

# Ag-ESD Symposium 2014



**PREMIUM  
Agriculture**

**&**

**Food Project**

**Program  
&  
Summaries**

Ag-ESD Symposium for  
GLOBAL ACTION Program

**11/10~14**  
Mon. Fri.

**University of Tsukuba**

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Date: November 10 (Mon.) to 14 (Fri.), 2014

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.

The Ag-ESD Symposium 2013 was held from November 25th to 29th and focused on “The Role of Universities in Promoting Agricultural Education for Sustainable Development”. Seventeen participants from 7 countries: Philippines, Thailand, Indonesia, Afghanistan, U.S.A, Kenya and Japan.

## Theme and Objective

### 1) Theme

Premium Agriculture and Food Project

### 2) Objective

To promote APEID program and Global Action Program, which is a post-ESD program of UNESCO, we will focus on issues related to the role of universities in promoting agricultural education for sustainable development.

## Outline of Schedule

Nov. 9 (Sun.)	Arrival at Narita Airport, Japan
10 (Mon.)	Registration, Opening Ceremony, Keynote Addresses Welcome Party
11 (Tue.)	Invited Lectures, Discussion with Students
12 (Wed.)	Invited Lectures, Poster Viewing Excursion (Visit ASAKUSA)
13 (Thu.)	Poster Session, Awards Ceremony
14 (Fri.)	Young Researcher's Forum, Closing Ceremony
15 (Sat.)	Departure from Japan

## Accommodations

Nov. 9 (Sun.)	Hotel Nikko Narita (Phone) 0476-32-0032
Nov. 10(Mon.) – 14 (Fri.)	University Hall Annex, University of Tsukuba (Phone) 029-853-2386

# Ag-ESD Symposium 2014 Program

Program of 2014 International Symposium on Agricultural Education for Sustainable Development

**November 9 (Sun.)** Arrival at Narita Airport [ ⇒ stay at Hotel Nikko Narita ]

## **November 10 (Mon.)**

- 10:30 Leave Hotel Nikko Narita for University of Tsukuba (UT)
- 12:00 Arrival at University Hall, UT
- 12:00-13:00 Lunch
- 13:15-13:30 Group Photograph (1)
- 13:30-14:00 **Opening Ceremony** [ Special Conference Room, University Hall A ]  
Welcome Address
- Michiyoshi AE, Vice President, University of Tsukuba
- Opening Address
- Atsushi TAJIMA, Director, Agricultural and Forestry Research Center (AFRC)  
(Associated Center of APEID), University of Tsukuba
- 【 \* Chairperson: Ryozo NOGUCHI 】
- 14:00-14:15 Group Photograph (2)
- 14:15-15:15 **Keynote Address**
- Hiroyuki KONUMA, Assistant Director-General and the Regional Representative for Asia and the Pacific, Food and Agriculture Organization (FAO) of the United Nations (UN)
- ◇ Topic: “ Status of World Food Security and its Future Outlook, and Role of Agricultural Research and Education ”
- 【 \* Chairperson: Ryozo NOGUCHI 】
- 15:15-16:15 **Registration and Orientation**
- 18:00-20:00 **Welcome Party** [Restaurant at Administration Center]

## **November 11 (Tue.)**

- 09:20-09:40 **Address**
- Hideo YOSHIDA, Assistant Professor, Agricultural and Forestry Research Center (AFRC), University of Tsukuba
- ◇ Topic: “ Education for Sustainable Development in Agriculture at the University of Tsukuba ”
- 【 \* Chairperson: Yoshihiko SEKOZAWA 】

- 09:40-10:20 **Invited Lecture (1)** [ Special Conference Room, University Hall A ]  
 • Yutaka KITAMURA, Professor, University of Tsukuba  
 ◇ Topic: “ How About Rice Made Cheese? - Development of Value-added Rice - ”  
 【 \* Chairperson: Yoshihiko SEKOZAWA 】
- 10:20-11:00 **Invited Lecture (2)** [ Special Conference Room, University Hall A ]  
 • Junko NISHIWAKI, Assistant Professor, Ibaraki University  
 ◇ Topic: “ Balance of Greenhouse Gas Emission and a Food Supply in Paddy Field ”  
 【 \* Chairperson: Yoshihiko SEKOZAWA 】
- 11:00-12:15 Break and Lunch ( Free )
- 12:15-13:30 **Discussion with Students** [ University Hall A ]  
 • Lucille Elna Parreño DE GUZMAN, University of the Philippines, Los Baños  
 • Narongchai PIPATTANAWONG, Kasetsart University  
 • Slamet BUDIJANTO, Bogor Agricultural University  
 • Abby BENNINGHOFF, Utah State University
- 13:30-14:00 Break
- 14:00-14:40 **Invited Lecture (3)** [ Special Conference Room, University Hall A ]  
 • Slamet BUDIJANTO, Professor, Bogor Agricultural University  
 ◇ Topic: “ Rice Analogue as Food Diversification Vehicle ”  
 【 \* Chairperson: Internship Student 】
- 14:40-15:20 **Invited Lecture (4)** [ Special Conference Room, University Hall A ]  
 • Narongchai PIPATTANAWONG, Senior Researcher / Vice President for  
 Special Project Coordination, Kasetsart University  
 ◇ Topic: “ Strawberry Production and the Royal Project Foundation, Thailand ”  
 【 \* Chairperson: Internship Student 】
- 15:20-16:00 **Invited Lecture (5)** [ Special Conference Room, University Hall A ]  
 • Lucille Elna Parreño DE GUZMAN, University Researcher, University of the  
 Philippines, Los Baños  
 ◇ Topic: “ Diversified and Integrated Farming Systems (DIFS):  
 Philippine Experiences for Improved Livelihood and Nutrition ”  
 【 \* Chairperson: Internship Student 】
- 16:00-16:10 Break
- 16:10-16:50 **Invited Lecture (6)** [ Special Conference Room, University Hall A ]  
 • Kobra HEMMATY, Lecturer, Balkh University  
 ◇ Topic: “ Current Status of Agriculture in Afghanistan ”  
 【 \* Chairperson: Internship Student 】
- 16:50-17:30 **Invited Lecture (7)** [ Special Conference Room, University Hall A ]  
 • Chin Ping TAN, Professor, Universiti Putra Malaysia  
 ◇ Topic: “ Sustainable Development of Palm Oil Industry Via Process  
 Improvement and Product Diversification ”  
 【 \* Chairperson: Internship Student 】

