virtual objects superimposed upon or composited with the world. Using AR technology, the grower can see an actual plant and useful information (computer graphics) simultaneously on the same screen.



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**Activities for Global Education in the College of Agro-Biological  
Resource Sciences, University of Tsukuba**

In line with the policy of Japanese government to reconstruct Japanese national universities as “National University Cooperation” on 2004, all Japanese national universities have clarified their mission to be distinguished in their role and responsibility in higher education in Japan. One of the missions of University of Tsukuba declared on 2004 is “To link with countries and regions all over the world and to become a university with high international reputation and influence by actively promoting world-class education, research activities, and collaborative interaction”. Educational organization of agricultural education has been provided in the field of Life and Environmental Sciences. Particularly, College of Agro-Biological Resource Sciences (CARS) is strongly pursuing several programs to nurture human resources to contribute to the global society for agriculture and agro-industries. This requires an understanding of both local and global point of view. From 2009, CARS is providing several educational curricula for the International Program in Life and Environmental Sciences with the cooperation of College of Biological Sciences and College of Geoscience. These international programs offer all courses in English and accept students from overseas. These kinds of program are not only for increasing the incoming international students but also for providing an understanding on agriculture from a global point of view for Japanese students.

Various programs aimed to promote international student mobility are also actively being conducted by CARS. Short-term agricultural internship program such as agricultural field practices is offered mainly for 1<sup>st</sup> and 2<sup>nd</sup> year students. These activities are conducted with foreign partner universities (University of Bordeaux, Utah State University, Kasetsart University) and usually work as motivation for students to go and participate in longer exchange programs (for 1-semester to 1-year), which could be a good opportunity for them to broaden their knowledge about global agriculture.





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## **Farming Knowledge from Agricultural Training on Future Farms Investment Planning**

Farmers' decisions or planning to invest more on farm are based upon a range of socio-economic factors and also farmers' attitudes and level of knowledge. Moreover, farmers who plan for doing or investing more on farm will keep agricultural sector still sustainable. Hence, to find out the factor affecting farmers' decision to future investment, especially testing affect from agricultural policy and farm knowledge from training to future investment was mainly objective of this paper .A survey of 252 farming families was conducted in the harvest season in 2012 in Nakhon Si Thammarat province, southern Thailand. By applied logit model, the result showed that socio-economic factors as age and level of education of household head are negatively significantly influence on future planning for investing more on farm. Meanwhile, other factors as farmers' attitudes toward farming offers a stable career, level of supporting child to study agriculture, farmers' attitudes toward agricultural policy, Younger generation's helping in farming, and farmers who received training are positively significantly influence on planning to invest more on farm. For increasing farmers' knowledge on farming many types of "farmer training" have been complemented since farmer training is one of the most important schemes which can not only increase farming knowledge but also increase (the return on) the investment in farm.

**Key words:** farmer training, Farmers' decisions, future farms investment planning



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## **Dissemination and Adoption of Normal and Nutritionally Enhanced Highland Maize Varieties in Transzoia County, Kenya**

Maize is a major crop in eastern Africa region in terms of production, consumption and income generation. Significant progress has been made in the area of research and development in improving maize crop technologies. One of the major focuses is to improve the quality of seed varieties which encompass special attributes such as pest and disease resistance, early maturity, high yields and nutritional quality. Most of these varieties are designed to adapt to wider agro-ecological zones.

Though the highland zones of the region are among the potential areas for maize production, only a few of the several improved varieties adapted to the ecologies have been accepted by farmers. Despite the increase in the number of hybrids released and the range in the seed market, one single variety still dominates many farms in the County. Conventional maize is deficient in two essential amino acids, lysine and tryptophan. Adoption of Quality Protein Maize (QPM) can alleviate hunger and malnutrition problem facing the farming community in the region.

The main study objective was to evaluate the dissemination and adoption of normal and nutritionally enhanced highland maize varieties in Transzoia County. A survey was conducted covering both subsistence and commercially oriented farmers. Study results indicated that socioeconomic characteristics differed significantly across segments. Overall, the number of farmers growing hybrids is more than 90 percent. However, the slow pace of uptake of other varieties and the replacement of the old variety is a cause for concern. There is a strong response to seed-to-grain price ratio both for subsistence and commercially oriented farmers. There is evidence of a commercial orientation in both subsistence and large scale farmers and hence the necessity to get the right price for seed. The preference to Quality Protein Maize is a response to address protein inadequacy gap in the diet. The findings would be essential to policy makers when designing public awareness and maize technology promotion among farmers.



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## **Importance of Agriculture Training Centers in Promoting Sustainable Rural Development**

Agriculture continues to be sub-Sahara's dominant economic activity accounting for 40% of GDP, 15% of export and 60-80% of employment. In Kenya agriculture is the mainstay of the Kenyan economy directly contributing 26% of the GDP annually and another 25% indirectly. The sector accounts for 65 percent of Kenyans total exports and provides more than 70% of informal employment in the rural areas. Therefore the agricultural sector is not only the driver of the Kenyans economy but also the means of livelihood for the majority of the Kenyan people.

Higher agricultural productivity is a precondition for growth and development in most African countries and increasing yields is the key to raising incomes in the rural areas. With continued increase in population, climate change, land subdivision among others, the traditional methods of farming can no longer support the rising population. There is therefore the need for advanced agricultural education that will assist farmers to produce high value crops and transform their farming into a globally competitive and innovative agriculture as stated in Kenyans vision 2030.

The agriculture training centers (ATC) plays a key role in disseminating knowledge, technologies and agricultural information, and in linking farmers with other stakeholders in the economy. The ATCS are critical change agents required in transforming subsistence farming to modern and commercial agriculture to promote household food security, improve income and reduce poverty. Agricultural training centers frequently offer in-service training to public sector employees, farmer training to farmers, and short courses on demand to others in the public or private sectors. The Ministry of agriculture is usually responsible for agricultural training programs.

Kenya therefore needs to continually develop the capacity of its ATCS for rural development in terms of staff capacity and increased funding .This would positively impact on delivery of necessary skills for improved productivity and sustainability of farming systems and assist the rural people improve their quality of life and livelihoods.

The ATCS has had challenges in fulfilling their mandate mainly due to low funding from the governments leading to deterioration of infrastructure and facilities for training and technology demonstration. This has also lead to limited capacity to train on emerging issues like biotechnology among others. The ATCS has thus not been able to respond to market demands for specialized courses. Different forums like new partnerships for Africa have recognized the need for agricultural trainings and have recommended additional funding to the agriculture sector. The ministry of agriculture has also recommended the restructuring of the institutions for improved coordination. Some more practical way of minimizing this challenge is for the ATCS enter into productive relations with other actors in the sector and wider economy thereby sharing in the comparative advantage of different actors and institutions to reduce transaction costs, achieve economies of scale, exploit complementariness' and realize synergies in innovation. With this they will be able to achieve their important role of training farmers and staff.



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## **The Role of Ag-ESD Program in Promoting Education for Sustainable Agriculture at Bogor Agriculture University, Indonesia**

Six Indonesian representative papers that have been presented in the eighth cycle (2008-2013) of APEID program as well as academic curricula and research topics of Bogor Agricultural University (IPB) were reviewed to evaluate role and contribution of the Ag-ESD program to education for sustainable agriculture in Indonesia, particularly at IPB.

Education in sustainable development science is an important key to create a strong community in coping the upcoming challenges and problems of growth and environment. Education that combines agriculture sustainability - where sustainable development science becomes the core value of its curricula - should be developed. It is recommended to improve the IPB's academic curricula, course content, research, and community services of sustainable agriculture development since many fields have been being delivered by IPB as foremost agricultural university in Indonesia. The fields are such as food and nutrition security problems, agricultural crops production, mine reclamation, and natural resources utilization. The improvement as expected contribution of the Ag-ESD program will generate better and high competent agricultural scientists and practitioners in optimizing and sustainable utilization of agricultural resources.

Many undergraduate and graduate courses of IPB explicitly describe sustainable agriculture while many others are closely related to ecology that fully consider environmental balance as an important factor in utilizing natural resources, and some others take into account terms of environment and sustainable. Sustainable agriculture development and natural resources utilization have been explicitly and mostly addressed to PhD dissertation and MS thesis.

Many needed field schools as nonformal education of sustainable agriculture have been conducted in order to specifically solve agricultural problem (integrated pest management, soil and water conservation, watershed management). It has been created and funded either by government, Non Government Organization, or foreign organization such as Environmental Services Program (ESP), USAID.



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## **The Roles of Kasetsart University in Promoting Agricultural Education for Sustainable Development (Ag-ESD)**

Kasetsart University (KU) is the first higher educational institute to offer agricultural education in Thailand. With a strong emphasis on the basic and applied agricultural research to produce food and agricultural products to feed Thai people and the country, Kasetsart University has been the destination of choice for students across Thailand to take advantage of the university's innovative research and educational opportunities. As the acceptance of sustainable agriculture as the mainstream agriculture in Thailand has become increasing, Kasetsart University has pledged to innovate and advance education and research on a diverse range of sustainable agriculture and development.

Kasetsart University, through the Faculty of Agriculture, has offered a master's degree program on sustainable agriculture. With a growing public recognition on the program and the financial support, especially in the form of scholarships, from the KU International Study Center (ISC), the Sustainable Agriculture Master's Degree Program has recruited more students into the program, including foreign students. From 2007-2011, the Faculty of Agriculture, had provided a 2-week-long training program entitled "KU-UT Internship Program in Sustainable Rural Development" to over 30 master's degree students from the University of Tsukuba (UT). Under the strong partnership between KU, UT, and the Japanese International Cooperative Agency (JICA), this internship program has been deemed as one of the most successful projects from which other KU training programs need to learn. The KU-UT Internship Program has been widely known for offering ample opportunities to UT students (mostly from African and South East Asian countries) to learn, engage, and experience agricultural systems in Thailand which have embraced the concept of sustainable development. Kasetsart University also promotes the university-wide programs which address social and environmental problems and later employ the sustainable approach to achieve the solution. With 16 agricultural research stations and 4 student training centers located throughout Thailand and being ready to serve as students' experiential laboratories, Kasetsart University has boasted its readiness and leadership in the education on sustainable agriculture and development.



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## **Challenges and Opportunities for Sustainable Agriculture Education in the Philippines**

The Philippines is an archipelago of more than 7000 islands situated in Southeast Asia, with a land area of almost 300,000 km<sup>2</sup>. The estimated total population (July 2011) was 103,775,002, with an annual growth rate of 1.9 %. It is one of the countries in Southeast Asia with highest economic growth during the period ending the second quarter of 2012. Basically with an agriculture-based economy, agriculture education in the country is through the 110 State Universities and colleges (SUCs) and the national university (University of the Philippines) that were created by the Acts of Congress.

There are three important recent developments that pose opportunities and challenges to sustainable agriculture education the Philippines: a) The enactment of the Enhanced Basic Education Act of 2012 or the K - 12 Basic Education Program which extends by two years the country's previous 10-year education curriculum; b) the rise in influence of global rankings of universities which underlies the internationalization of higher education; and c) the regionalization because of the integration of the Southeast Asian economies into the ASEAN Economic Community in 2015 (ASEAN 2015).

The recent implementation of the K – 12, is beset by many problems ranging from financial, facilities and capacity/capability of the delivering institution at the secondary level. It also requires a thorough review of current Bachelors degree programs, an opportunity to use sustainable agriculture as an overarching principle in the review process. The issue of internationalization/regionalization for developing countries in their curricular programs presents many challenges and decisions. However, among others, the development of signature academic programs with ASEAN perspective is very appealing and may attract international students in degree programs such as Sustainable Agriculture Innovation and Entrepreneurship, ASEAN Sustainable Policy Development Studies, and others.





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## **Study on Agricultural Education for Sustainable Development of Agriculture in Afghanistan**

Sustainable development refers to a mode of human development in which resource use aims to meet human needs while ensuring the sustainability of natural systems and the environment, so that these needs can be met not only in the present, but also for generations to come. The definition of sustainable development was used by the Commission: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Nearly 80% of Afghanistan's population lives in the rural areas depending strongly livelihoods in the agriculture sector which, in turn, depends heavily on agriculture production. Agricultural education is essential for fulfilling ever increasing human basic needs such as food, fodder, cloths, and energy, for ensuring long term productive potential of natural resources and for maintenance of environmental functions. Agricultural development depends to agricultural education in Afghanistan. Agricultural education is implemented by agriculture's specialists and expert farmers. Research and education are applied in agriculture schools, agricultural institute and agriculture faculty. Traditional education is applied by expert farmers through their sustainable agricultural practices. There is a correlation between sustainability of agriculture and education. Importance of agricultural education is its effectiveness on sustainable development of agriculture sector. The biggest challenges of agricultural educations in Afghanistan are weakness of management, institution, research activities, inputs, continuous war and security. Education and training are widely recognized in research as contributors to national economic growth. Many organizations and institutions are supplying agricultural education to specialists and farmers as well, but lack of update materials is a significant challenge in Afghanistan. The objective of Afghanistan's representative participation in this symposium is sharing experiences with the scientists of developing and developed countries. The specific objectives of agricultural education in Afghanistan are to give update information of agricultural progresses of world to the Afghan farmers, to provide essential training about agricultural practices regarding agricultural technology, cultivation, processing, storing, post-harvest knowledge, irrigation, supplying of fertilizers, usefulness of bio-diversity conservation, soil health, biotic and abiotic stresses, climate changes and its role on agricultural production, The discipline of rural development recognizes the crucial links between agriculture, natural resources, human settlement, and biodiversity. Sustainable development clearly requires the cooperation and inputs of sectors other than agriculture, including infrastructure, education, health, and energy.

Key words: Agriculture, Education, Sustainable, Development.

**Summaries**  
**for the Young Researcher's Forum**

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## **【Young Researcher’s Forum】**

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**Conservation of Endangered “Lower” Plant in the Tropical Area.  
- A Study of Fungal Symbiosis with *Huperzia* spp. in Indonesia -**

Mycoheterotrophic plants are partly or entirely non-photosynthetic plants that obtain nutrients from fungal symbiont. *Lycopodiaceae* has worldwide distribution, and many species inhabit in tropical regions and is classified in an ancient clade that is sister to all other extant vascular plants. Subterranean gametophyte (haploid stage) of *Lycopodiaceae* is regarded as a kind of mycoheterotrophic phase associated with Arbuscular Mycorrhizal Fungi (AMF). Therefore, *Lycopodiaceae* is not able to exist without AMF symbiont. *Lycopodiaceae* –AMF association are poorly studied compare to other mycoheterotrophic plant (e.g. *Orchidaceae*). In a recent study, however, mycoheterotrophic gametophytes of *Huperzia hypogaea* (*Lycopodiaceae*) in Ecuador were found to be associated with AMF and linked with own sporophytes (autotrophic phase) via their hyphal network.

Sundaland region consisted of Borneo, Java, Sumatra, and Peninsular Malaysia is high diversity rainforest areas. Sixty percent of the 25,000 plants recorded from this region are endemic, but the natural habitats have been decreasing steadily over time. Especially, West Java province is heavily populated thus the natural habitats of endemic organisms are only remaining in the conserved areas such as Mount Gede Pangrango National Park. In this study, colonization status of AMF and Root Endophytic Fungi (REF) in sporophytes of *Lycopodium clavatum*, *Huperzia selago* and *H. serrata* inhabiting in the Mt. Pangrango were investigated. As a result, AMF colonization was observed in *H. selago* and *H. serrata* except *L. clavatum*. Moreover, as the REF, some of ericoid mycorrhizas and dark septate endophytes were isolated from all *Lycopodiaceae* species. Such REF was more frequently isolated from the sub alpine area (>2400 m asl.) where is abundant in *Ericaceae* plants compare to the montane area (1500–2400 m asl.). Our results not only confirmed *Huperzia* –AMF association and also imply a hyphal network between sporophytes of *Lycopodiaceae* and shrubs of *Ericaceae* linked via REF. Therefore, the conservation of *Ericaceae* plants may contribute to the conservation of the natural habitats of *Lycopodiaceae*. Additionally, in the future, the combination application of AMF and REF to *Lycopodiaceae* will help to fulfill the demands of a cultivation method to avoid *Lycopodiaceae* from an extinction in the wild.



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## **Land Optimization of a Sugarcane Plantation (East Seram County)**

The utilization land for agricultural development requires information about the potential of land resources and the land. Information is really important as it approaches in knowing constraints, and alternative solving. One approach to overcoming that problem is through the activity of land evaluation of conformity. Conformity is a depiction the level of land evaluation suitability or the assessment process of land resources to a particular use. This analysis aims to find any land belonging to the class suit (S1), is quite suitable (S2), marginally suitable (S3) and the land belonging to the class is not suitable (N) for sugarcane in the district of East Seram. . Based on the agro-ecosystem (biophysical) field, thematic map (slope, contour, soil, land use) and the results of laboratory analysis of soil and assisted with interpretation of Landsat imagery, acquired the lands in the district of East Seram most classified as not suitable (N) with a variety of limiting factors. Most other classes considered reasonably appropriate according to the category (S2) and the corresponding marginal (S3), while those belonging to the class suit (S1) is only a small part. The limiting factor found in this area most of the danger of erosion, due to the district of East Seram is dominated by choppy slopes, hills to the mountains, where the criteria sugarcane belonged not appropriate. Optimization of land use is an attempt to increase the utilization of land resources to be on the field. One objective optimization is utilizing land use while cultivated land into productive agricultural land and increasing cropping index to expand planting areas. One of the areas for the expansion of planting area, especially the plantations of eastern Indonesia, one of which region of East Seram, Maluku Province. One is the sugarcane commodities. Indication of the suitability of sugar cane lands in Eastern origin is reinforced with sugar cane that has been around since 6000 BC in Papua and surrounding islands. The method used for determining the valuation of land and land that is the optimal method of land suitability analysis, mapping, weighted-scoring method and GIS mapping. Weighted-scoring method are to find an effective, optimal areas for sugar cane plantations and sugar industries, by using certain criteria such as being in the land suitability classes S1, S2 and S3, the milled cane 150 days, the economic figures for the sugar cane plant is  $\geq 8000$  TCD .



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## **Ameliorative and Detrimental Consequences of Nitrogen and Water on Maize Varieties under Short and Prolonged Drought**

Drought and food security is the great concern now a day under rapid changing of global climate. Inadequate management of nitrogen and water stress is considered as the major factors in decreasing the growth and yield of maize.

Two field experiments were conducted at National Corn and Sorghum Research Center, Thailand during 2010-11 and 2012 under short pre-anthesis (SPD) and prolong bracketing-flowering stage drought (PBD), respectively. Split plot design with factorial RCB arrangement was maintained for the experiment where 2 water regimes [well-watered and water-stressed] formed main plots, and 2 maize hybrids [Pioneer 30B80 and Suwan 4452] and 3 nitrogen levels [0, 160 (optimal) and 320 (supra-optimal) kg nitrogen ha<sup>-1</sup>] collectively formed subplots.

Supra-optimal N (urea) had a significant impact on changing soil pH temporarily. Optimal N and well-watered enhanced net assimilation rate at vegetative stage (NAR<sub>v</sub>), ovule number per primary ear (ON<sub>pe</sub>), leaf area duration at reproductive period (LAD<sub>r</sub>), specific leaf weight at anthesis (SLW<sub>a</sub>), current assimilate transfer to kernel (CATK), SPAD chlorophyll content at anthesis (Chl<sub>a</sub>), nitrogen use efficiency (NUE), biological yield and finally kernel yield plant<sup>-1</sup> (KYP), where supra-optimal N as well as zero N and water stress had detrimental effects on these parameters except Chl<sub>a</sub>. PBD was found more detrimental than SPD regarding plant performance. More roots to shoot ratio, LAD<sub>r</sub>, Chl<sub>a</sub>, NUE, NAR<sub>v</sub>, and ON<sub>pe</sub> were recorded as nitrogen and water stress tolerance characters in Pioneer30B80. Optimal N had ameliorative consequences against drought especially under SPD. The correlation between KYP and other considered traits i.e. LAD<sub>r</sub>, Chl<sub>a</sub>, NAR<sub>v</sub>, ON<sub>pe</sub>, and CATK were positive and highly significant except SLW<sub>a</sub>, where CATK, ON<sub>pe</sub> and NAR<sub>v</sub> had significant and positive direct effect on KYP under both SPD and PBD. Maize variety development with the above mentioned desirable characters and optimal N management can be helpful for maximum kernel and biomass production, which in turns will contribute to food security and environment safety.





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## **Sustainable Agricultural Production Systems for Food Security in a Changing Climate in Batanes, Philippines**

Talubo, Joan Pauline P., Zamora, Oscar B., De Guzman, Lucille Elna P., Nelson, Gloria Luz M., Tatlonghari, Rosario V., Espaldon, Maria Victoria O., Hostallero, Cesar Doroteo V.

Climate change could have significant impacts in the Philippines with large sections of population who are poor and vulnerable, especially those who live in areas prone to coastal storms, drought, and sea level rise. The sector mostly affected by climate change is agriculture and food security because of the risk of low productivity due to increasing temperature, drought, and increasing frequency and intensity of rainfall that brings about floods and landslides.

Located in the northernmost tip of the country, the Batanes group of islands lies on the country's typhoon belt. Because of vulnerability and its isolation from the rest of the archipelago, the Ivatans have developed self-sufficient, organic and climate-resilient crop production systems. This paper presents the indigenous crop production systems that have made the Ivatans food self sufficient despite the vulnerability of their agroecosystem.

A typical Ivatan farmer owns 3-5 parcels of land. Each parcel has an average size of 300-500 m<sup>2</sup>. Because there are no irrigation facilities, the farmers plant rice only once a year during the rainy season. In one parcel during the dry season, a multiple cropping system is employed, with a specific spatial arrangement of corn (*Zea mays*), gabi (*Colocasia esculenta*), yam (*Dioscorea alata*), and tugue (*Dioscorea esculenta*), using corn stover, hardwood trees, or a local reed called *viyawu* (*Miscanthus* sp.) as trellis. Banana (*Musa* sp.) and assorted vegetables are planted around this parcel. The rest of the parcels are left to fallow and used as grazing area for cattle. The same crops are planted on the second parcel in the next season and the first parcel utilized will again be planted only after 3-5 years. This unique fallow system maintains soil fertility without the use of chemical fertilizers. They also practice an indigenous storage system that involves hanging of their harvest such as corn, rice, garlic and onion bulbs, even meat and fish, above the firewood-fed cooking area, to keep for long typhoon seasons. The Ivatan farmers' indigenous agricultural production systems, for generations, have ensured a certain level of food security at the household level.



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## **Overview of Biodiesel Production from Microalgae**

It has become obvious that continued dependence on fossil fuel is unsustainable because of global warming by greenhouse gas emission and the future depletion of fossil fuel. Development of renewable energy has attracted much interest for energy sustainability. Biodiesel is a renewable fuel which is produced from oils derived from plants, animals or microbes. It is non-toxic and biodegradable, and has lower emission of greenhouse gas when burned in diesel engine. Various methods such as transesterification, blending, cracking, microemulsification and pyrolysis have been developed to convert oil into biodiesel which is comparable to diesel fuel. Transesterification is the most common method for the production of biodiesel and consists of a number of consecutive reversible reactions. Triglyceride is converted stepwise to diglyceride, monoglyceride and finally glycerol and a mole of fatty acid methyl ester named as biodiesel is liberated at each step. Generally, alcohol and catalyst are needed for transesterification of oil.

Microalgae are unicellular microscopic (2–200  $\mu\text{m}$ ) autotrophic organisms which grow by photosynthesis and are the eukaryotic representatives, though the prokaryotic cyanobacteria are often included in algae. Some species contain more than 70% lipids (dry weight basis). They also grow extremely rapidly under optimal conditions and their growth rates are 100 times faster than terrestrial plants. Oil yield of microalgae containing 70% oil content is 58,700 L/ha year and much higher than other crops (e.g., soybean 446 L/ha year and palm 5950 L/ha year). In addition, microalgal cultivation does not encroach on arable land suitable for food production.

Currently, there are various researches of transesterification of microalgal oil. The conversion efficiency of biodiesel via transesterification depends on microalgal characteristics, amount and type of alcohol and catalyst, operating temperature, and reaction time. This study reviewed the technologies which generate biodiesel from microalgae by transesterification. The performances of alkaline, acidic and enzymatic catalysts were evaluated. Also, modern techniques of development of biodiesel i.e., microwave method and supercritical method were discussed.

**Abstracts**  
**for Poster Presentations**

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## **Morphological diversity of wild *Rhynchostylis gigantea* ‘Changkra’ in Thailand**

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*Rhynchostylis gigantea* ‘Changkra’ is one of monopodial epiphytic orchids widely distributed in Thailand. In spite of many commercial hybrids produced from this species, the wild *R. gigantea* is quite rare due to the deforestation. Lack of the diversity information of this species is also one of the current issues. This study is aim to investigate diversity of this orchid spices using morphological character. Forty two wild samples were collected from 18 locations throughout Thailand. The number of 64 qualitative characters and 12 quantitative characters were evaluated according to the modified UPOV description. The result show that wild *R. gigantea* in Thailand can be divided into 7 groups by UPGMA method. Considering PCoA analysis, the first and the second PC explained 58.69% and 4.05% of the morphological variation respectively and making a total of 62.74%. However, morphological characteristic cannot clearly explain the discrete of *R. gigantea* as concern by the collected region of Thailand. The overlap of the groups may occur due to environments or natural gene flow. However, quantitative analysis revealed that size of whole flower and dorsal sepal are highly significant between regions of distribution in which the accessions from northern region have bigger size than the other regions. Therefore, to obtain the manifest picture of wild distribution of this species, molecular techniques should be employed to gain more valuable information.

## **Analysis of *actin* sequences using for detection of *timeless* expression in *Aedes albopictus*, vector of chikungunya in rubber plantation area**

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*Aedes albopictus* is a vector of Chikungunya. These mosquitoes were found in rubber plantations. The behaviors of *Ae. albopictus* are related to human activity on rubber-tapping. The rubber-tapper may face to a high risk of chikungunya infection causing incapability to work. The most effective means to prevent chikungunya infection are protection of human from mosquito biting. Host seeking behavior involving in mosquito biting is regulated by *timeless* which is a crucial gene to control circadian rhythm. Therefore, daily expression of *timeless* gene in *Ae. albopictus* was investigated the relation between *timeless* and biting behavior. Usually, constitutive gene *actin* is used as constitutive control in the studies of *timeless* expression since this gene can be amplified by universal primers. However, the size of PCR product is not appropriate to real time PCR using for detection of *timeless* expression. Therefore, *actin* gene of *Ae. albopictus* in Thailand were analyzed by amplifying this segment with these universal primers. The obtained DNA sequences from amplification were then aligned to find conserved sequences using for primer design to produce appropriate size of PCR product for real time PCR. The results showed that the sequences of *actin* obtained from male and female *Ae. albopictus* are similar to the sequences presented in Genbank database. Then, the suitable primers of this gene will be designed for real time PCR using for detection of *timeless* expression in the future.

## **Effects of *Agrobacterium tumefaciens* strain, plant expression vector and *Agrobacterium* cell suspension preparation to efficiency of tomato transient transformation**

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*Agrobacterium* transient transformation is commonly used to determine transgene expression and promoter efficiency in plant tissue due to its low cost and a relatively short period of preparation. In a complex tissue that is constantly developing such as fruit, however, transient transformation efficiency has been found to be promising yet variable and unreliable. The purpose of this study is to investigate influencing factors to the efficiency of fruit transient transformation, including strains of *Agrobacterium tumefaciens*, plant expression vector, *Agrobacterium* cell suspension preparation and incubation time using tomato (*Lycopersicon esculentum* L.) a commonly used fruit model. The results showed that pCAMBIA1304 is the most effective plant expression vector for fruit transient transformation followed by pCAMBIA2301 and pCAMBIA1301 respectively. Two day incubation period and *Agrobacterium tumefaciens* strain C58 produced high tomato transient transformation efficiency.

Key words: fruit transient transformation, *Agrobacterium tumefaciens*, tomato

## Development of Microsatellite Marker useful for genetic analysis on Mangosteen (*Garcinia mangostana*) in Indonesia

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Mangosteen is one of the tropical fruits that native from Indonesia and spread to tropical region of Asia and America, known as the queen of tropical fruits. The mangosteen is allotetraploid derived from *G. malaccensis* (2n=42) and *G. hombroniana* (2n=48) (Verheij, 1992). As apomictic fruits, the mangosteen has narrow genetic variation but phenotypes in field have variability (Sobir and Poerwanto, 2007). In this presentation the molecular marker approach based on microsatellite polymorphism were applied to analyze genetic variability of mangosteen in Java Island.

We conducted selective hybridization to develop microsatellites marker in mangosteen (Zane et al, 2002). DNA is extracted from dried leaf by modified CTAB method (Doyle and Doyle, 1987), and then digested by *RsaI* restriction enzyme. DNA fragments ligated with specific-adaptor linkers and then amplified with one of an adaptor linker as primer. DNA fragments were captured on nylon membrane that hybridized with microsatellite oligonucleotides. The membranes were washed with shaking at 60<sup>0</sup>C in washing solution. Then DNA was eluted from the membrane in boiled water. The eluted fragments were ligated into pGEM®-T easy vector and transformed into *E. coli*. The positive colonies containing microsatellite sequence were selected by colony PCR. Plasmids were extracted from the selected-colony and then purified by PEG precipitation. The inserted DNA was sequenced by ABI3130xl genetic analyzer with Big dye® terminator ver. 3.1 sequencing kit. Microsatellite primers were designed by PRIMER3 from the sequences containing microsatellite. Optimum annealing temperature was analyzed for suitable amplification for each primer pair. We collected leaf samples of mangosteen for their genetic analysis from four area of mangosteen production in Java Island. They are Leuwiliang, Wanayasa, and Puspahiang in West Java, and Kaligesing in Central Java. In each location, leaf samples of 20 individuals were randomly collected and used for PCR by poorman's approach (Schuelke, 2000), and microsatellite analysis. The amplified microsatellite fragments were sized by genetic analyzer with Genescan™500LIZ™.

We developed microsatellite marker from library that collected from Kaligesing (Central Java) population and named IGMB. We collected 40% colonies that containing microsatellite fragment and to prior analysis six primer pairs were designed. Four primer pairs successfully amplified microsatellite region in the collected samples. They are IGMB001, IGMB002, IGMB003, and IGMB006 containing AC motif. Number of alleles observed in four-mangosteen population ranged from 4 to 11 per locus, with an average of 6.5. IGMB003 has the maximum number of allele with polymorphic among population. Only an IGMB002 has no polymorphism. In population, Wanayasa has the maximum number of allele with polymorphic especially amplified by IGMB003 primer. We will use these primers for further analysis on mangosteen.

## **GIS-based Spatial and Network Modeling for Urban Waste Management and Potentials of Urban Agriculture**

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GIS could help in dealing with several factors simultaneously which needs to be considered while planning waste management in urban areas. The urban solid waste management becomes a complex issue and an integrated concept as well in the developing regions. In this regard, GIS-based networking can assist in increasing information and efficiency of solid waste collection system in an urban settlement. Rapid urbanization has inevitably increased pressure on urban infrastructure and services, much of which have not been provided to muddle through with rapid urban growth; thus, resulting in poor urban service delivery including uncollected solid waste in most urban locations in developing countries like Bangladesh. In the capital, Dhaka itself carried 3,500 to 4,500 metric tons waste per day on very rough per capita basis, which has been taken to be between 0.45 and 0.50 kg. By 2015, it was projected, more than 6,000 tons of solid waste would be generated in Dhaka City Corporation (DCC) area. A sustainable waste management, urban waste reduction and reuse also important for sustaining and minimizing ecological footprints. Among other things, composting from urban organic wastes can reduce the volume of waste and the need to collect and transport wastes to distant dumps. Urban agricultural policy can be an integral part of a set of policies for sustainable urban environmental management. Urban agriculture has potentials to reuse of solid waste. This research is designed for the conditions of Dhaka city in Bangladesh. It is based on the practical observations regarding the functions and time wise needs of the city. The city conditions are such that the inhabitants face a lot of problems due to improper management of solid wastes. Dhaka City is divided into 10 zones and the research was conducted in one of the zones of the city namely Mirpur zone – 8. This zone, an administrative unit of Dhaka city, located at 23°48'15"N 90°22'00"E. We have observed during the fieldwork that solid waste management was done in mainly two phases. One was the waste management in the area where it was generated and second was the management of waste at dumping grounds. Private organization called Primary Collection Service Provider (PCSP) and the government was handling the issues jointly without satisfactory conclusions. Lack of information on the extent of solid waste generated, inadequate data on the number of households generating the waste, poor cost recovery due to non-payment of refuse collection fees and poor collection system within settlements made the system inefficient and environment was polluted. This research also included the issues related to the waste generation, their storage, collection and first dumping point and removal from the collection points. To enhance the efficiency and planning, GIS-based mapping for the Zone 8 was completed using ArcGIS. The geo-spatial analysis and geo-referencing was made to locate the waste generating zone, uncollected points and PCSP road networking in the study area. The suitability model shows the potential locations of urban agriculture. A structured interview was conducted between the household families to understand their motivation of separating waste and collection of compost to establish urban agriculture, like roof gardening, undisputed land owned by DCC. We have found GIS could support the practical planning of this urban waste management and located the potential regions to implement urban agriculture. Further research would be carried out with JICA and extend to other zones of City to establish potential agricultural regions and ensure a green and healthy environment of Dhaka.

# Separation Engineering Evaluation of Introducing Oil-Water Separation Technology for Organic Wastewater Treatment

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The technologies to recover oil from wastewater including food fat and oil are developed. They contribute to reduce the load of blocking the drainage derived from mass of oil, reduce the initial cost and running cost of the facilities for wastewater treatment, and reuse the recovered oil as valuable resources. By introducing oil-water separation technologies, especially in food processing factories satisfied with sanitary condition, the recovered oil could be sold as food fat and oil and the recovered water could be used as water resource. Then not only the cost reduction of wastewater treatment but also the profit from the valuable resource are expected. However, the performance and economic value of introducing these technologies in the field of food processing factories is still unclear.

This study aims to propose engineering evaluation method for introducing oil separation technologies to wastewater treatment from food processing factory to reduce initial cost and running cost of wastewater treatment facilities and to produce benefits from recovered oil as resources. The evaluation method consists of two components; Separative Work Unit (SWU) which is widely used for an expression of capability to enrich uranium to express total value by the separation, and value function determined by oil concentration of wastewater. The variable numbers used in this simulation were assumed based on the hearing investigation. 125 JPY/L of oil price, 0.6 JPY/L of water price, and -0.2 JPY/L of wastewater disposal cost. The recovered oil over 99.7% concentration of oil was used as valuable oil, the recovered water under 0.03% concentration of oil was used as valuable water, and the other concentration was treated as wastewater to disposal.

Results of trial calculation for food processing factory, Naoetsu-Yushi Co., Ltd., showed that over 99.7% separation performance was required to obtain positive value for separation process, and below 99.7% separation performance decreases SWU markedly to minus value. These result clarified appropriate separation performance and the evaluation method can be used for the evaluation standard for introducing the separation technology for organic wastewater treatment. Moreover, it was clarified if separated water is used as valuable resource, SWU will be higher and it means the separation has more value.



## The effect of free air CO<sub>2</sub> enrichment (FACE) condition on the yield and chemical composition of rice ratoon grown for two weeks

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The well growing rice ratoon after harvest of rice is recently observed. It was reported that the rice ratoon had potentially no little biomass and good quality with high crude protein and high digestibility as roughage for ruminants (Arifusa *et al.*, 2012). Besides, the increasing of atmospheric CO<sub>2</sub> concentration ([CO<sub>2</sub>]) in near future and the effects of high [CO<sub>2</sub>] on the yield and quality in other crops were reported (Elizabeth *et al.*, 2004). Therefore, the effects of high [CO<sub>2</sub>] on the yield and chemical composition of rice ratoon grown for two weeks were investigated in terms of the carry over and direct effect (COE and DE) in the present study.

Tsukuba FACE site was established in farmers' rice field in Tsukubamirai City, Ibaraki Prefecture, Japan. An ambient [CO<sub>2</sub>] plot (AMB: control plot) and an elevated [CO<sub>2</sub>] plot (FACE, AMB+200μmol mol<sup>-1</sup>: treatment plot) were set and each plot has 4 replications. [CO<sub>2</sub>] in FACE was elevated from 31 May to 14 September, 2012. Akitakomachi was tested as a cultivar. In treatment1, rice ratoon was sampled on 28 September which is 2 weeks after the harvest of rice (14 September) in AMB and FACE, in order to determine the COE of elevated [CO<sub>2</sub>] (E-[CO<sub>2</sub>]) before harvest of rice on the growth of rice ratoon. In treatment2, rice ratoon was sampled on 14 September which is 2 weeks after the harvest of rice (31 August) in AMB and FACE, in order to determine the DE of E-[CO<sub>2</sub>] on the growth of rice ratoon. The numbers of stem, stubble and heading, plant length and dry matter weight of samples were recorded. Crude protein, neutral detergent fiber, crude ash and *in vitro* digestibility in the samples were analyzed. ANOVA was conducted for statistical analysis.

In treatment1, crude ash was significantly shorter in FACE than that in AMB ( $P < 0.02$ ). In treatment2, there were no differences between AMB and FACE. These results suggest that the COE of E-[CO<sub>2</sub>] reduced the crude ash of rice ratoon cultivated two weeks; however, it grows about two or three months. Accordingly, the effect of E-[CO<sub>2</sub>] on rice ratoon with prolonging the cultivation term needs to be investigated for the actual utilization of the rice ratoon.



## **Wine production from whole blueberries by use of wet milling process**

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Blueberries are perennial flowering plants with indigo-colored berries in the section *Cyanococcus* within the genus *Vaccinium*. Blueberry has a lot of dietary fibers and polyphenols with it substrate such as resveratrol and anthocyanin. Therefore, it is said to be effective for eye strain recovery, anti-oxidation, anti-aging, and lifestyle-related disease prevention. Currently, in addition to raw food eating, blueberries are supplied as materials of variety of products such as jam, baked-cakes and wine. In the manufacturing process of the wine, functional ingredients such as dietary-fiber and polyphenols which are abundant in pericarp were lost by filtration and squeezing processes. In this study, we proposed wet milling process which makes filtration and squeezing unnecessary in order to keep rich in functional ingredients of the wine product.

The approach to make blueberry wine could be divided to three processes. First, the miniaturization of washed blueberries, harvested from Tsukuba area was approached by the wet milling machine. The grinding characteristic of the blueberries was analyzed as well as sedimentation properties and particle size distribution. Second, the fermentation process was initiated by addition of sugar and yeast. At this fermentation process, the temporal change of pH, glucose, organic acids such as ethanol and other parameters were observed. The last process, the dietary fiber and polyphenols of blueberry wine were tested by implement a functional test based on the food sensory test method. By this new process, the production of delicious-functionality wine with whole blueberries are expected to provide a positive effect to he human health and the decrease lifestyle-related disease. The successfully process are expected to contribute to the six primary industries of blueberry producer in Tsukuba area. The value of blueberry is hopefully increased.

Results of the grinding experiments with mixer,the smallest particle size has been found more than 100 $\mu$ m. Further, as a result of applying the wet milling using a stone mill,with moderation feeding rate being smaller and the rotational speed being higher, the particle size that could be pulverized was smaller. Therefore,we had found that stone could be pulverized finer than mixer. In the future, I'm planning fermentation and a functional test.

## **Main Factors Affecting Agricultural Production and Sustainable Development in Inner Mongolia**

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As population grows, over-cultivation and over-grazing are the major problems in Inner Mongolia of China, which influence the sustainable development. In order to illustrate the tendency on what has happened in the past and relate the main factors affecting agricultural production, it analyzes the Statistics of Year Book 2001 to 2011 by national level.

Result one showed that gross population increase quickly from 1823.4 ten thousand persons at the year-end of 1978 to 2472.2 ten thousand persons at the year-end of 2010. Because of the growth of population and their consumption of food, grain production and animal production increase dramatically; it showed that grain production changes from 499 ten thousand tons in 1978 to 2158.2 ten thousand tons in 2008, and the numbers of large animals changes from 4162.3 ten thousands heads to 10798.5 ten thousands heads. Also, it showed that total land area, 118.3 sq. km, and prairie area, 8666.7 hectares, are constant from 2001 to 2010, but cultivated land area increase slightly which changes from 709.1 ten thousand hectares at the year-end of 2001 to 714.9 ten thousand hectares at the year-end of 2010. In addition, result two showed that water resource decrease quickly from 2004, such as total water resources volume decreases from 545.95 one hundred million cu.m in 2004 to 388.54 in 2010; surface water volume decreases from 406.6 to 253.38; ground water decreases from 236.22 to 227.65. Inner Mongolia is a semi-arid regions, it showed that the annual total precipitation of major cities is decreasing from 2001 to 2010. It also showed that effective irrigated areas increase from 237.2 ten thousand hectares to 302.75 ten thousand hectares, which means that irrigation uses the considerable amount of water resource. It could be safely concluded that population growth and water resource might be the two main factors affecting agricultural production and sustainable development. Therefore, how controlling well the population and food consumption growth and improving the agricultural productivity should be the fundamental issues so as to solve the problem on over-cultivation and over-grazing. Furthermore, how sustainably use the water resource could be the inevitable problem, because it is necessary to extend the water-saving irrigated and effective irrigated areas at irrigation areas.

# Producing higher polyphenol juice and healthier food

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## 1.Introduction:

It is well-known that apple contains lots of nutrition facts, such as sugar, protein, vitamin and microelement. Each nutrition plays a very important role on our body. Scientists always say an apple will keep the doctor away. However, many people do not like eating apple skin, which means a lot of nutrition will be lost. It is proved that almost half of the vitamin C content is just underneath the skin. Polyphenol is an good antioxidant for human body due to it can prevent lots of disease, such as cancer, coronary heart disease. However, most of the polyphenol is exist in the apple skin. In order to full use of the apple and do not influence the taste, a new strategy using apple juice with skin instead of eating apple directly is proposed.

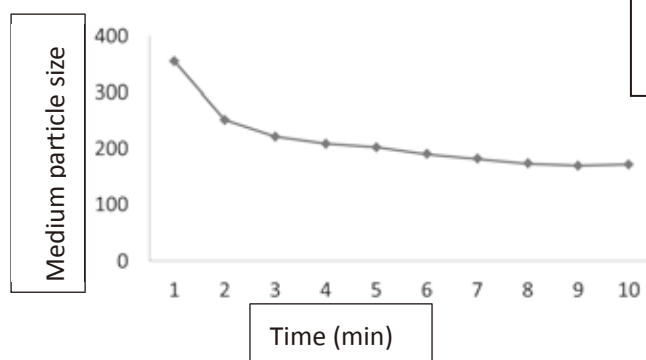
## 2.Material and Method:

Preparing two kinds of apples, one is with the skin, the other is without the skin. Mixing for five minutes respectively, and using the Folin-Ciocalteu method to test polyphenol and particle size distribution measurement.

## 3. Result and discussion:

### Experiment 1:

Testing particle size distribution measurement



### Experiment 2:

With skin of apple juice polyphenol:55.672mg  
Without skin of apple polyphenol :3.312mg

From experiment 1, we can observe that particle size gradually decreased with increasing time. However, particle size is still about 195µm after 10minutes.

We can see from experiment 2 that polyphenol in apple juice with skin is about 10 times higher than without skin. Therefore, it is proved that most of polyphenol is contained in the apple skin

If produce apple juice with the skin, it will also have some problems. To produce more tiny and good tasty, I will use wet willing and pectinase in the future.

## **Mimosine brocks root cell growth by inducing cessation of cell division**

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Mimosine ( $\alpha$ -Amino- $\beta$ -[1-(3-hydroxy-4-oxopyridine)] propionic acid) is a non-protein amino acid, contained in the leaves and seeds of *Leucaena* sp.. Mimosine shows various toxic effects on animal cells, such as blocking of cell cycle and induction of apoptosis through generation of reactive oxygen species (ROS). Further, this compound works as an allelochemical, which inhibits plant growth. Therefore, mimosine is expected source compounds for future herbicides. Our previous results showed that mimosine selectively inhibited root growth and increased dead cells in lettuce and onion roots. The results of thiobarbituric acid reactive substances (TBARS) determination and dihydroethidium (DHE) staining suggested that oxidative damage is directly involved in the phytotoxic action of mimosine. Mimosine decreased the number of cells that enter into mitosis and induced chromosomal abnormalities. We discuss the possible mechanisms of blocking cell division by mimosine.

# **Ultrasonication and Photocatalysis Synergy for Enhancing Purification Effect of Refractory Organic Wastewater by using TiO<sub>2</sub> Coated Glass Beads**

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Heterogeneous photocatalytic oxidation using TiO<sub>2</sub> as photocatalyst is an attractive practice for wastewater purification as it has the characteristic of high efficiency, low cost, and easy operation under ambient conditions. However, its practical application is seriously limited by the aggregation and tedious post-separation of TiO<sub>2</sub> nanoparticles. In the present study, TiO<sub>2</sub> coated glass beads was synthesized by a sol-dipping-gel method to avoid the post-separation after treatment. Sonication of aqueous solutions induces acoustic cavitation created by the growth and adiabatic collapse of the bubbles in the liquid, leading to enhancing the degradation efficiency of RhB. Therefore a novel photocatalytic reaction system coupling with ultrasonication was developed in this study.

For enhancing the stability of the synthesized TiO<sub>2</sub> thin film on the glass beads, polyethylene glycol 300 (PEG-300) was added to the sol as a binder and dispersant. The synthesized TiO<sub>2</sub> coated glass beads was characterized by the X-ray diffraction (XRD), Scanning electron microscopy (SEM) and BET surface area analyses. The photocatalytic efficiency of synthesized TiO<sub>2</sub> coated glass beads was evaluated by the degradation of Rhodamine B, a model of organic wastewater under UV irradiation. The synthesized TiO<sub>2</sub> coated glass beads was optimized by investigating the effects of the amount of PEG, dipping time and calcination temperature, number of coating layers to determine the optimum operation parameters so as to enhance process performance and purification efficiency. The 3-times repetitive utilization of the synthesized TiO<sub>2</sub> coated glass beads for RhB degradation gave a standard deviation of 1.6. Comparing with the blank control, the results showed that PEG-300 addition in the sol obviously enhanced the stability of TiO<sub>2</sub> thin film on the glass beads. The optimum conditions for synthesizing TiO<sub>2</sub> coated glass beads are PEG-300 percentage of 5%, dipping time of 48 h, calcination temperature of 500 °C for 2 hours, and coating of 3-layers. The synergy of photocatalysis using the synthesized TiO<sub>2</sub> coated glass beads as photocatalysts and 1-h ultrasonic irradiation (200 W, 39 KHz) proved to be a promising option for purification of organic wastewater.

## Genetic evaluation of a blast resistance gene, *Pi40(t)*, using standard differential blast isolates

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Blast in rice, caused by *Pyricularia grisea* is one of the most serious diseases in rice production. Use of resistant cultivar is cost-effective and eco-friendly way to prevent this disease. However true resistance genes easily breakdown due to spread of dominant isolates. In Japan, some of previous rice cultivars with true resistant genes broke down their resistance. Broad spectrum blast resistant gene is considered to be more effective than previous ones. In 2007, *Pi40(t)* was found by J. U. Jeung as a broad spectrum blast resistant gene derived from wild rice, *Oryza australiensis*.

To characterize *Pi40(t)*, a near-isogenic line (NIL) was developed by backcrossing *Pi40(t)* donor line, IR65482-4-136-2-2, and susceptible line, US-2. Resistant plants were always selected by inoculation of PO6-6 for backcrossing. 4 BC<sub>5</sub>F<sub>3</sub> lines and 27 BC<sub>6</sub>F<sub>2</sub> lines were derived and used for inoculation test to 22 Japanese Standard Differential Blast Isolates (SDBI). From those BC<sub>5</sub>F<sub>3</sub> and BC<sub>6</sub>F<sub>2</sub> lines, a line, 40i-16, was selected as *Pi40(t)* homozygote line by inoculation test. 40i-16 showed highly resistant phenotype to 21 of 22 SDBI. The introgression of *Pi40(t)* was also confirmed using the polymorphic DNA marker in the region near *Pi40(t)*. Based on these experiment, NIL for *Pi40(t)* was successfully selected.

Using NIL for *Pi40(t)*, evaluation of *Pi40(t)* to blast isolates and investigation about linkage between *Pi40(t)* and other agricultural traits will be conducted. NIL for *Pi40(t)* can be used as source of resistant gene or differential variety for evaluation of isolates and may contribute to sustainable rice production.

## Effect of Soil Moisture Stress at Booting Stage on Photosynthesis in NERICAs

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NERICAs (new rice for Africa) were developed as the product of interspecific hybridization between *Oryza sativa* L. and *Oryza glaberrima* Steud., and mainly cultivated under rainfed upland conditions. The yield of NERICAs can be reduced under soil moisture stress caused by the uncertain rainfall. Soil moisture stress at booting stage severely reduces the grain yield, but the physiological mechanism of the yield reduction is not well understood. Therefore, this study was undertaken to clarify the effect of soil moisture stress at booting stage on photosynthesis of NERICAs.

Three-week-old seedlings of NERICA1, NERICA4, NERICA7 and Yumenohatamochi (japonica upland rice) were transplanted into 1/5000 a pot filled with a mixture of soil contained N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O = 1.0: 1.8: 1.0 g/pot and grown in the glasshouse. Soil moisture stress was imposed for 15 days at booting stage, maintaining the soil pF 2.3~2.7. The soil moisture of the control plants were kept under field capacity, less than pF 1.5. Photosynthetic rate and chlorophyll fluorescence were measured before, during and after the stress, and carbon isotope discrimination was determined with the flag leaf excised at maturity.

The soil moisture stress resulted in substantial inhibition of photosynthetic rate with the simultaneous decline of stomatal conductance and intercellular CO<sub>2</sub> concentration. The carbon isotope discrimination of the flag leaf was lower in the stressed plants, suggesting their stomata tended to be more closed than the control. The stress reduced quantum yield of photosystem II (PSII), while increased the non-photochemical quenching which enhanced thermal dissipation of PSII. NERICA4 showed slightly larger stomatal conductance and carbon isotope discrimination than the other cultivars, but had the largest decline of quantum yield and membrane stability index. It is concluded that the soil moisture stress inhibited photosynthesis due to both diffusive and metabolic limitations. Metabolic limitation of photosynthesis may be related to the adverse effect of photochemical and RubisCO activity, and the oxidative damage to the chloroplast. NERICA4 maintained the stomata more open, but had more damage in PSII than the other cultivars under soil moisture stress. These characteristics of NERICA4 may originate from African rice, *Oryza glaberrima* Steud. which is the genetic background of this cultivar.



# **Intergenerational Ethical Implications for the Expansion of Biofuel Production from the Viewpoint of Natural Environmental Recovery**

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Biofuel receives many attentions in recent years because biofuel has the potential to be developed as an alternative to petroleum fuel. On the other hand, the major issues of food price inflation and ecological destruction is derived by the rapid expansion of biofuel production. Those issues influence on not only our generation but future generation for a fairly long time.

Attitude of the intergenerational ethics is a responsibility of our generation and accountable for the life of future generation (Kato 1991). Therefore, the rights and wrongs of biofuel production should be discussed from the viewpoint of the intergenerational ethics based on scientific approach. Noguchi (2012) proposed that our generation impose obligation on future generation if the time to reforestation from biofuel production is over 50 years, supposing that the working time of human is 50 years.

Our objective is to clear the requirement for consideration to intergenerational ethics for biofuel production on the assumption sustainable development of the society from the perspective of anthropocentrism or environmentalism (Nash 1993). In this study, we discussed intergenerational ethics for biofuel production from the potential of secondary forests, growing on abandoned agricultural lands, to serve as sinks for carbon dioxide in above ground biomass and soils for 50 years. If the amount of sinking carbon dioxide of secondary forests is as much as primary forests in 50 years, there no issues about intergenerational ethics about biofuel production from the perspective of anthropocentrism.

A review of literature data showed the amount of the sinking carbon dioxide of secondary forests did not reach the primary forest's level in a time span of the about 50 years. It was clarified that there were the issues about intergenerational ethics about biofuel production, if the forest was not recovering from the viewpoint of the sinking carbon dioxide.

## **Comparison of total nitrogen and phosphorus in soil between the meadow and grazing land in Xilingol grassland in Inner Mongolia**

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It is widely accepted that serious degradation of grassland in Xilingol has been caused by grazing. Therefore, the land use has been converted from grazing land to the meadow in many areas of Xilingol in order to minimize the effects and maintain production by livestock. However, there is no study in regard to the effects of converting to the meadow on soil properties in Inner Mongolia. The objective in this study, therefore, was to compare total nitrogen and phosphorus in soil between the meadow and grazing land in Xilingol grassland in Inner Mongolia.

Three sites were selected as the study sites. Five sampling quadrats (1m x 1m) were randomly set in the meadow and grazing land in each site. Soil samples were taken at the soil surface (0-5cm) from each sampling quadrat on 16 and 17 July 2012. Each sample was analyzed for bulk density (g/cm<sup>3</sup>), total nitrogen (g/kg) and total phosphorus (g/kg). Two-way ANOVA was conducted for statistics.

The bulk density (g/cm<sup>3</sup>) in the grazing land (Ave 1.34) was significantly higher than in the meadow (Ave 1.26) (P<0.05). The total nitrogen (g/kg) in the grazing land (Ave 1.56) was significantly lower than in the meadow (Ave 1.85) (P<0.05). The total phosphorus (g/kg) in the meadow (Ave 0.20) was significantly lower than in the grazing land (Ave 0.24) (P<0.05).

It was considered that the higher bulk density in the grazing land could result from trampling of livestock in grazing land (Markus et al., 2007). The decrease in total nitrogen of the grazing land, indicated that cyanobacteria which fix nitrogen mainly in Inner Mongolia might be decreased by livestock trampling and feeding damage (Holst et al., 2009). The lower total phosphorus in the meadow suggested that phosphorus is not supplied in the meadow while it is supplied in the grazing land by excreta, although phosphorus decreases by depriving of plant and livestock in both of the meadow and grazing land. This result might indicate that the conversion from the grazing land to the meadow is not always effective on material cycle or movement in terms of grassland conservation. Further studies including phosphorus fertilization on the grassland are needed to evaluate the historical relationship between the decrease of phosphorus and the grassland degradation in this region.

## **Effects of Rice Husk Charcoal on the Growth and Yield of Rice, and Soil Physical Properties in a Paddy Field**

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Rice husk are used as soil conditioners and propagation material, but 36.5% of the husks are not used and burnt instead. Promotion of the reutilization of rice husks is needed for achieving a sustainable society through resource circulation. If there are other ways for reutilization of rice husks, we can increase the rate of utilization. Rice husk charcoal is carbonized biomass, namely biochar. Application of biochar improves soil physical properties and nutrient retention power of soils. In this study, we investigated the influence of application of rice husk charcoal on the growth and yield of rice and soil physical properties in a paddy field for establishing a cultivation method related to the effective use of rice husk for achieving sustainable agriculture.

Experiments were carried out in an experimental paddy field at the Agricultural and Forestry Research Center, University of Tsukuba in 2012. Rice husk charcoal (RHC) was applied at 20 kg, 200 kg and 2000 kg/10a, and rice husks (RH) were applied at 200 kg/10a to separate plots. Rice seedlings, cultivar 'Nipponbare', were transplanted with four seedlings per hill at 20 hills per m<sup>2</sup> on May 26<sup>th</sup>. Experiments were conducted in a randomized block design with three replications. Yield and yield components were measured using 10 hills per plot. Penetration resistance, three phases of soil, and maximum water capacity were measured at maturity.

Application of rice husk charcoal and rice husks increased LAI 56 days after planting (DAP) when compared with no-treatment plots (control). Plant length was highest in the 2000 kg/10 RHC plot. Plant length in the 200 kg/10a RHC plot and 200 kg/10a RH plot were also higher than the controls at 70 and 84 DAP. Rice yield in the 2000 kg/10a RHC plot increased 5% over the control. Although the number of grains per panicle increased with application of rice husk charcoal and rice husks, the percentage of ripened grains decreased in these plots. The number of panicles per unit area in the 2000 kg/10a RHC plot was 6% higher than the control. This shows that application of a large quantity of rice husk charcoal increases rice yield by increasing the number of panicles. On the other hand, one application of rice husk charcoal did not affect the soil physical properties. These results show a feasibility to achieve sustainable agriculture by applying large amounts of rice husk charcoal to the soil in paddy rice fields.

## The use of the color cue in host finding of *Ascogaster reticulata* Watanabe (Hymenoptera: Braconidae)

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Insect parasitoids are used as natural enemies in biological control of insect pests that cause various damages to plants or crops. Parasitoids are said to use several cues (e.g. visual, chemical, tactile stimuli) for host searching. Many studies on the searching behavior of parasitoids have focused on chemical cues, but several studies have shown that parasitoids also use visual cues. *Ascogaster reticulata* is an egg-larval parasitoid of *Adoxophyes honmai* (Lepidoptera: Tortricidae), known as a pest of tea plants. We conducted several experiments on color learning in *A. reticulata* in order to understand details of host searching behavior of this parasitoid.

In this study, we tested whether females of *A. reticulata* can associate color cues with the presence of the host. The female wasp was trained to lay eggs on the host egg mass placed on a piece of paper (1x2 cm) of a certain color. After training, parasitoids were presented with two pieces of paper including the color used for training and new colors in a choice test without host egg masses. Results showed that *A. reticulata* can distinguish different color combinations and significantly chose blue (vs. green) and black (vs. green). This study also suggests that the learning ability of *A. reticulata* may differ with color combinations. Based on these results, *A. reticulata* appears to use color as a cue in some situations to increase host searching efficiency in nature. That is, we suggest that *A. reticulata* may use visual stimuli (e.g. color) as well as chemical stimuli (e.g. extracts of egg, wing scale) as a cue for host location.

## Development of a New Rice Beverage by Improving the Physical Stability of Rice Slurry

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Rice has been used a staple food in Japan since ancient times. However, the consumption of rice has recently decreased. A reduction in the self-sufficiency rate of Japanese food is a serious problem, and Japan is obligated ensure the future reliability of the food supply. A reliable rice supply can mitigate the observed reduction, and an increase in the level of rice consumption is desired. These improvements can be achieved by establishing new demands for rice, such as rice flour and bioethanol.

Thus, “rice slurry” was developed as new liquid food material. Rice slurry is made from brown rice with wet stone milling. Rice slurry can be used to make processed food for which rice flour is unsuitable, such as pudding, ice cream, and beverages. Brown rice contains multiple functional ingredients: GABA, resistant starch,  $\gamma$ -oryzanol, and tocotrienol. Non-heated raw brown rice is ideal for health because these ingredients can be lost by heat. However, raw brown rice is unfit for consumption because it is too hard to be chewed. Thus, “rice milk”, a beverage made from rice slurry, was developed as a way to ingest raw rice. However, the rice particles in the rice slurry settled to the bottom when the slurry was allowed to rest for several hours. The Stokes’s law shows that two conditions, overly fine particles or an increase in the viscosity, suppress the sedimentation velocity of the particles. The purpose of this study was to investigate the milling conditions to generate fine rice particles and the effects of a thickener to improve the physical stability. In addition, the possibility of developing rice milk for human consumption was investigated through a sensory evaluation.

A separated milling method was established, which reduced the particle size of the rice slurry to less than 20  $\mu\text{m}$ . This size ensured that the slurry was suitable for consumption. Moreover, the effects of a thickener to improve the physical stability were investigated. The sedimentation velocity decreased exponentially with the viscosity and was steady at more 80  $\text{mPa}\cdot\text{s}$  when the concentration of xanthan gum exceeded 0.1 wt%. A sensory evaluation indicated a favorable rate of 55.6% for the rice slurry containing 0.3 wt% xanthan gum. The characteristics of “thickness” and “sweetness” significantly impacted the sensory evaluation.

## **Comprehensive Evaluation Method for the Effective Control of Rice Husk Combustion**

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This study proposes a comprehensive evaluation method for rice husk combustion to obtain alternative energy sources in rural areas by utilizing unused rice husk as agricultural residue. Rice husk burner produces not only heating but also smoked rice husk, which is worth as fertilizer. In the conventional study, there are some evaluations about energy efficiency of rice husk combustion. However, low environmental impact and high economic efficiency are also important for diffusion of the rice husk burner in rural areas. Therefore, it is essential to evaluate rice husk combustion comprehensively in order to maximize benefit obtained by rice husk burner. By establishing this comprehensive evaluation method, it is possible to offer useful information at introduction of biomass energy and technology development.

A comprehensive evaluation method was constructed by three points of view, energy efficiency, environmental impact, and economical efficiency. An inventory analysis was conducted to estimate inputs and outputs of rice husk burner's utilization. And the inventory data was collected by the combustion experiment of the rice husk burner developed by Kaneko Agricultural Machinery (Saitama, Japan). The combustion experiment was conducted in the condition that amount of supplied rice husk was the range from 13.1 kg/h to 20.3 kg/h. The material flow and the energy flow of the rice husk combustion were analyzed based on the result of the combustion experiment. LIME2 (Life-cycle Impact assessment Method based on Endpoint modeling) was used for environmental impact assessment. Evaluation of economical efficiency was estimated by adding value of smoked rice husk to value of heating.

Results revealed that when the amount of supplied rice husk was 15.5 kg/h, comprehensive evaluation value was the highest, as the optimal combustion, because the rice husk was burned while producing a valuable smoked rice husk and small quantity of harmful substance, maintaining high energy efficiency. On the other hand, it was shown that comprehensive evaluation values of combustion were low because of bad environmental effect and bad economical efficiency, even if they showed high energy efficiency. It was clarified that the comprehensive evaluation method contributes for optimal design and control of biomass burner to achieve high energy efficiency, low environmental impact, and high economical efficiency simultaneously.

## Host Plants of Herbivorous Insect *Mythimna separata* affect its Larval Parasitoid *Cotesia kariyai*

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Previous studies show that host plant species of herbivore affect the success rate of parasitism by its parasitoid wasps or flies. However, this phenomenon is known only in limited species, such as tiger moth, parsnip webworm. In this study, we demonstrated the effects of host plant species of rice armyworm *Mythimna separata* (Lepidoptera: Noctuidae) on the successful parasitism rate by the larval endoparasitoid *Cotesia kariyai* (Hymenoptera: Braconidae).

The rice armyworm *Mythimna separata* is a pest of corn, rice and some other poaceous plants. Rice armyworm is a single host species of *C. kariyai* and the wasp can parasitize 2-6 instar larvae. In this study, we used five plant species, i.e., corn, rice, barley, kidney beans and Japanese radish as food for armyworm. Corn, rice and barley are usual host plants for rice armyworm and both kidney beans and J. radish are unusual ones.

At the first, we gave five plant species for rice armyworm individually from 5th instar until pupation to examine effects of host plant species on the survival rate of rice armyworm. Then we recorded survival rate of each cases. Next, we gave five plant species for parasitized rice armyworm individually from 5th instar until pupation of host larvae to examine the effects of host plant species on the success rate of parasitism by *C. kariyai*. Then we recorded survival rate of both armyworm and *C. kariyai*.

As the result, survival rate of rice armyworm was affected by its food plants (corn > rice > barley > kidney beans > J. radish). On the other hand, survival rate of parasitized rice armyworm with J. radish was higher than any other plant species. These results suggest that J. radish is not an optimal food for normal moth, but it protect host larvae from the risk of death by parasitoids.



## Structure and antitumor activities of polysaccharides from soybean curd residue fermented by *Morchella esculenta*

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Soybean curd residue (SCR) is the main surplus material from soybean products, and it is often regarded as waste. It is a loose material consisting of nutrients, including protein, fibre, minerals and fat. Recently, more attention has been focused on the utilization of SCR to produce value added products in food industry, such as soluble dietary fibre, polysaccharides, antioxidant material and protein. The nutrients could allow them to be used as high quality media for edible fungi fermentation.

The mushroom *Morchella esculenta* (*M. esculenta*) has long been known for their medicinal properties. Recently, many reports on *M. esculenta* have been published concerning the health-promoting effects, including antioxidant activity hepatoprotective activity, antimicrobial properties and antitumor effect.

The level of the polysaccharides' bioactivities is closely related to their chemical composition, molecular weight, branching, and chain conformation. In this study, Structure and antitumor activities of polysaccharides from soybean curd residue (SCR) fermented by *M. esculenta* were investigated. The crude polysaccharide fraction were applied to a DEAE *Sephadex A-50* chromatography (OH-form) column (2.5 cm×40 cm) and eluted with different concentration of NaCl (0; 0.01; 0.10; 0.50 M) at a flow rate of 1.25 ml/min. The obtained fractions were combined based on the total sugar content quantified by the phenol sulfuric acid method. The relevant fractions were concentrated and further loaded on to a *Sephadex LH-20* gel permeation column (2.5 cm×100 cm) with water as the mobile phase.

The characteristic of crude and purified polysaccharides were studied by GC-MS and FTIR. Moreover, the antitumor and immunity activity of the polysaccharides will be studied using the cell of *DLD-1*, *HepG2*, *Hela* and *RAW264.7*. SCR fermented by *M. esculenta* to produce polysaccharides was a good choice for the reuse of SCR and it could be used to produce antioxidants for food, pharmaceutical and cosmetics.

## **Antioxidant Activity in Vitro and Antitumor Potential of Extracts from *Actinidia kolomikta* Leaf and Root**

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*Actinidia kolomikta*, which is a species of deciduous dioecious woody vines in the genus *Actinidia*, has been a wild plant that grows in the northern part of Indochina and Eastern Asiatic region. Specific *Actinidia* species has a long history of its health-promoting and therapeutic effects. Molecular mechanisms and pathways underlying these effects have not been studied.

In the present study, we tried to examine various activities of leaf extract (AK-LW) and root extract (AK-RW and AK-RE) of *Actinidia kolomikta*. Phytochemicals (including total phenols and total flavonoids) and chemical antioxidant activities (including DPPH radical scavenging activity, ABTS radical scavenging activity, ferrous metal ions chelating activity and reducing power) were determined respectively. Ultra-violet spectrum and infrared spectrum were also investigated. Anti-proliferation activity on human hepatocellular carcinoma cell line (HepG2), human cervical cancer cell line (Hela), human colon cell line (DLD-1) and human lung cancer cell line (A549) were assayed by WST-8 method using in vitro cell culture system. The results showed that different extracts exhibited considerable variations in their phytochemicals, as well as chemical and antioxidant activities. We also found that different fractions were supposed to possess selective anti-proliferative potent. The data suggested that *Actinidia kolomikta* leaves and roots may offer natural and economic sources for antioxidant and anti-cancer treatment.

# Hydrogen-conversion oriented ammonia production by anaerobic digestion: Effect of partial heating modules

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## 1. Introduction

Ammonia has been taken as a good storage medium for hydrogen for decades and is a fundamental raw material for industry and agriculture. However, over 80 % ammonia used at present is produced by the synthetic process by fossil fuels (mainly natural gas and coal), which intensifies the energy crisis. In fact, ammonia is able to be recovered from the protein-rich waste/wastewater by anaerobic digestion.

In this work, a partial heater was used to develop an ammonia production and volatilization system by a fixed bed reactor without alkali addition. The objective of this work is to (1) enhance the ammonia production and its volatilization by a partial heater; (2) investigate the effect of heating modules on ammonia production.

## 2. Materials and methods

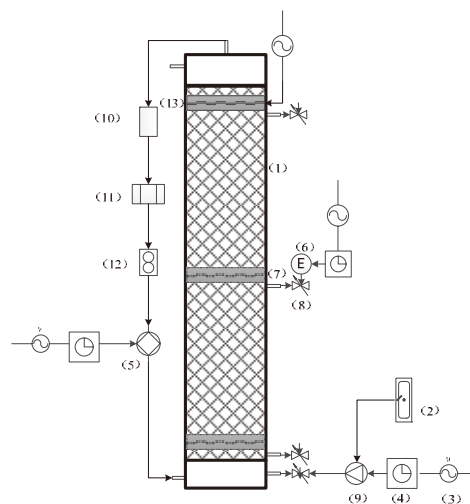
The synthetic wastewater was made by the protein powder with total nitrogen 1009-N mg/L. A fixed bed reactor was employed (Fig.1). A partial heater was set up at the top (THSR) compared to the control (SR) without a heater. Another two modules MHSR and BHSR, whose heater were set up at the middle and bottom of the reactor, respectively, were used to investigate the effect of heating modules on the production and volatilization of ammonia.

Continuous operations were conducted with HRT=0.9 d at 35 °C for all the runs.

## 3. Results and discussion

The average total ammonia nitrogen (TAN) for THSR was 778 mg/L, compared to 744 mg/L for the control. The nitrogen removal rate for THSR was 6-fold of that of the control. The results indicated that ammonia release was enhanced by the partial heating at the the top of the reactor.

For the varied heating modules, TAN in MHSR was a little higher, however, the nitrogen removal rate was 26.7 % of that of THSR. TAN and the nitrogen removal rate in BHSR were similar to that of the THSR. THSR and BHSR were considered to be effective on the ammonia production and especially on its volatilization.



(1)Fixed bed reactor; (2)Wastewater reservoir; (3)AC source; (4)Timer; (5)Air pump; (6)Magnetic valve; (7)Sample port; (8)Valve; (9)Peristaltic pump; (10) Ammonia capture; (11)Gas collection; (12)Flow meter; (13)Partial heater

Fig.1. Ammonia production system by fixed bed reactor

# Functional Analysis of Host Plant Odors in the Regulation of Ovipositional Behavior in the Yellow Peach Moth *Conogethes punctiferalis*

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The yellow peach moth *Conogethes punctiferalis* (Lepidoptera: Crambidae) is a serious polyphagous pest throughout the Asian and Australian regions. Host plant odors induce oviposition of mated yellow peach moth females (Honda and Matsumoto 1984), but the detailed functions of the odors in a series of oviposition behavioral responses are still unclear. Therefore, in this study, the complete process leading to oviposition was explored in a wind tunnel and divided into five behavioral components; take off flight from release point, half way flight, hovering close to source, landing and egg-laying. Subsequently, the effects of host plant odors on these behavioral components were analyzed by providing continuous or transient odor stimuli during each behavioral component. Plant odors accelerated the take off flight and increased orientation to stimulus source in hovering and landing. These odors also stimulated females to lay more eggs resulting in a significantly longer time for egg-laying with no decrease in the time necessary to lay each egg. The absence of plant odors delayed take off flight and interrupted the subsequent behavioral responses. These results indicate the host plant stimuli induce orientation by flight and stimulate egg-laying, and may also independently regulate each component of the behavioral responses by the central nervous system for oviposition in the yellow peach moth.

## Prediction of Aerobic Plate Count on Beef Surface Using Fluorescence Fingerprint via Optical Fiber

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Even has bad reputation as dangerous, raw dish meat still popular in some part of the globe. In 2011, a food borne outbreak occurs in Japan, caused by raw dish meat called yukke. Microorganism content found as poisoning agent. Thus, microorganism monitoring on meat is important. In other hand, conventional microorganism monitoring method for food is time consuming and laborious. Spectroscopy is a good technique to solve this problem which is rapid and non-destructive analytical method.

Fluorescence spectroscopy has better sensitivity, selectivity and rapidity than absorption spectroscopy. The fluorescence fingerprint (FF) is a set of fluorescence spectra acquired at consecutive excitation wavelengths. FF has been used as a non-destructive technique for both qualitative and quantitative measurement (Fujita et al., 2010; Kokawa et al., 2012; Shibata et al., 2011). Therefore, by use of beef, our objective is to develop an estimation method of aerobic bacteria population on the surface by FF measurement through an optical fiber and multivariate analysis.

Meat samples were purchased from a local store and transported NFRI laboratory (Ibaraki, Japan)., Samples were stored in an incubator at 15°C and analyzed after 12, 24, 36, 48, 60 and 72 hours of storage. FF as explanation variable were obtained by fluorescence spectrophotometer F7000 (Hitachi-High-Technologies, Japan) coupled with optical fiber. The PLS regression model was developed to estimates an aerobic plate count (APC) from FF.

The information on the various fluorophores on the surface of beef was used comprehensively, and appropriate estimation accuracy ( $R^2=0.975$ ; RMSECV = 0.849) was achieved by PLSR. The PLSR model then validated with a new dataset of FF. Validation shows high prediction with  $R^2$  validation and RMSEP are 0.81271 and 0.88094, respectively.

High related coefficient comes from several wavelength regions related to three kind of intrinsic fluorophores. According to fluorophores library, those peaks can be attributed to NAD(P)H, Porphyrins, and Flavin. The proposed method can expect to improve meat monitoring technology which can achieve rapid, nondestructive, and continuous measurement.

## **Women Contribution about Community Improvement**

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It is said that the rural development should be done immediately and required to use regional resource fully. It is also said that rural situation is more and more serious holding problems and it is useful to solve problems in rural society firstly and show the primary factor of solving it. Today, community activities advance making use of women power in rural area and are paid attention in Japan. Although it is difficult to measure the effect quantitatively, has a lot of effect. Women starting a business is for example. So, I want to take up women role for rural development in paddy field.

## Effect of Sperm Pre-treatment with Triton X-100 on *In Vitro* Porcine Embryo Production Following ICSI Using Freeze-Dried Sperm

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Freeze-drying preservation of boar sperm has been developed with a major concern because it is known that if fertilization-competent spermatozoa could be stored in a freeze-dried (FD) state, the cost for maintenance and shipping could be enormously reduced. The successful decondensation of sperm nuclear after being injected into the oocytes is a prerequisite factor for the following events of zygote activation. The pre-treatment of frozen-thawed sperm with Triton X-100 (TX) and dithiothreitol for disrupting sperm membrane has been applied to improve the fertility of ICSI-oocytes with the certain findings. Although dithiothreitol has been reported to cause the artificial decondensation *in vitro* in mammal sperm, it apparently causes a increase in the sperm DNA damage. Therefore, in this study, only TX treatment was used to investigate its effect on fertilization, cleavage and *in vitro* embryonic development of IVM oocytes injected with resulting FD sperm. Boar sperm were centrifuged to remove seminal plasma and re-suspended in basic freeze-drying media containing 0 or 15 mM trehalose, freeze-dried for 39 h and stored at 4°C. FD sperm were rehydrated and centrifuged, then, sonicated to isolate the heads from their tails and treated with 0, 0.5% or 1.0% TX for 10 min at room temperature. Treated sperm were washed to remove TX before being injected to *in vitro* mature oocytes. Sham injection was conducted as control. Fertilization status at 10 h after injection (Exp 1) and subsequent development after 6 day *in vitro* culture (Exp 2) were carried out. When FD sperm were injected to *in vitro* mature oocytes and stimulated electrically, the percentages of oocytes displaying two polar bodies and two pronuclei (considered as normal fertilization) were not different in all sperm-injected groups (6 groups). However, the rate was significantly lower in sham injection group ( $P < 0.001$ , by ANOVA-Tukey). In experiment 2, there was no difference in terms of the rate of cleaved, 4-cell stage, fragmented embryos on day 2 of *in vitro* culture in all groups. Blastocyst formation rate of oocytes injected with FD sperm pre-treated TX at 0.5% in 15 mM trehalose group was significantly higher than that in no TX-treated group ( $P < 0.05$ ), while no difference was observed in other groups. Moreover, the blastocyst quality measured by mean cell number was not different in all groups. In conclusion, the present study showed that boar FD sperm treated with TX at 0.5% increased the development of embryos to blastocyst stage. This finding suggests for further experiments about the mechanism underlying effect of TX, the dynamic changes of sperm-born oocyte activating factor after TX treatment.



## **Analysis of Saccharification Properties of Rice Slurry for Brewing Rice Wine**

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Decrease in consumption of “Sake” becomes the problem because of avoid alcohol in a young generation and depopulation. Number of sake brewery fall off and the local industrial decline is concerned with that. Development of new type of Sake is important to increase consumption of Sake.

Sake is made from rice. The processes are mainly rice polishing, steaming, saccharification, ferment, and refined moromi. Rice bran and sake lees are removed in these processes but they are rich to nutrient and functional ingredient. Therefore, it is expected that sake including rice bran and sake lees becomes nutritious new type of sake. But there are two problems. First, saccharification takes time because surface of brown rice is hard. Second, texture of sake is bad due to cohesion and sedimentation of moromi. Miniaturization process, “wet milling” was proposed to solve these problems. “Rice slurry” is liquid food material which applied wet milling to brown rice. Reactive and texture of sake improvement is expected by using wet milling.

Saccharification is to hydrolyze starch to glucose. It is very important process. The reason is that yeast cannot carry out alcohol fermentation from starch. It is thought that the saccharification properties of the rice slurry are different to rice because rice slurry is liquid. Therefore, the purpose of this research is to make clear the saccharification properties of the rice slurry.

Starch is saccharified by the saccharifying enzyme. The reaction rate of the saccharifying enzyme is represented with Michaelis Menten’s equation. This equation indicates the relationship between substrate concentration and reaction rate. Kinetic analysis of the saccharification of the rice slurry is held by using Michaelis Menten’s equation. The Saccharification rate is affected with three factors: saccharifying enzyme concentration, pH and temperature. The change of the saccharification rate is obtained with changing factors stepwisely. When influence of factors becomes clear, control and optimization of saccharification of the rice slurry are available.

## Evaluation of the inter-species migratory ability of exogenous gonadal germ cells collected from endangered birds using a germ cell competition method

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Conservation of animal genetic resources is important to maintain genetic diversity on earth. The necessity to maintain genetic diversity is particularly acute in avian, where 13% of known species are classified as endangered. There is an apparent necessity to develop a system to conserve and retrieve endangered avian species. It has been suggested that inter-species germline chimera technology, using poultry as germ cell recipients, can be applied to secure endangered birds. For the production of inter-species germ line chimeras, exogenous germ cells need to migrate into gonads of recipient embryos. The aim of present experiment, therefore, was to evaluate the inter-species migratory ability of exogenous gonadal germ cells (GGCs) collected from endangered birds using a germ cell competition method.

Under inter-species germ cell transfer condition, the migration index of GGCs (Migratory ability of GGCs /Migratory ability of PGCs) isolated from *Geronticus eremita* embryos at stage 26-33, 34-36 and 37-39 were estimated to be  $0.38 \pm 0.14$ ,  $0.06 \pm 0.04$  and  $0.04 \pm 0.01$ , respectively ( $P < 0.05$ ). Under intra-species condition, the migration index of GGCs isolated from left gonad of White Leghorn (WL) embryos at stage 26-33, 34-36, 37-39, 40-42 and 43-45 were estimated to be  $0.22 \pm 0.04$ ,  $0.19 \pm 0.04$ ,  $0.12 \pm 0.04$ ,  $0.03 \pm 0.01$  and  $0.03 \pm 0.01$ , respectively ( $P < 0.05$ ). The migration index of GGCs isolated from WL and *Geronticus eremita* embryos did not differ significantly ( $P > 0.05$ ). These results indicate that GGCs from *Geronticus eremita* partly share the common migration system with chick PGCs.

Future study should be directed toward examining the developmental ability of GGCs collected from endangered birds under inter-species condition.

## Isolation of Gonadal Germ Cells from Gonad of Developing Avian Embryos by PBS[-] Methods

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One thousand two hundred forty out of 10,064 known avian species are listed as endangered according to the International Union for the Conservation of Nature Red List of Threatened Species (IUCN 2012). Thus, conservation of avian genetic resources is critical for the maintenance of avian genetic diversity. In avian species, technologies of producing germ-line chimeras have been developed by using gonadal germ cells (GGCs) collected from early chick embryos. The handling of GGCs after trypsin digestion, however, is difficult due to the presence of overwhelming number of contaminating somatic cells. In our previous study, spontaneous GGCs discharged from gonad into Phosphate Buffered Saline without containing  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  (PBS[-]) was observed when the gonad recovered from 7-day-old chick embryo were incubated in PBS[-] (Nakajima *et al.*, 2011). In the present study, attempts were made to collect GGCs from embryonic gonad other than 7-day-old chick embryos.

In experiment 1, developing left gonad recovered from 5-, 7-, 9-day-old White Leghorn (WL) embryo was incubated for 1 hour in PBS[-] at 37.8 °C for 1 hour. Number of spontaneously discharged GGCs from gonad of 5-, 7-, 9-day-old WL embryo into PBS[-] was  $262.1 \pm 56.7$ ,  $671.7 \pm 137.8$  and  $2,027 \pm 567.7$ , respectively.

In experiment 2, left gonad recovered from developmental stage (St.) (Hamburger and Hamilton, 1951) 31, 34, 36 and 37 of *Ciconia boyciana* embryos, and St. 30 of *Geronticus eremita* embryo was incubated for 1 hour in PBS[-] at 37.8 °C for 1 hour. Number of spontaneously discharged GGCs from gonad of St. 31, 34, 36, and 37 of *Ciconia boyciana* embryo and St. 30 of *Geronticus eremita* embryo into PBS[-] was 60, 260, 1,100, 60 and 160, respectively.

In conclusion, it was shown that the PBS[-] method can be applied for collecting GGCs from developing avian embryos.

## **Sterilize by Heating of Rice Slurry for Lactic Fermentation**

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Rice slurry is developed as a new liquid food material. It is produced from brown rice by stone mill. Now, in Japan, to increase consumption of rice, the development of a new processed rice food become popular. For example breads, sweets and noodles, which were made from rice flour. But, although the use of rice flour is same it of flour, the price of rice flour is higher than it of flour. So, its consumption failed to increase as much as expected. Then we developed a new processed rice food, rice slurry. Rice slurry is liquid, so it will be processed various foods that rice flour cannot be.

Lactic fermentation has some advantages. Lactic fermentation is a reaction that lactic acid bacterium make lactic acid from glucose. By lactic fermentation, lactic acid in a food is increased and the pH value of a food is decreased. Then, the food preservation and safety improve. On the other hand, functionalities of lactic acid bacterium attract notice recently. For example, it is intestine regulating function and blood pressure lowering action.

Rice slurry is that brown rice is milled without heating, so it is necessary for rice slurry processing to sterilize by heating. When rice slurry is heated, gelatinization of the starch occurs. Gelatinization is the state that the bonding of molecules in the starch becomes weaker. The state of the starch can have an effect on lactic fermentation. In the results so far, it is clearly that the heating time has effects on gelatinization of rice slurry. Gelatinization degree of rice slurry can be measured by viscosity. Viscosity of heated rice slurry is enhanced until one heating time. After one time, viscosity is drop. In short, the condition of sterilize by heating will have effect on lactic fermentation. So, it is necessary to establish the best way to sterilize by heating of rice slurry for lactic fermentation.

When the best way to sterilize by heating of rice slurry for lactic fermentation is established, rice slurry can be widely applicable for a new processed rice food. For example, a lactic fermenting beverage, a cheese like food, and a yogurt like food. These foods have some advantages. First, these are lower allergen than dairy products. So, even allergic people can eat like dairy products. Next, these are will have lower calories than dairy products. So, the people who have dietary restrictions due to an illness and so on can eat like dairy products. In short, to develop new lactic acid fermentation rice foods leads to improvement in quality of such people's food life.

## Nitrogen Efficiency of Two Composts on the Growth and Yield of Potato (*Solanum tuberosum*) in an Andosol Soil

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Farmyard manure and composts are used as nitrogen (N) sources to replace inorganic nitrogen (IN) in current farming systems, but their efficiencies in terms of N availability to potato crops are not clear. Without this knowledge, composts can be over or under applied and lead to poor yield and nitrate (NO<sub>3</sub><sup>-</sup>) leaching in large scale farming or unreliable results in potato experiments. This research aimed to evaluate the efficiency of N in different composts as compared to IN in terms of growth and yield of potato in an Andosol soil.

Experiments were carried out at the experimental farm of the Agriculture and Forestry Research Center, University of Tsukuba from March to July, 2012. Four treatments including swine manure (SM, 1.8% N), poultry manure (PM, 2.5% N), ammonium sulphate (21% N) and a control (C) with no application were laid out in a randomized block design with three replications. Applications were set at 120 kg N/ha. Plant lengths, SPAD and LAI were measured every 10 days starting from 23 days after planting (DAP). Leaf petiole sap was measured and analyzed for plant nitrate N (NO<sub>3</sub><sup>-</sup> N). Tubers were harvested at 94 DAP and yield (marketable and non-marketable) and yield components were measured and analyzed. Efficiencies of the composts were calculated using the following formula: (SM or PM – C) / (IN – C) \* 100.

SM showed slightly higher plant lengths when compared to IN, but with no significant difference, while PM plant lengths were only 50% of the IN plot. This was similar for LAI values only on 33 and 43 DAPs. Petiole NO<sub>3</sub>- N levels in both SM and PM were low when compared to IN. SM produced a high aboveground weight that was greater than 100% more than in the IN plot. Marketable tuber yield was only 50% in the compost plots, but the tubers had higher non-marketable weights. Total tuber weight was not significantly different in all plots except for the control. Starch percent based on tuber fresh weight was significantly higher in the SM plot at 87.2% compared to 76.6%, 62.1% and 32.1% in the IN, PM and control plots, respectively.

SM showed comparable efficiencies to the IN plot in plant lengths, LAI, aboveground biomass and starch levels but not in marketable tuber yield. PM effects were approximately 50% in almost all measured parameters when compared to the IN plot. Marketable yield of both compost treatments were 50% of those produced in the IN plot. The amount of SM and PM must double to make it comparable to IN in terms of plant available N.

## Cellulose- and Xylan-Degrading Potentials and Phylogenetic Diversity of Cellulolytic Bacteria Isolated from the Rumen

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The rumen microbes such as bacteria, protozoa and fungi degrade plant fiber and supply nutrients to host animals. Bacteria are the most numerous of these microorganisms and play a major role in the biological degradation of cellulosic plant materials such as cellulose and hemicelluloses. In order to understand the mechanisms of cellulose degradation in the rumen, many cellulose- and hemicellulose-degrading bacteria have been isolated from the rumen and their properties of cellulose digestion have been characterized. Recent molecular techniques show that the majority (77%) of fiber-associated community members are uncultured bacteria, which had low similarity (<97%) with 16S rDNA sequences of known bacteria. Therefore, this study attempted to isolate the cellulolytic bacteria from the rumen using new media, an agar medium (ACMBM) and a gellan gum medium (GCMBM), containing azo-carboxymethylcellulose (azo-CMC) as a carbon source, and determined their degradability of cellulose filter paper, azo-CMC and azo-xylan.

From the media, 129 isolates were collected, of which the numbers of isolates showed filter-paperase, carboxymethylcellulase and xylanase activities were 51, 108 and 118, respectively. The isolates were classified into 6 phyla, into 14 known genera and unclassified genera. Approximately 18.6% of the total isolates belonged to unclassified genera showed (<97%) sequence similarity with known bacterial species. Therefore, these isolates are presumed to be novel species of unclassified genera. Moreover, it was indicated that the bacterial composition of ACMBM was significantly different from that of GCMBM at the genus level ( $P = 0.01$ ). Isolates showing cellulolytic activity were obtained from both media. GCMBM significantly supported growth of more isolates showing higher CMCase activity than ACMBM ( $P < 0.05$ ). The numbers of isolates showing high xylan degrading activity were almost same in both media. This study demonstrates the cellulolytic bacteria could be isolated by the modified culture media and provides a better understanding of bacterial physiology of cellulose digestion in the rumen.



# PCR-RFLP Patterns of COI Gene Established for Accurate and Rapid Identification of *Bactrocera invadens* and *Ceratitis* spp Infesting Sweet oranges in Nigeria

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Tephritid fruit flies are considered an insect group of major economic significance in agriculture. They attack different types of commercial and wild fruits and vegetables, causing considerable damage to agricultural crops. In addition, few insects have a greater impact on international market and world trade in agricultural produce than tephritid fruit flies. Some of them are serious quarantine pests and constitute a major obstacle to the movement of tropical fruits in the world. Horticulture plays a major role in the economy of many nations as a source of income, ensure food security, and create jobs. Citrus is the most widely grown fruit crop in Nigeria; however, tephritid fruit flies attack on citrus cause economic yield losses and have been identified as the major constraint to citrus production in Nigeria. Many species of tephritid fruit flies that appear morphologically similar differ in their biological behavior and thus have quite different potential impacts on food production and implications for biosecurity and market access. At quarantine checkpoints, the immature fruit flies are the most likely life stages to be intercepted in food produce. Moreover, in host fruit surveys immatures of different genera have been found to share the same fruit and they lack morphological diagnostic features. These limitations have led taxonomists and quarantine officials to seek viable alternative ways of fruit fly identification including the use of molecular markers such as PCR-RFLP of COI gene. In order to develop and establish an alternative method of fruit flies identification that is reliable and rapid, we extracted genomic DNA from citrus fruit flies in Nigeria, amplified the COI gene, identified and constructed for the first time PCR-RFLP patterns of COI gene for accurate and rapid diagnosis of the different species. The different species were reliably identified and separated on 2% agarose gel using three restriction enzymes. The invasive tephritid *Bactrocera invadens*, *Ceratitis anonae*, and a cryptic *Ceratitis* sp were identified as key sweet orange fruit flies in Nigeria. The identification was confirmed by sequencing COI gene and comparing with sequences from GenBank. The sequences of all analyzed *B. invadens* and *C. anonae* showed 100% similarities with their respective species sequences from GenBank. However, the taxonomic status of the cryptic *Ceratitis* sp is yet to be determined since it showed 99.9% similarity with *C. anonae* but produced different fragment lengths with one of the three restriction enzymes used to construct the PCR-RFLP of the COI gene. The identification is very rapid, accurate and reliable, and without many difficulties. The PCR-RFLP patterns of COI gene so constructed for accurate and rapid identification and separation of *B. invadens* and *C. spp* is the first of its kind in Nigeria and Africa. The established identification method in effect will enhance easy monitoring and decision making regarding fruit fly infestation in domestic movement of fruits and vegetables, maintain international market access for Nigerian producers, and protect Nigerian borders from exotic fruit fly incursion.



## **Feasibility Study on Oil Recovery System for Organic Wastewater of Food Processing**

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Organic wastewater that contains food fat and oil drained from food restaurant or food factory causes clogging of sewerage pipe, and water pollution. The amount of waste from animal oil is about 0.4 million ton and vegetable fat about 0.2 million ton that recover and reuse in Japan every year. Potential of recovering rest of the fat has  $9.07 \times 10^3$  TJ of maximum heat energy, 0.628 million ton of CO<sub>2</sub> reduction capability and 17,900 million yen of economic gain effect. It was examined that recovery fat could expect as effective energy with low discharge CO<sub>2</sub> compare to fossil fuel, and fat recovery have the possibility that can reduce various burdens while treating the wastewater. The fat recovery equipment has the potentiality to separate and recovery fat from the wastewater and could widely diffused in food factories and restaurants.

The purpose of this research is to clear how oil separating affect environment and economic by examination of material and energy flow and the treatment capacity of wastewater treatment system with fat recovery equipment in food processing factory (Naoetsu-Yushi Co. Ltd.: Higashi-nakajima, Joetsu, Niigata, Japan). Over 94.9% of removal ratio for n-hexane extract content was measured using the oil recovery equipment, and the wastewater treatment plant showed high performance of purification after installing the oil recovery equipment. It was clarified that wastewater and energy except for gas and emitted heat from steam boiler tank were effectively utilized in the food processing factory. Construction cost for waste water treatment system from 100 million yen (1 million US\$) to 220 million yen (2.2 million US\$) was decreased to about 1/3 to 1/4 by introducing the fat recovery equipment (14 million yen, 0.14 million US\$).

From the above results, it was proved that an oil recovery system from wastewater not only reduced the load of waste water treatment plant including sewerage but is one of the effective method for resource recycling, energy utilization and economic efficiency.

## Innovation of Living Mulch Cultivation using Aquatic Plants in a Paddy Rice Field

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Cultivation systems using living mulch have an advantage for weed suppression, prevention of soil erosion, improving soil fertility and other benefits. Cultivation systems are commonly used in upland fields, but there is no usage of living mulch in paddy rice fields. Therefore, we tried to develop a polyculture system using living mulch in a paddy rice field for promoting sustainable agriculture.

Experiments were conducted at the Agriculture and Forestry Research Center during 2009-2012. Rice cultivar; cv. Akamai was transplanted at spacings of 30 × 15 cm except in 2011 (15 × 25 cm). *Spirodela polyrhiza* Schield, *Lemna aoukikusa* Beppu et Murata and water hyacinth *Eichhornia crassipes* were used as living mulch and rice bran, and buckwheat hull and paper mulch as non-living mulch. Hand weeding with no treatment was used as a control. Living and non-living mulches were applied in plot experiments on 7 days after transplanting (DAT) except the paper mulch which was applied on 0 DAT. Inoculation rates of *Spirodela* were 100, 75, 50 and 25% of the surface area. Inoculation rate of *Lemna* was 75% and 12 plants/m<sup>2</sup> for water hyacinth. Experiments were conducted in a randomized block design with three replications. Plant length, stem number, SPAD, LAI, cumulative solar radiation, number and dry weight of weeds, water and soil temperatures, and yield and yield components of rice were measured.

Inoculation of *Spirodela* at 100% coverage reduced rice growth during the early stage, but growth recovered. *Spirodela* biomass at 28 DAT was negatively correlated to stem number. Number of weeds during growing period was reduced with the inoculation of *Spirodela*. Accumulated solar radiation was positively correlated to weed numbers during the growing season and at rice harvest, and to accumulated soil temperature. Although living mulch reduced the number and dry weight weeds, it couldn't inhibit the growth of the perennial weed *Eleocharis kuroguwai*. Brown rice yields in living mulch plots were higher than or equal to that of controls with an increase in rice panicle numbers and grain numbers.

## Induction of Tea Leaves treated with *Adoxophyes honmai* Reproductive Organs to Arrest the Egg-Larval Parasitoid *Ascogaster reticulata*

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Biological control, as one of the approaches to integrated pest management (IPM), has been shown to be an effective pest control measure to limit the growth of pest populations. Natural enemies are fundamental for biological control. Parasitoids, commonly known as natural enemies of various pest insects, have an immature life stage that develops on or within a single insect host. They locate their hosts by using not only kairomones from their hosts, but also synomones released by herbivore-damaged plants. Induction of odors from plants after herbivore damage in tritrophic interactions may vary, depending on the plant and the herbivore species. Better understanding of tritrophic interactions can enhance the efficacy of biological control.

Tea, *Camellia sinensis* (L.) O. Kuntze, is a major plantation crop for the economies of several undeveloped and developing countries in Asia and Africa, including Japan and Thailand. All parts of the plant are fed on by at least one pest species. Among leaf-feeders, tortricid species are economically important pests of tea plantations. Of these, *Adoxophyes honmai* Yasuda (Lipidoptera: Tortricidae), is a major pest of tea in Japan. In order to avoid residue pesticides on the tea leaves, use of pesticides is controlled. Therefore, alternative methods for controlling tortricid species are needed. *Ascogaster reticulata* Watanabe (Hymenoptera: Braconidae) is a solitary egg-larval parasitoid of several tortricid species, including *A. honmai*. The relationships between herbivore-induced plants and parasitoids receive attention as well. An interesting phenomenon is that some plant species can respond to the first step of herbivore attack for laying eggs on host plants as indirect defense. It is utilized by parasitoids to find their hosts. In these studies, we focused on the responses of tea plants infested with host egg masses and the effect of the reproductive organ of mated female moths on the tea leaves as an elicitor inducing tea leaves to produce cues to arrest the parasitoid *A. reticulata*. We found that host searching behaviors of *A. reticulata* were stimulated by *A. honmai* egg mass deposition on the under surface of the tea leaves. This process did not result in any visually recognizable damage. Naïve female parasitoids also responded to the tea leaf treated with reproductive organs of mated female host by an intensive zigzag searching. Elicitors in the female reproductive organs of *A. honmai* induced tea leaves to produce cues that arrested parasitoids between 24 and 48 hr after treatment of the leaf. The concentration of homogenized reproductive organ was important for the induction of tea leaves, because the time spent by parasitoid searching on tea leaves treated with higher concentrations was significantly longer than for lower concentrations.

# Screening and Characterization of Novel Non-Starter Lactic Acid Bacteria that Accelerate Cheese Ripening

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## **Introduction**

Cheese is an important dairy product, which is nutritious, tasty and can be preserved for an extended period of time. The cheese consumption in Japan has been increasing over the past decade. However, the market share of domestic cheese production remains at about 20%, primarily due to the high production cost compared with imported cheese. One of the countermeasures to reduce the cost of producing cheese is to shorten ripening period. In order to promote cheese ripening, it is necessary to select lactic acid bacteria (LAB) of growing well under low temperature with NaCl stress and possessing high protease activity. According to present study, some of non-starter LAB (NSLAB) possesses those abilities. Therefore, the objective of this study is to screen and characterize novel NSLAB that can potentially accelerate cheese ripening.

## **Materials and methods**

LABs were isolated from 9 ripening cheeses produced at different periods and places. The species of isolated LAB were identified with 16S rRNA gene sequence analysis, and one strain was selected from each species. The growth pattern of isolates was determined by culturing with MRS medium under different temperature (10, 15, and 30°C) and NaCl concentration (0, 1.7, and 4.0%). The proteolysis ability of isolates was evaluated with the amount of free amino acid in skim milk culture.

## **Results and discussion**

Two new NSLAB strains, EG9 (*Lactobacillus paracasei*) and FM1 (*Leuconostoc mesenteroides*), were selected based on 16S rRNA gene sequence analysis. It was revealed that EG9 can grow well under 10°C/1.7% NaCl stress, whereas FM1 revealed high proteolysis ability. The effect of these novel NSLABs addition on cheese ripening should be studied in the future.

## Effect of irrigation methods on growth, dry matter production and water use efficiency of rice

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Water and food demands are increasing in developing countries due to the population growth, thus the efficient use of water resource is required in agriculture. The amount of irrigation water in rice cultivation is twice as much as that of upland crops. Previous research has shown that intermittent irrigation has the effect of saving water. Therefore, objective of this study was to clarify whether the intermittent irrigation saves water without reducing growth and dry matter production of rice.

Rice (*Oryza sativa* L. cv. Koshihikari) was grown in 1/5000 a pots filled with soil in plastic house in 2013. Treatments included five irrigation regimes: continuous flooding (CF), drying (D), alternate wetting and drying every four days (AWD4), every eight days (AWD8) and every twelve days (AWD12) started 7 days after transplanting. In CF, the water depth was controlled at 3 cm above soil surface. In D, the soil moisture was maintained 80% of field capacity. In AWDs, the water was added to the depth of 3 cm at irrigation. Leaf age, plant length, number of tillers, and SPAD value were recorded every 7 days from the transplanting to heading. The photosynthetic rate was measured with a portable photosynthesis system (LI-6400, LI-COR). The amount of water added to each pot was regarded as evapotranspiration. Plants were sampled at transplanting and heading, and dry weight increase was determined. Water use efficiency was calculated as the dry weight increase divided by evapotranspiration.

In active tillering stage, leaf age, plant length, number of tillers and SPAD value in D were inferior, while the growth parameters in AWDs were similar or even larger than those in CF. Similar tendency was found in photosynthesis. At heading stage, photosynthetic rates in AWD12 were markedly lower than those of CF before irrigation, but they recovered after irrigation. Dry weight increase from transplanting to heading was the largest in CF, followed by AWDs and the lowest in D. Evapotranspiration during this period decreased in the order CF, AWD4, AWD8, AWD12, and D. The percentage decrease of evapotranspiration to CF was 14, 27, 39, and 70% for AWD4, AWD8, AWD12, and D, respectively. Water use efficiency of AWD 8 and AWD12 was similar to CF, and that of AWD4 and D was lower than CF. The results indicate that AWDs save water, but reduce dry matter production, thus AWDs did not show positive effect on water use efficiency of rice clearly at vegetative stage.

## The difference of vegetation, chemical composition of grass and grazing management observed in Hargebi and Saihangebi village of Inner Mongolia

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The twin production of sheep by the effective grazing management using a normal (NG) and salt accumulated grassland (SG) was documented in Hargebi village of Xilingol League, Inner Mongolia (Kimura, 2011). The possibility of economical and sustainable effects of the twining management in degraded grassland was discussed in the report. The twining management, however, has not been employed in other villages in Inner Mongolia, although the reason is unclear. To clarify the factor(s) disturbing spread of the twining system, vegetation, chemical composition of grass and grazing management were surveyed in Hargebi and another village of Inner Mongolia in the present study.

Hargebi as a village with twining system and Saihangebi, Sonid Left Banner, as a village without twining system were selected to survey. Three quadrats (1 x 1 m) were set in NG and SG randomly in each village. Plant species and coverage rates were recorded and all plants in the quadrats were collected July 18 and 19 2012. Chemical composition of grass was analyzed by the Cornell Net Carbohydrate and Protein System (CNCPS). Interview to farmer in each village was conducted in regard to grazing management.

The dominant plants were *Leymus chinensis* and *Stipa capillata* in NG of Hargebi village and *Stipa gobica* and *Salsola collinal* in NG of Saihangebi village, respectively. The dominant plant was *Reaumuria soongorica* in SG in the both villages. Although Saihangebi village was located to western dry area, significant difference was not observed in coverage rate between two villages. Crude ash of SG was higher than that of NG in each village ( $P < 0.05$ ). Grazing managements and breeds of sheep were different between two villages. SG was managed as common grassland utilized by more than 40 farmers in Hargebi village. SG was private land and separated from NG in Saihangebi village. Farmers, therefore, can only use one type of the grassland in the village. Breed of sheep was Ujimqin in Hargebi village and Sonid in Saihangebi village, respectively. Many common plant species including annual plants were observed in the two villages, indicating that it might reflect unusual conditions with a lot of rainy days in this year in both villages. Crude ash contents in the plants of SG were higher than those in the plants of NG. Higher crude ash in halophytes was reported (Ishikawa et al., 2003). Based on the results, one of factors disturbing spread of the twining system in Saihangebi village might at least be difference in the patterns of land use.



# Feasibility of Domestic Water Supply by Using Irrigation Canals in Time of Disasters

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The Great East Japan Earthquake, which was occurred on March 11, 2011, caused the suspension of water supply in the wide area. Many water trucks were arranged in the disaster area to supply mainly drinking water. On the other hand, the many victims felt a big stress for the shortage of domestic water, especially toilet water. From the view point of disaster prevention, it is important to take the measures to supply domestic water at the time of disasters.

This study focuses on irrigation canals as one of the infrastructure to supply domestic water. Total length of main agricultural canals is about 40,000 km in the nation and a lot of canals are located close to the living area. However, there are the cases that they cannot be used by the following reasons 1) flow capacity of the canals is lost by the shortage of maintenance. 2) It is difficult that ordinary person take water from canals in the pipeline districts. Therefore, it is necessary that the irrigation conservancy facilities, which can be actually utilized to supply domestic water, are determined and the beneficial area is estimated.

Oyama city, Tochigi prefecture, and Kamisu city, Ibaraki prefecture, were selected as the target sites. The former can be expected to obtain the large effect by using irrigation canals since the main canal is through the central area of the city. The latter is the disaster area, which was suspended water supply for more than one month, after the Great East Japan Earthquake.

Published GIS data, which are administrative districts, canals and population density(500 m × 500 m), were obtained from websites. Based on the overlap of the population density data and the canal data, the number of beneficiaries in each city was estimated. In Oyama and Kamisu, the rates of beneficiaries to the total population were 51 % and 10 %, respectively. Oyama had comparatively many beneficiaries because the main irrigation canals are close to the densely populated area. On the other hand, in Kamisu, the rate of beneficiaries was small due to the reasons that the number of the canals is less and the most sections of them are located away from the residential areas.

However, there are some irrigation facilities, which are not registered in the public GIS data as small irrigation pumps. They haven't been considered in the present processing yet. Therefore, it is necessary to improve the GIS data by the further field survey. Based on the improved data, we will consider the feasibility of domestic water supply by irrigation canals.



## **Salt tolerance properties of some grass species for sustainable use of saline soil field**

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In dry land which consists of roughly 40% of whole land in the world, and supports as much as 40% of world food production, salinized soil is one of the most serious problems. Salinized soil is defined as a condition of the soil that the salt content of the soil is so high that proper plant growth is limited. It tends to happen where evaporation from the ground exceeds rainfall, and also develops because of a high salinity ground water table, poor soil drainage and mismanagement of irrigation. As a result, soil salinity is steadily increasing.

In order to utilize saline land, or the land which has the potential to become saline, salinity tolerance is a very important characteristic for plants. It has been investigated mainly using salt solution culture or sand culture with the irrigation of salt solution from the surface. Both methods were aimed to measure the degree of salinity tolerance or the influence of salt under stable salt concentration.

Our studies focus on the influence of salt on the plant growth under the situation that salt water is steadily supplied as a ground water table, thus the salt content changes. For plant species, we have selected Kentucky bluegrass (*Poa pratensis* L.), which is one of the most common turf grasses and forage crops.

From June 6, 2013, Kentucky bluegrass plants (c.v. Award) were grown in 1/2000 Wagner pots filled with Uonuma-syodo (the soil without any nutrients). The salt treatments (0, 6000, 12000 ppm NaCl) were started on July 12 with 4 replications for each, and it was conducted as the irrigation from the bottom of each pot using trays filled with the solutions. The solutions were replaced once a week. EC and pH of the soil, plant length, number of stems, SPAD and dry weight were measured during the treatment period.

As a result, Kentucky bluegrass plants continued their growth despite under salty condition. However, their growth was gradually affected by high salt content of the soil. Kentucky bluegrass was sensitive to salt. Although breeding some salt tolerant cultivars can be considered, there's other solution to apply halophytic species, which shows high salt tolerant properties. For example, alkaligrass (*Puccinellia* spp.) is known to have high salt and alkali tolerance, and its appearance is similar to Kentucky bluegrass. This plant is expected to be applied as alternative turf and forage plant at the salty land. It was estimated that utilization of this kind of plants may be able to inhibit the desertification and remedy the salty land.

# The Effect of Agricultural Water Use to Water Temperature Change in Kokai River Basin

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It is expected that water temperature in the basin, as well as air temperature, will rise significantly by the effect of climate change. High water temperature causes high temperature injury of paddy, which decreases quality of rice. Moreover, the changes in water temperature will affect the ecosystem in the basin.

It has been already found out that water temperature rises while flowing down through river (Kobatake *et al.*, 1995). On the other hand, a lot of water is used for irrigation in Japan. Therefore, not only the process of river flow, but also the processes of agricultural water management, which are water allocation in the paddy area, reservoir in paddy plots and water reuse between upper and lower irrigation areas, may affect the changes of water temperature change in the basin. However the structure of water temperature change in the basin including paddy area is not clear.

In this study, the water temperature variations at the Kokai River basin, which flows between Ibaraki and Tochigi prefectures having a total length of 112 kilometers, was observed. The sensors, which collect continuously data of water level and water temperature, were installed at the following sites. a) upper, middle and lower points of the Kokai River, b) upper, middle and lower points of a main irrigation canal, and c) the top of a main irrigation canal and the tail-end of a main drain in some irrigation districts. The observation was performed through the irrigation period in 2012. In this study, the result of 20<sup>th</sup> to 24<sup>th</sup> in August, which is the hottest date in the irrigation period, is shown.

In the Kokai River, it indicated that water temperature had daily variation at all three points, which were installed the sensor. Furthermore, the daily maximums of water temperature at the upper, middle and lower points are 29.6 degrees, 32.3 degrees and 29.2 degrees, respectively. The daily maximum of water temperature at the middle point was highest. In the main irrigation canal, the daily averages of water temperature at the upper, middle and lower points are 20.2 degrees, 23.5 degrees, 24.7 degrees, respectively. It tended that water temperature was higher at the lower point. It was found out that rise in water temperature was caused by flowing down through the canal. On the other hand, water temperature at the top of the main irrigation canal was higher than at the tail-end of the main drain in the target paddy districts. It is expected that water temperature was cooled, while water was stored in the paddy plots or flows down through the drain.

In this study, the followings were clarified. 1) Water temperature is raised while water flows through the rivers and the irrigation canals. 2) Water temperature is lowered at the paddy plots or in the process of flowing down through the drains. From the above view points, water temperature changes in the Kokai River are interpreted as follows. During the section between the upper and middle points of the Kokai River, water temperature increased gradually because there are not any inflows. Meanwhile, in the section between the middle and lower points, water temperature is cooled by the return flow from paddy area and the inflow of sub streams including the outflow from another paddy area.

# Effects of Irrigation Intervals and Manure Levels on Growth, Photosynthesis, and Carbon Isotope Discrimination of Field-Grown Maize in Thailand

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Water saving without yield loss caused by drought is vital in irrigation culture of maize. Long interval irrigation is one of water saving culture, but this method might reduce growth and yield by soil water stress. On the other hand, manure improves soil texture and maintains water in the soil. The objective of this study was to assess the effects of irrigation intervals and manure levels on growth, photosynthesis and carbon isotope discrimination of field-grown maize.

The field trial was conducted on Latosol at the National Corn and Sorghum Research Center in Thailand. Maize (*Zea mays* L., cv. SW4452) was sown on 3 January with 75 cm between rows and 20 cm between plants. Fertilizer was applied with 37.5 g m<sup>-2</sup> of urea. The experiment was conducted by split-plot design with three irrigation intervals (1, 2, and 3 weeks) in main plots and three manure levels (0, 6.25, and 12.5 t ha<sup>-1</sup>) in sub plots. Irrigation treatment was started 36 days after sowing. Plant height, SPAD value, leaf area index (LAI) and dry weight (DW) of plants were measured at different growth stages. Photosynthetic and transpiration rates were measured with ear leaf at vegetative and reproductive stages. Carbon isotope discrimination (CID) of ear leaf was analyzed with a stable isotope ratio mass spectrometer (Integra 2, Sercon).

Soil water potential was lower in longer irrigation intervals, but there was no significant difference among manure levels. Plant growth was inferior in the longer interval plots. Application of manure increased the early growth, but the effect disappeared at later stages. Photosynthetic rates were also lower in longer interval plots and significantly correlated with stomatal conductance. Above-ground biomass at maturity and grain yield were the lowest in 3-week interval plots, but there was no significant difference between 1 and 2-week interval plots. CID increased gradually with growth stages. DW and grain yield were negatively correlated with CID.

The results suggest that i) irrigation with 2-week interval might be useful as water saving culture, ii) manure application is not effective in water saving culture in Thailand, and iii) CID could be used as a parameter for dry matter productivity and yielding ability.

# Effects of Climate Change on Rice Production in Cambodia

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*Keywords: climate change, rice production, price response, supply and demand model, Cambodia*

The occurrence of climate change in Cambodia is closely linked to agriculture and forestry. Cambodia, the country where agriculture is the main livelihood activities, has been badly affected. As evidence, 70% of rice damage is caused by flood, 20% by drought and only 10% by pests and diseases. Such a developing country as Cambodia with low resilience capacity is very vulnerable to climate change. Once the adaptation option is well adopted, the adverse effects will be reduced. This research is proposed with aims (1) to predict the effects of climate change on rice production under various scenarios; (2) to quantify the impacts of climate change on people's welfare under different scenarios; and (3) to identify suitable adaptation options against the negative effects of climate change. The research will employ supply and demand model of agricultural product as the main research method. The simulation result of the price response to climate change in Cambodia will be used to compare with the simulation result of the price response in regional model.

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## **Optimization of the Sewage Sludge Used as Inoculum for Higher Biohydrogen Production from *Ipomoea Aquatic***

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The world is turning to a search for clean energy source to mitigate coming climate change and the impending shortage of readily available fuel. Hydrogen, the most abundant element in the Universe has the potential to serve the purpose of fuel and is eco-friendly. One option would be to use biological means such as potential substrates, wastes and biomass to produce hydrogen.

*Ipomoea aquatic* is one such Biomass which is the case study in my research. *Ipomoea aquatic* is a semi aquatic, tropical plant grown as a leaf vegetable and commonly known as “Water Spinach”. It’s known for treating wastewater in lakes and ponds in order to avoid eutrophication. Most importantly these plants after water treatment cannot be consumed and also, they impose some environmental problems due to its rapid growth, therefore it can be treated as Biomass for Hydrogen production. With a high percentage of Carbohydrate (54%), it can serve as a viable source for Hydrogen production. Moreover, the leaves and stems of *I.aquatica* are delicate and therefore do not require pretreatment with acid or other physical methods. Also, sewage sludge is used as inoculum and optimized by pretreating with acid which is still not quite used by many researchers, but has potential.

In this experiment we subject *I.aquatica* to fermentation after pulverizing it, using activated sludge as an inoculum to produce Hydrogen. The inoculum is subjected to various pretreatment methods like heating at 100°C for 30 mins and acid pretreatment using HCl (6N). The amount of Hydrogen produced is measured timely and optimum conditions for the same are being determined. The best pretreatment was determined based on the amount of Hydrogen accumulated after a week. From, the results acid pretreatment seemed to be efficient as it effectively destroys the methanogens, increasing Hydrogen yields.

This experiment is cost efficient and sustainable as the resources are available in plenty and materials are inexpensive. As, it’s the first time that experiment is being done using *I.aquatica* as substrate it’s possible, it might prove to be an appropriate and sustainable material to produce Hydrogen, not only to solve energy needs but also solve environmental problems like eutrophication caused by accumulation of wastes.

## Feasibility of Renewable Energy Utilization in Irrigation for the Nile Delta

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The potential of renewable energy by solar power and wind power is high in the Nile Delta of Egypt, because of its long daylight and available wind velocity in this region. The Egyptian government is investigating promotions of renewable energy utilization for all the land of Egypt. On the other hand, numbers of crops, which need different amount of water requirements and its energy consumptions in irrigation, are cultivated throughout a year in the Nile basin. The Nile Delta is the main agricultural area with intensive cultivation. Thus, abundant water and its lifting energy from the canal to field are needed for irrigation by using many pumps powered by diesel engine

The purpose of this study is to clarify energy consumption of lifting water by pumps and feasibility of introducing renewable energy to substitute diesel fuel for the pump. To calculating energy consumption for lifting water and energy potential of renewable energy resources, field surveys at the Nile Delta in 2012-2013 and the statistical analysis were carried out.

Result of investigation showed that 58.65 billion m<sup>3</sup> of water was required for irrigation yearly in the Nile Delta. This quantity of the irrigation water was occupied approximately 90% of the total supply water in Egypt. The energy consumption for lifting water was 1.59 billion MJ. According to the statistical data, the quantity of sunlight of Egypt was 6,800-9,400 MJ/m<sup>2</sup>/year. The potential of solar power generation was 500 MWh/ha (1.84 million MJ/ha Conversion efficiency 20%). The average of wind velocity was 4.5 m/s in the Nile Delta. Considering this wind velocity, the potential of wind power generation was 300 million kWh /unit of wind turbine. (10.8 million MJ /unit). This results show that an area of about 900 ha was necessary to install solar photovoltaic panel. On the other hand, 150 units of the wind turbine (1500kWh/unit) were required to supply energy for irrigation for the Nile Delta using electric motor pump.



## **Water Management in Reservoir Irrigation in Kagawa -A Case Study in Saburo Lake Beneficial Area-**

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In Kagawa prefecture, the annual precipitation is less than 70% compared to the average precipitation of Japan. In addition, most of Kagawa is flat land, which is mostly used as rice field, whereas the rivers have only a small catchment area. Therefore, Kagawa has been suffering lack of water from long ago. To solve this problem, many reservoirs with the purpose of collecting rainfall for irrigation have been constructed from more than 1000 years ago. In reservoir beneficial areas, the customs of water use have developed to distribute water efficiently and equally. Furthermore, the Kagawa Irrigation Channel, whose source is the Sameura Dam, was opened to enhance the water resources in 1975. However, droughts have still been occurring in spite of the activities above.

In recent years, rice fields in this area have been rapidly decreasing due to urbanization. Thus there is a possibility that water requirement for irrigation has decreased. On the other hand, the changes in agricultural condition such as the increase of part-time farmers, the aging of farmers, and the decreasing in number of farmers may have affected the water demand.

In this study, we observed the water allocation in a reservoir beneficial area in 2012. From the analysis, the present situation of water management in this area was clarified and future measures were considered.

The target area is the Saburo Lake beneficial area located in Takamatsu. The agricultural area has decreased by 27% in the last twenty years, and is currently 342 ha. The irrigation period is from mid June to the beginning of October with the total of 114 days in 2012. There are two main dual-purpose canals in the area. The intermittent irrigation, which is normally 3 days on and 2 days off, is adopted. In addition, the rotational irrigation is also adopted for the 3 irrigated days. The beneficial area is divided into three blocks, and each block can take water according to the permitted time and date. In the specific custom, the farmers in the down-stream block are allowed to stop the water intake of another block on a determined day. On water shortage, the farmers of the lower block have to close the division works of the upper block, because the upper blocks would keep on taking in in order to take more water.

To clarify the situation of water allocation, water level sensors were installed in 11 points of the main canals. The interval of data collection was 10 minutes. From the continuous discharge data, the water intake of each block and dead outflow were calculated. Furthermore, the water level data of the Saburo Lake and the Sameura Dam and the meteorological data were obtained. The effects of weather conditions on the operation of the Saburo Lake and the intake of each block were considered.

In 2012, there was much rain compared to that of an average year, particularly at the critical period of irrigation. Therefore, water management was different from usual. In July and September, the intermittent irrigation was stopped and the release from the Saburo Lake was performed everyday. There is no severe water shortage like the past and water management with sufficient margin has been made in 2012. Comparing the average water intake per paddy area of each block, it was confirmed that at block 3, where the reduction of agricultural area due to urbanization is significant, water intake is bigger than the other blocks. The imbalance of water distribution by urbanization was confirmed.



## **Methane fermentation characteristic of bean sprout residue**

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Nowadays, amount of food waste or residue is increased and efficient use of them is required. The ways of efficient use of them are to produce feedstuff, compost and so on. Especially, high-value utilization such as bio-ethanol or bio-gas which is more useful than feedstuff and compost is focused on. We have a chance to search for the way of efficient using the bean sprout residue as a sprout processing company required us. The way of high-value added use is concretely bio-ethanol, bio-gasification, bio-dieselization, burnable gasification. Bean sprout residue contains over 90% moisture, which has an organic compound without fat and sugar. So transforming bean sprout residue to bio-ethanol, bio-dieselization, burnable gasification is not suitable. We consider that the bio-gasification is most suitable for high-value added use of bean sprout residue. The bio-gasification of bean sprout residue has not been studied until now, so this study focus on the experimental analysis of bio-gasification of bean sprout residue.

Bio-gasification is also called methane fermentation which transforms organic compound to methane gas by microbe. In general, the ratio of carbon and nitrogen (C/N) for substance require 10 to 20 in methane fermentation, because fermentation will stop out of the range 10 to 20. C/N ratio of bean sprout residue is 5.5. We will confirm whether the inhibition caused by low C/N ratio will occur or not during the fermentation experiment. Hydraulic retention time (HRT) is fixed at 20 days. Organic loading rate per effective volume per day (g/L·day) is changed as 1, 3, 5, 7. I will study methane fermentation of bean sprout residue in the condition and find out its characteristic. Finding out characteristic of efficient using food waste or residue may lead decrease of environment load and garbage.

Now, we cultivate microbe which will be used as seed sludge on methane fermentation. Substance is dog food. Dog food is added per a day to digestive sludge which we brought from sewage plant. Component of gas produced by microbe is about CH<sub>4</sub> 60%, CO<sub>2</sub> 40%. This result is considered reasonable but this experiment is not steady state yet. So we continue to experiment this until state is steady. After that, we will experiment methane fermentation of bean sprout residue.

## Biosynthetic pathways for C15-dienal sex pheromone in *Dolbina tancrei*

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We surveyed the sex pheromones of fifteen hawk moths and found a novel sex pheromone component 9,11-pentadecadienal from *Dolbina tancrei*. Pheromone components with functional groups are most commonly made from even-carbon chain fatty acids such as C<sub>16</sub> or C<sub>18</sub> acids. Therefore odd-carbon chain pheromones may be synthesized by a unique biosynthetic pathway. Here we investigated the sex pheromone precursors of *D. tancrei* and propose a possible pathway.

Common pheromone component in hawk moth such as 10,12-hexadecadienals are synthesized from C<sub>16</sub> fatty acids through several modification steps. We postulated two pathways for the changes of *D. tancrei*; (1) C<sub>16</sub> precursor conversion into C<sub>15</sub> fatty acid, or (2) modification of the steps in biosynthesis of 10,12-hexadecadienal. To determine the precursors, we analyzed fatty acids in the pheromone gland extracts. Glycerolipids and free fatty acids from the extracts were converted to the corresponding methyl esters and analyzed by GC-MS and DMDS or MTAD derivatization. As a result, methyl hexadecanoate and methyl octadecanoate were the major components detected. In addition, methyl 7-hexadecenoate, methyl 9-hexadecenoate, methyl 11-hexadecenoate, methyl hexadecadienoate, methyl pentadecanoate, methyl 5-pentadecenoate and methyl pentadecadienoate were also detected.

Although C<sub>15</sub> fatty acids existed in the extracts, monoenyl C<sub>15</sub> intermediates that can be pheromone precursors were not detected in the extracts. Moreover, the existence of 11-hexadecenoic and 10, 12-hexadecadienoic acids supports second postulated pathway. These results suggest that 9,11-pentadecadienal is biosynthesized from palmitic acid via 11-hexadecenoic and 10,12-hexadecadienoic acids rather than from C<sub>15</sub> fatty acids, and predict a specific enzyme for 1C chain shortening.

# Effect of Planting Density on the Growth, Dry-matter Yield and Forage Quality of Different Types of Forage Rice Varieties

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Self-sufficiency rates of food and forage in Japan were 39% and 26% in 2011, respectively. Although rice is a staple food in Japan, its cultivation area has decreased in the past 50 years because of rapid decline in rice consumption. Cultivation area of forage rice has increased rapidly during the past 10 years to improve this situation. Low-cost and low-labor cultivation methods are required for forage rice production. Sparse rice planting is considered as one such methods. There are two types of forage rice varieties, grain-weight type for grain use and straw-weight type for whole crop silage use. We investigated the effect of planting density on the growth, dry-matter yield and forage quality using two types of forage rice.

‘Kusahonami’ (grain-weight type) and ‘Leafstar’ (straw-weight type) were planted at two planting densities, normal (30 x 15 cm, NP) and sparse (30 x 30 cm, SP). Experiments were conducted in the Agricultural and Forestry Research Center, University of Tsukuba using split-plot design with three replications. Plant length, stem number and leaf area index (LAI) were measured during the growth period. Dry-matter yield of above ground was measured at heading and yellow ripe stages. Rice was harvested at the yellow ripe stage for silage. During ensiling, pH and lactic acid of the silage extract were measured as indicators of fermentation. Feed compositions of rice were also measured.

There was no difference in plant length between NP and SP. Stem number per hill was larger in SP than in NP, but stem number per unit area was larger in NP than in SP for both varieties. LAI increases were higher in NP than in SP, but the difference was slight at the heading stage. There were no significant differences in dry-matter yield at heading and yellow ripe stages between NP and SP in both varieties. The pH of silage extract decreased with silage fermentation. Lactic acid content of silage was higher in ‘Leafstar’ than in ‘Kusahonami’, but there was no significant difference between NP and SP in both varieties. Crude protein and fibers contents were not significantly different between NP and SP in both varieties.

The difference in dry-matter yield between NP and SP was not significant regardless of plant types. The reduction in differences was mainly due to the compensatory effect of rice tillering. Silage fermentation and feed compositions were almost the same in NP and SP for both varieties. Consequently, sparse planting is considered to be promising as a low-cost and low-labor cultivation method for forage rice.

## Use Oil from Fish Processing Waste for Biodiesel Production

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Recently due to the exhaustion of fossil fuel resources, biodiesel fuels are attracting increasing attention as an alternative fuel. Biodiesel is derived from vegetable oils, animal fats, fish oil and other oils containing fatty acids. Production of biodiesel from vegetable oil is currently being commercialized. Biodiesel using vegetable oil has been studied widely, and has been used fairly reliably. The use of vegetable oils has a slight advantage. Vegetable oils contain a substantial amount of unsaturated fatty acids. Biodiesel has high oxidation stability and combustion heat generation is uniform. However, vegetable oil is limited. The alternative raw materials for biodiesel has been proposed. Animal fats, such as pork lard, beef tallow, chicken fat and other kinds have been used as a biodiesel production material. Biodiesel made using animal fat has a higher cetane number than that using vegetable oil. Due to this, such biodiesel has a high heat of combustion. But, because of the high saturated fat content, the combustion heat is less stable for oxidation. It also has the disadvantage of existing as a solid at room temperature. For these reasons, the biodiesel produced from animal fat is not suitable for use as fuel. As an alternative, animal fats might be mixed with other raw materials. However, fish oil can be thought of as a different raw material for biodiesel. Fish oil can be extracted from the lipid content from the discarded parts of fish. The oil is refined by a set of pre-treatment processes. This refined fish oil can be used as raw material for biodiesel. 70% of the world is covered by the sea. Japan is surrounded by water and produces a substantial amount of fish. The amounts of discarded parts of fish such as heads, fins, tails and other parts are substantial. Making biodiesel from fish oil has some advantages. Biodiesel production using fish oil uses pieces of discarded fish, which could make production of biodiesel less expensive. Using fish waste for the manufacture of biodiesel can help to protect the environment. Fish oil contains much saturated fatty acid. Some of them have considerable amounts of high cetane content fatty acid. So, we can expect to have higher heating value in the combustion process. The purpose of my experiment is

1. Study the influence of centrifuge and winterization
2. Optimize the condition of using waste fish oil to produce biodiesel

## Physiological Changing of Blackberries during Postharvest Storage

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Blackberries (*Rubus* spp.) are known for their high antioxidant activity, high levels of vitamins A, B and C, as well as iron and magnesium compared to other berries. For this reason, blackberry has gained growing market attention in recently. However, the fruit is highly perishable causing high losses of production during transportation. Also, several physiological changing such as discoloration and weight loss of the fruit occur during storage before sold. For these reasons, it is hard to keep the blackberries in high quality as it were harvested in the field. Ethylene is a putative agent which affects physiological change in fruits. Although ripening in blackberries, as a non-climacteric fruit, is independent of importance of ethylene, the fruit is known to produce increased amounts of ethylene at the full ripe stage and physiological changes occur by the ethylene. Fortunately, 1-MCP (1-methylcyclopropene) is known as an efficient ethylene desensitizer in postharvest technique, yet effects on alleviating discoloration and weight loss in blackberries need to be confirmed.

To study this, we used two thornless cultivars of blackberries: 'Navaho' and 'Ouachita'. Fruits were harvested from the Agricultural and Forestry Research Center, University of Tsukuba (Latitude 36.53° N, longitude 140.62° E) at full ripe stage, which was based on its black color. Collected fruits were divided into two groups: the 1-MCP group received 5µg/ L of 1-MCP for 24 hours, and the control group did not. After pre-cooling (10°C), groups were packed in oriented polypropylene (OPP, 20cm x 30cm) and transferred to 0°C. Fruit weight, length, width, color (L\*, a\*, b\*, Color Space by chromameter), and ethylene production were determined at 0, 3, 7 days of storage.

Our results showed that, 1-MCP treatment could decrease the weight loss in 'Ouachita'; and, alleviate both of ethylene production and weight loss in 'Navaho'. On the part of weight loss both on 'Ouachita' and 'Navaho', 1-MCP treatment has exhilarating effect to decrease the weight loss. Color change in 'Navaho' which was treated with 1-MCP was significantly less than that in 'Ouachita'. Berries without 1-MCP treatment are easily to develop patchery of red coloration after 7 day storage at 0°C, which is indicative of discoloration.

We hereby show that ethylene appears to contribute to the process of fruit senescence including weight loss and discoloration in blackberries. Treatment with 1-MCP on the blackberries could significantly reduce the weight loss of the fruit and retard discoloration upon storage. In conclusion, treatment with 1-MCP appears to be an efficient postharvest technique to minimize losses in marketing of blackberries.

# Development of Efficient Delivery System of Liquid Analyte for Paper Sensors

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Paper is a traditional material conventionally used for writing, printing and packaging. Since 2007, microfluidic paper-based analytical device as a burgeoning research field provides a novel system for fluid handling and fluid monitoring as well as food quality testing, due to the outstanding merits including low-cost, spontaneous liquid transportation based on capillary force and compatible with chemical/biochemical applications. Up to now, most published researches on paper-based devices were focused on inventing low-cost and simple fabrication methods and exploring new applications. Even though paper is a promising alternative substrate for analytical sensors, there were still some limitations reported. One of the main limitations is the sample retention (i.e., the ineffective sample consumption) within paper fluidic channels and the sample evaporation during transport result in the low efficiency of sample delivery within the device. And not much attention had been drawn to this.

In this work, a modified solution which was mixed using PS-co-PAA (CP-900, Harima Chemical), ethylene glycol, neutral red dye and water was used as an ink to make a hydrophobic barrier to fabricate a micro-channel on paper. Filter paper (No.1, Advantec) was used as the substrate for the experiments of fiber orientation and channel width and laboratory sheets were prepared for experiments of beating degree and calendering. Micro-channels were fabricated using an ink jet printer (Dimatix DMP-2831, Fujifilm).

The cross-section views of the hydrophobic barriers were observed using a stereo microscope (SZX10, Olympus) at the same magnification ( $\times 4$ ) and pictures were taken using a digital camera (C3040ZOOM, Olympus) mounted on the stereo microscope. Since neutral red dye is a fluorescence dye, hydrophobic barriers were observed using Confocal Laser Scanning Microscope (CLSM)(LSM-710, Carl Zeiss) and 3D images were taken. Scanning Electron Microscope (SEM) (S-4200, Hitachi) was used to identify the PS-co-PAA distribution in paper substrate. Water absorption rate was measured by using Automatic Scanning Absorptometer (ASA) (Kumagai Riki Kogyo).

It was proved that printing CP-900 ink using an ink jet printer is a feasible and stable way to fabricate a micro-channel for aqueous liquid flow by making a hydrophobic barrier in paper substrates. A micro-channel aligned in MD had a higher flow rate than one aligned in CD. Beating increased density of paper but reduced water flow rate probably because of smaller pore size. Calendering would decrease water flow rate.

Finally, micro-channels fabricated on less calendered paper substrates prepared from a less beaten pulp and along MD of the paper are considered to be advantageous for higher flow rate.

## Novel type of Sex pheromone system in Hibiscus flower borer, *Rehimena surusalis*

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*Rehimena surusalis* (Lepidoptera: Crambidae) is a serious pest insect of Rose of Sharon, *Hibiscus syriacus* (Malvaceae). Identification of sex pheromone of this species is essential to developing pheromone lures for pest management. Sumiuchi (2005) tentatively reported that sex pheromone of *R. surusalis* are consisted of (*E*10,*Z*12)-10,12-hexadecadien-1-al (*E*10,*Z*12-16:Ald), (*E*10,*Z*12)-10,12-hexadecadien-1-ol (*E*10,*Z*12-16:OH) and (*E*10,*Z*12)-10,12-hexadecadieny-1-acetate (*E*10,*Z*12-16:Ac), but these components never showed any attractive activity in field trials. In this study, we revised pheromone components and found a new formulation that showed remarkable activity in field assays.

We identified three compounds as sex pheromone components of *R. surusalis*. From pheromone extracts of virgin females by using gas chromatography (GC) coupled with an electroantennographic detector (EAD) and a GC-mass spectrometry (GC-MS), *E*10, *Z*12-16:Ald, and *E*10, *Z*12-16:Ac were confirmed and furthermore, (*Z*3,*Z*6,*Z*9)-3,6,9-tricosatriene (*Z*3,*Z*6,*Z*9-23:HC) was found as a new component. The natural ratio of these components in the extracts was 1:5:14. Male moths were, also, exclusively attracted to a ternary blend of *E*10,*Z*12-16:Ald, *E*10,*Z*12-16:Ac, *Z*3,*Z*6,*Z*9-23:HC at a this ratio in field tests, whereas single and binary blend of either compound had a weak activity in male attraction.

Analogous blends of polyunsaturated, long-chain hydrocarbons (Type II) with much shorter chain aldehydes or alcohols (Type I) recently have been discovered in some species in Crambidae or Pyralidae. This type of hybrid components from two distinct chemical groups may be widespread in this taxon.



## **System Analysis for the Schematic Flow of Palm Oil Extraction to Reduce the Environmental Degradation**

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Palm oil, total production of which in the world is 47.26 million ton in 2010, is a raw material of not only food, soap and cosmetics but also biofuel as bio-diesel fuel (BDF). However, palm oil mill effluent (POME) discharged from palm oil factories causes often serious environmental problems such as water pollution, odor, and so on. POME without appropriate processing increases biochemical oxygen demand (BOD) in river near palm oil factory, changes quality of water from aerobic to anaerobic, and destructs aquatic life. Anaerobic process of POME in artificial pond is also a main cause of awful smell of methane which is one of the origin substances of global warming. Inadequate burning process of empty fruit bunch (EFB) to produce heat energy discharges huge smoke to outside of the factory. Furthermore, rapid transformation from natural forests to oil palm plantation brings soil erosion and loss of wildlife. These backgrounds promoted the demand of environment protection for the factory and its surrounding. Thus, Roundtable on Sustainable Palm Oil (RSPO) was established in 2004 to protect the environment of palm oil production based on the policies.

The purpose of this research is to develop a simulation model of schematic flow for palm oil extraction considering with the possibility to install an oil-water separation system to solve the environmental problems. Fresh fruit bunch (FFB), water, and fuel were used for the input materials of the simulation model. Fiber, shells, kernels, crude palm oil (CPO) and POME were used for output materials. The simulation model and its estimation method of process were developed on the system dynamics software, Studio 9 (Powersim). Simulation model included the modules of the equipment or machine such as sterilization, pressing, clarification, and so on. Moreover, the simulation model has various viewpoints such as water quantity, materials quantity and chemical reaction, and so on. The function of control time series variation was developed to analyze the schematic flow of palm oil extraction, since material flow and energy flow for a palm oil factory were simulated with input and output materials.

## Alkaligrass Grow Faster under High Alkali Stress

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Soil salt-alkalization is a widespread environmental threat which limits the crop growth and agricultural productivity. Alkaligrass (*Puccinellia* spp.) is an alkali tolerant halophyte species which survives in highly alkaline soil (e.g., pH 10). Alkaligrass is considered as an outstanding pasture for soil improvement.

In the present study, we analyzed the growth characteristics of Nuttall's alkaligrass (*Puccinellia airoides*) in response to different pH stress ( $6.2 \leq \text{pH} \leq 10.0$ ). The growth rate, fresh weight, length of spike, electronic leakage rate, chlorophyll content, and tissue pH were investigated to examine its physiological responses to varied conditions. The data obtained here showed that the alkaligrass grew faster under higher pH. After one year of alkaline treatment, we found that the alkaligrass gained more fresh weight when grown at higher the pH, and their spikes also grew faster at higher the pH. To explore the possible reasons, first, we measured the rate of electrolyte leakage (REL), which reflects the degree of plant injury under alkali stresses. It was found that the REL was lower at pH 10 than at more neutral pHs, indicating less damage to alkaligrass leaf membranes under higher pHs. Also, the chlorophyll contents of *P. airoides* were measured while they were grown under different pHs. Interestingly, we found that the alkaligrass under high pH showed higher contents of chlorophyll. This was possibly because high pHs may have suppressed the activity of chlorophyllase. Moreover, alkaligrass can keep the pH inside the root tissue stable, despite how the environmental pH changes. Stable tissue pH, probably resulting from intracellular ion balance, is a requisite for plants to maintain normal metabolism.

These results showed that high pH promotes the growth of alkaligrass, leading to a conclusion that alkaligrass is an alkaliphilic plant. Since *P. airoides* is closely related to many monocotyledonous crop species, these physiological characteristics of alkaligrass showed that *P. airoides* can be a good model plant for studying the mechanisms of alkaline tolerance in monocotyledonous crops.

## **Mitigating Ammonia Inhibition of Anaerobic Digestion with Ammonium-rich Agricultural Wastes by Developing a Novel Fixed-bed Bioreactor**

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Anaerobic digestion of organic waste is an attractive practice as it can solve the problem of agricultural waste contamination and produce renewable energy. However, the ammonia that is produced as a common metabolic end product during the anaerobic digestion of high nitrogen containing organic loading agricultural substrates, such as livestock waste and sludge, often cause the inhibition of anaerobic digestion process.

In the present study, for mitigating the ammonia inhibition to improve the efficiency of anaerobic digestion, physicochemical and biological methods were combined to counteract ammonia inhibition. A novel fixed-bed bioreaction system was developed by suspending microorganism immobilized carrier wrapped 20g/L of zeolite absorbent in the fermentor. Different materials including polymer foaming sponge (PFS), chlorinated polyethylene (CPE) and porous nylon (PN) were used as the wrapping material. Using ammonium-rich swine wastes (ammonium nitrogen concentration: 7511 mg/L) as the substrate, a series of batch anaerobic fermentation experiments under 35°C were carried out by utilizing the developed fixed-bed bioreaction system. The bioreactor suspending with CPE wrapped zeolite required the shortest start-up period (2 days) and achieved the highest methane production (about 29, 6, 96 times higher than that of PFS, PN, and Control, respectively) after 30-day anaerobic digestion. The scanning electron microscopy was used to observe the main cellular morphologies present in the biofilms of the three different bed materials and zeolite. The microphotographs indicated that different form of bioreactor gives specific conditions for the adherence of distinct microbe quantity and types. Meanwhile, instead of the bed material, the majority of microorganisms are attached at zeolite. The synergy of ammonia adsorption by chlorinated polyethylene warped zeolite and immobilized microorganism contributed to the enhancement of anaerobic digestion efficiency. The developed fixed-bed bioreactor suspending with chlorinated polyethylene warped zeolite is suggested to be a favourable system for enhancing the anaerobic digestion efficiency of ammonium-rich agricultural wastes and could contribute the sustainable development of agriculture.

## **Enhancement of Photocatalytic Activity of Novel Ag/TiO<sub>2</sub> Thin Film on Glass Tube for Organic Waste Degradation under Simulated Solar Light**

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In recent decades, TiO<sub>2</sub> photocatalysis has attracted considerable interest for water purification due to the relatively high photocatalytic activity, biological and chemical stability, low cost and non-toxicity. However, its practical application is still constrained by the fast recombination of photogenerated electron–hole pairs, low effective utilization of visible light (account for 3–5% in solar light) and tedious post-separation of TiO<sub>2</sub> nanoparticles. In this present study, TiO<sub>2</sub> thin film on glass tube was synthesized by hydrothermal method to avoid the post-separation process, and Ag was used as a dopant for improving its photocatalytic activity under visible light. The synthesis of Ag/TiO<sub>2</sub> thin film was optimized by investigating the effects of the amount of Ag dopant, calcination temperature and time, number of coating layers. The characteristics of synthesized Ag/TiO<sub>2</sub> thin film were analyzed by X-ray Diffraction (XRD), Brunauer–Emmett–Teller (BET) surface area and Scanning Electron Microscope (SEM). The synthesized Ag/TiO<sub>2</sub> composite exhibited smaller crystallite size than pure TiO<sub>2</sub> and an obvious red-shift in the absorption spectrum (380–560 nm). The photocatalytic activity of synthesized Ag/TiO<sub>2</sub> thin film was evaluated by degradation of Rhodamine B, a model of organic waste under simulated solar light. Comparing with TiO<sub>2</sub> thin film, it showed much higher visible light driven photocatalytic activity for RhB degradation. The synthesized Ag/TiO<sub>2</sub> thin film coated glass tube seems to be a promising material for the water purification under solar light.

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Tofael Ahamed                      Associate Professor, Graduate School of Life and Environmental Sciences, UT

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Tomoyuki Taniguchi                Assistant Professor, Graduate School of Life and Environmental Sciences, UT

( Institute of Applied Biochemistry)

Nakao Nomura                      Associate Professor, Graduate School of Life and Environmental Sciences, UT

(Laboratory School)

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(Agricultural and Forestry Research Center)

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Tomohiro Takigawa                Professor, Agricultural and Forestry Research Center, UT

Naoya Fukuda                      Associate Professor, Agricultural and Forestry Research Center, UT

Tatsuyuki Seino                    Associate Professor, Agricultural and Forestry Research Center, UT

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Naoto Ishikawa                    Assistant Professor, Agricultural and Forestry Research Center, UT

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Daiki Mizuta                      Assistant Professor, Agricultural and Forestry Research Center, UT

Yoshihiko Sekozawa                Assistant Professor, Agricultural and Forestry Research Center, UT

(JICA)

Takao Shibusawa                    Director, Training Program Division, Japan International Cooperation Agency (JICA)

(As of Oct.1, 2013)

## Executive Committee

### Chairperson:

Atsushi Tajima                      Director, Agricultural and Forestry Research Center, UT

### Members:

Hisayoshi Hayashi	Professor, Agricultural and Forestry Research Center, UT do.
Tomohiro Takigawa	do.
DeMar Taylor	do.
Naoya Fukuda	Associate Professor, Agricultural and Forestry Research Center, UT
Ryozo Noguchi	do.
Tatsuyuki Seino	do.
Atsushi Asano	Assistant Professor, Agricultural and Forestry Research Center, UT
Naoto Ishikawa	do.
Morio Kato	do.
Daiki Mizuta	do.
Yoshihiko Sekozawa	do.
Yasuhiro Matsumoto	Senior Technical Official, Agricultural and Forestry Research Center, UT
Kazunori Yonekawa	do.
Hiroshi Hiki	Chief Technical Official, Agricultural and Forestry Research Center, UT
Tsuyoshi Honma	do.
Takashi Katagiri	do.
Kazuto Yokoyama	do.
Miho Satoh	do.
Kazuo Sakai	do.
Kiyoshi Karube	do.
Hideaki Omiya	do.
Keiko Sugawara	do.
Momoyo Itoh	do.
Mutsumi Itoh	do.
Katsuhiro Yoshida	do.
Mizuki Matsuoka	do.
Tomonari Yamamoto	do.





- ・筑波アジア農業教育セミナー及び国際農学ESDシンポジウムの沿革
- ・国際農学ESDシンポジウム2013の概要
- ・国際農学ESDシンポジウム2013の日程表

## 筑波アジア農業教育セミナー及び国際農学ESDシンポジウムの沿革

筑波大学農林技術センターは、1979年にユネスコから、その主事業の一つであるAPEID(The Asia-Pacific Programme of Educational Innovation for Development)の協同センター(Associated Center)として指名され、以来、日本ユネスコ国内委員会との共催により、「筑波アジア農業教育セミナー」(TASAE:Tsukuba Asian Seminar on Agricultural Education)を関係部局との協力のもとに毎年開催してきた。

「筑波アジア農業教育セミナー(TASAE)」の目的は、筑波大学の農業教育活動の一環として、アジア諸国の農業教育および農業研究に従事する専門家を我が国に招聘し、我が国の専門家を交えて各国の実情と問題点を比較検討し、この分野での我が国の教育水準を向上させ、併せてアジア地域の農業教育および農業研究の国際協力推進に寄与することであった。

APEID事業の第2期である1979年から1981年までの3年間は、「中等段階(Secondary Level)の農業教育問題」に焦点が置かれてきた。各年の開催テーマは、以下のとおりである。

- 1979年 アジア地域の中等段階農業教育の現状と問題点
- 1980年 アジア地域の中等段階農業教育における実験と圃場実習の重要性  
—主として、カリキュラム開発について—
- 1981年 アジア地域の中等段階農業教育における教授法  
—主として、稲作について—

APEID事業の第3期としての1982年から1986年までの5年間は、前期の総括を受けて、アジア地域の農業教育革新の必要性を、単に中等教育のみでなく、初等教育から高等教育に至るまでの全段階において考慮・検討することとした。そこで、APEID事業の第3期における統一テーマは、「アジア地域における農業教育革新のための戦略」とし、農林学、農林工学、応用生物化学といった具体的観点から、農業教育革新への技術的アプローチを行った。各年のテーマは、以下のとおりである。

- 1982年 アジア諸国の農業の現状と開発計画および教育の役割(序論)
- 1983年 アジア諸国の作物生産における技術革新上の問題点(農学からのアプローチ)
- 1984年 生産性向上のための農業工業分野における技術革新 —主として穀類の調製・貯蔵技術について(農業工学からのアプローチ)
- 1985年 アジア諸国における農村地域開発のためのバイオマスとバイオテクノロジーの有効利用(応用生物化学からのアプローチ)
- 1986年 アジア諸国における農業発展のための農業教育 —事例と展望(総括)

なお、1985年のTASAEでは、期間中にサテライトシンポジウム「アジア諸国における農村開発のためのバイオマスとバイオテクノロジーの有効利用」を開催し、また1986年のTASAEでは、ジョイントシンポジウム「アジア各国における農業の研究と教育 —21世紀をめざして」を熱帯特プロとの共催で開催した。

APEID事業の第4期、1987年から1991年までの5年間は、アジア太平洋地域各国において、森林や内水面を含む自然並びに農業生態系との調和のもとに農業生産性の向上を図るために必要な、農業の教育と研究の在り方について考慮・検討した。すなわち、APEID事業の第4期における統一テーマは、「アジア太平洋地域における自然並びに農業生態系を保全しながら農業生産性を高めるための教育と研究」とし、自然並びに農業生態系の保全と有効利用に焦点を合わせたセミナーを開催した。各年のテーマは、以下のとおりである。

- 1987年 アジア各国における自然並びに農業生態系を保全しながら農業生産性を高めるための教育と研究の現状、問題点並びに展望
- 1988年 アジア各国における森林の有効利用と保全のための教育と研究に関する現状、問題点並びに展望
- 1989年 アジア各国における内水面の有効利用と保全に関する教育と研究の現状、問題点並びに展望
- 1990年 アジア各国における耕地、水の有効利用と保全並びに農薬、化学肥料の適正利用に関する教育と研究の現状、問題点並びに展望
- 1991年 アジア各国における農業教育と環境教育の結合に関する現状、問題点並びに展望

APEID事業の第5期である1992年から1996年までの5年間は、統一テーマを「アジア・太平洋地域における持続的な農業発展と環境保全のための教育と研究」とし、本期の重点課題や強調点としてうたわれている環境問題と人材養成の2点を念頭に置き、アジア各国における持続的な農業発展と環境保全のための教育と研究の在り方について討議を深めた。各年のテーマは、以下のとおりである。

- 1992年 アジア各国における農業生産からみた問題土壌とその対応に関する現状、問題点並びに展望
- 1993年 アジア各国における持続的な家畜生産のための教育と研究の現状、問題点並びに展望
- 1994年 アジア・太平洋地域における持続的な農業発展と環境保全のための森林・林業の教育・研究の現状と課題
- 1995年 アジア諸国における持続的な農業発展のための植物育種と遺伝資源に関する教育と研究の現状、問題点並びに展望
- 1996年 アジア諸国における持続的な農業発展のための農業技術教育の現状と問題点並びに展望

APEID事業の第6期、1997年から2001年までの5年間は、統一テーマを「アジア・太平洋地域における農業・環境教育革新のための戦略」とし、アジア各国における持続的な農業発展と環境保全のための職業教育革新について討議を深めた。なお、1989年から期間中において、サテライトシンポジウムを毎年開催した。各年のテーマは、以下のとおりである。

- 1997年 アジア・太平洋地域における農業・環境教育革新の現状と展望
- 1998年 アジア・太平洋地域における農業・環境教育革新のための生物資源利用教育の現状と展望
- 1999年 アジア・太平洋地域における農業・環境教育革新のための地域情報利用教育の現状と展望
- 2000年 アジア・太平洋地域における農業・環境教育革新のための体験的教育の現状と展望：農業・環境教育の改善に対する大学の役割
- 2001年 アジア・太平洋地域における参加型アプローチを通じた持続的な地域資源管理および環境保全

APEID事業の第7期、2002年から2007年までの6年間は、統一テーマを「持続的な発展を前提とした生存・生産環境創成のための水資源利用・保全技術開発と農林業教育の役割」とし、アジア・太平洋諸国が抱える水資源の問題を分析し、新たな水環境の創生のために農林業教育が果たすべき役割について討議を深めた。各年のテーマは、以下のとおりである。

- 2002年 水資源の涵養と水災害などに関わる現状把握および農林業教育が果たすべき役割
- 2003年 人類生存・食料生産に関わる水資源の需要・分配と農林業教育が果たすべき役割

- 2004年 生存・生産活動と連動した水資源の量的確保に関わる現状把握、効率的利用を図るための技術動向および農林業教育が果たすべき役割
- 2005年 人類の生存・生産活動のための水資源管理と農林業教育が果たすべき役割
- 2006年 地球環境的・地域環境的視点からの水資源利用・保全技術動向および農林業教育が果たすべき役割
- 2007年 アジア・太平洋地域における参加型アプローチを通じた持続的地域水資源管理と環境保全

APEID事業の第8期を迎えた2008年には、これまでの教育セミナー形式を国際会議形式に発展させ、8期6年間（2008年から2013年まで）の統一テーマを「持続可能な未来のための農学ESDの推進」として、キックオフ会議「国際農学ESDシンポジウム（Ag-ESD Symposium 2008）」を開催した。この年のテーマを「持続的発展のための農学教育」に関する大学・関連機関の教育・研究活動の現状と果たすべき役割」として、討議を行った。

各年のテーマは、次のとおりである。

- 2008年 農学ESDのキックオフ会議  
「持続的発展のための農学教育」に関する大学・関連機関の教育・研究活動の現状と果たすべき役割」
- 2009年 「農学ESDにおける食の安全と食糧の安全保障」
- 2010年 「農業および環境分野における持続的開発のための中等・高等教育の役割」
- 2011年 「農学ESDにおける生物多様性の適正利用」
- 2012年 「農学ESD推進のための環境調和型農業技術開発」
- 2013年 「農学ESDにおける大学の役割」

2009年には、「農学ESDにおける食の安全と食糧の安全保障」をテーマとして第2回目の「国際農学ESDシンポジウム（Ag-ESD Symposium 2009）」を開催した。11月9日から12日までの間、7カ国（フィリピン、タイ、インドネシア、インド、マラウイ、ナイジェリア及び日本）から18人の専門家が出席し、テーマに基づいた講演、発表、活発な討議を行った。

2010年は、「農業および環境分野における持続的開発のための中等・高等教育の役割」をテーマに第3回目のシンポジウム（Ag-ESD Symposium 2010）を開催し、11月8日から11日までの間に8カ国（フィリピン、タイ、インドネシア、アフガニスタン、バングラデシュ、マラウイ、ガーナ及び日本）の専門家が出席し、講演、質疑応答を行なった。また、特に、海外交流協定校のフィリピン大学、カセサート大学、ボゴール農科大学の各附属高等学校及び本学附属坂戸高等学校の現職教員による発表セッションを組み込んで、発表、討議を活発に行なった。

2011年は、「農学ESDにおける生物多様性の適正利用」をテーマに第4回目のシンポジウム（Ag-ESD Symposium 2011）を開催し、11月7日から11日までの間に9ヶ国（フィリピン、タイ、インドネシア、アフガニスタン、アメリカ合衆国、ガーナ、ケニア、マラウイ及び日本）の専門家が出席し、テーマに基づいた講演、発表、活発な討議を行った。

2012年は、「農学ESD推進のための環境調和型農業技術開発」をテーマに第5回目のシンポジウム（Ag-ESD Symposium 2012）を開催し、10月29日から11月2日までの間に9ヶ国（フィリピン、タイ、インドネシア、アフガニスタン、アメリカ合衆国、ガーナ、ケニア、ラオス及び日本）の専門家が出席し、テーマに基づいた講演、発表、活発な討議を行った。

# 国際農学ESDシンポジウム2013 (Ag-ESD Symposium 2013) の概要

## 1. 題 目

「農学ESDの推進における大学の役割」

(The Role of Universities in Promoting Agricultural Education for Sustainable Development (Ag-ESD) )

第8期APEID計画統一テーマ：「持続可能な未来のための農学ESDの推進」

( Promotion of Ag-ESD for the Development of a Sustainable Future )

## 2. 期 間

平成25年11月25日（月）～11月 29日（金）（5日間）

## 3. 会 場

筑波大学 大学会館（特別会議室ほか）、農林技術センター

## 4. 主 催

筑波大学農林技術センター

## 5. 共 催

筑波大学大学院生命環境科学研究科

アジア共生社会を創成するための国際連携教育プログラム委員会

国際協力機構筑波国際センター

## 6. 後 援

文部科学省、日本ユネスコ国内委員会、茨城大学農学部

## 7. 参加者

- ・ カセサート大学、ボゴール農科大学、フィリピン大学ロス・バニオス校、ユタ州立大学（以上海外交流協定校）、の農学教育または農学研究に従事する教員・研究者
- ・ アフガニスタンの農学教育または農学研究に従事する教員・研究者
- ・ 筑波大学、茨城大学の農学教育または農学研究に従事する教員・研究者
- ・ 筑波大学生命環境科学研究科「持続的農村開発（SRD）コース」の修了生
- ・ 筑波大学大学院生、茨城大学大学院生
- ・ 農学教育又は農学研究に従事する一般の研究者 等

## 8. 会議の形態

基調講演 招待講演 ポスターセッション 若手研究者フォーラム

## 9. 使用言語

英語



## 国際農学ESDシンポジウム2013 (Ag-ESD Symposium 2013) の日程表

月 日	時 間	プ ロ グ ラ ム	
11月 24日 (日)		招聘外国人の成田空港到着・宿泊	[ 成田のホテル ]
11月 25日 (月)	08:30~10:00 10:30~12:00 12:00~13:00 13:15~13:30 13:30~14:00 14:15~15:15 15:15~16:15 16:15~17:00 18:00~20:00	招聘外国人の出迎え (大学から成田のホテルへ) 移動 (成田から大学へ) 昼食 記念写真撮影 開会式 基調講演 (1) 【ユタ州立大学】 基調講演 (2) 【筑波大学】 受付・オリエンテーション (概要説明) 歓迎パーティ	[ 大学会館特別会議室 ]        [ レストランプラザ ]
11月26日 (火)	09:20~09:40 09:40~10:20 10:20~11:00 11:00~12:15 12:15~13:30 13:30~14:00 14:00~14:40 14:40~15:20 15:20~15:30 15:30~16:10	講演 【筑波大学農林技術センター】 招待講演 (1) 【茨城大学】 招待講演 (2) 【筑波大学】 休憩・昼食 学生との対話 (「専門語学I」に対応) 休憩 招待講演 (3) 【SRDコース修了生1】 招待講演 (4) 【SRDコース修了生2】 休憩 招待講演 (5) 【SRDコース修了生3】	[ 大学会館特別会議室 ]   [ 大学会館ホール ]   [ 大学会館特別会議室 ]
11月 27日 (水)	09:00~09:40 09:40~10:20 10:20~10:30 10:30~11:10 11:10~11:50 12:00~13:00 13:00~13:50 14:00~14:30 14:30~15:30 15:30~16:00	招待講演 (6) 【ボゴール大学】 招待講演 (7) 【カセサート大学】 休憩 招待講演 (8) 【フィリピン大学】 招待講演 (9) 【アフガニスタン】 昼食 (弁当) 展示ポスター視察 (ポスター・ビューイング) 移動 (マイクロバス) *農林技術センターへ 農林技術センター訪問 移動 (マイクロバス) *大学会館別館へ	[ 大学会館特別会議室 ]    [ 大学会館第3会議室 ] [ 総合交流会館多目的ホール ]
11月 28日 (木) (ポスターセッション)	09:00~12:00 12:00~13:00 13:00~15:00 15:00~	ポスター 発表 昼食 ポスター 発表 優秀ポスター賞等表彰式	[ 総合交流会館多目的ホール ]  [ 総合交流会館多目的ホール ] [ 大学会館特別会議室 ]
11月29日 (金) (若手研究者フォーラム)	09:00~09:30 09:30~10:00 10:00~10:30 10:30~10:40 10:40~11:10 11:10~11:40 11:40~13:00 13:00~14:00 14:00~18:00 18:00~20:00	発表 (1) 【茨城大学】 発表 (2) 【ボゴール大学】 発表 (3) 【カセサート大学】 休憩 発表 (4) 【フィリピン大学】 発表 (5) 【筑波大学】 昼食・休憩 閉会式 (優秀発表賞等表彰式を含む) フリータイム 送別パーティ	[ 大学会館特別会議室 ]     [ 大学会館特別会議室 ] [ 本部棟1Fレストラン ]
11月30日 (土) ~12月1日 (日)	07:00~18:00	招聘外国人の帰国 (大学から成田空港へ送り)	



国際農学 ESD (Ag-ESD) 組織委員会  
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