**November 12 (Wed.)**

- 09:00-09:40 **Invited Lecture (8)** [ Special Conference Room, University Hall A ]  
• Abby BENNINGHOFF, Assistant Professor, Utah State University  
◇ Topic: “ Fighting Cancer with Functional Foods: New Approaches to Investigate the Interactions of Dietary Bioactive Chemicals and Basal Nutrition ”  
【 \* Chairperson: DeMar TAYLOR 】
- 09:40-10:20 **Invited Lecture (9)** [ Special Conference Room, University Hall A ]  
• Abdulai Mumuni BAAKO, Management Information Systems Officer (MISO), Ministry of Food and Agriculture, Ghana  
◇ Topic: “ Promoting on Farm Water Harvesting and Conservation Techniques for Sustainable Agricultural Production Systems through Capacity Development of Field Extension Officers and Farmers ”  
【 \* Chairperson: Shadreck MUNGALABA 】
- 10:20-11:00 **Invited Lecture (10)** [ Special Conference Room, University Hall A ]  
• Shadreck MUNGALABA, Director, Department of Cooperatives, Ministry of Agriculture and Livestock  
◇ Topic: “ Improving Yields and Profitability for Small-scale Farmers through Conservation Agriculture in Lusaka Province, Zambia ”  
【 \* Chairperson: Abdulai Mumuni BAAKO 】
- 11:00-11:30 Break and Poster Viewing [ Lounge at 30<sup>th</sup> Anniversary Hall ]  
11:30- Leave University Hall A for ASAKUSA  
Lunch and **Excursion**
- 16:30-17:00 Leave ASAKUSA for University Hall ( Annex )  
18:30 Arrival at University Hall ( Annex )

**November 13 (Thu.)**

[ Lounge at 30<sup>th</sup> Anniversary Hall ]

- 09:00-13:30 **Poster Presentation**  
• Selected persons: Graduate students, etc.  
Lunch ( Free )
- 13:30-15:00 **Senior High School at Sakado, University of Tsukuba Presentations**  
15:00- **Awards Ceremony for Best Poster Presentation**

**November 14 (Fri.)**

《 **Young Researcher’s Forum** 》

- 09:00-09:30 **Presentation (1)** [ Special Conference Room, University Hall A ]  
• Takahiro ITO, Doctoral Student, Ibaraki University  
◇ Topic: “ Pest Control by No-tillage Farming and Crop Rotation  
- A Study of Rice Cyst Nematode (*Heterodera elachista*) in Japan - ”  
【 \* Chairperson: Eriko ANKYU 】



09:30-10:00	<b>Presentation (2)</b>	[ Special Conference Room, University Hall A ]
	• Faleh SETIABUDI, Lecturer, Bogor Agricultural University	
	◇ Topic: “ Effect of Dough Moisture Content and Extrusion Temperature on Gelatinization Degree and Crystallinity of Rice Analogue ”	
	<b>【 * Chairperson: Takahiro ITO 】</b>	
10:00-10:30	<b>Presentation (3)</b>	[ Special Conference Room, University Hall A ]
	• Pinpinatt JUNHAENG, Ph.D student, Kasetsart University	
	◇ Topic: “ The Improvement of Barley Seed Quality by Priming Methods in Malt Industry ”	
	<b>【 * Chairperson: Faleh SETIABUDI 】</b>	
10:30-10:40	Break	
10:40-11:10	<b>Presentation (4)</b>	[ Special Conference Room, University Hall A ]
	• Dora Fe H. BERNARDO, Assistant Professor, University of the Philippines, Los Baños	
	◇ Topic: “ Premium Agrifisheries for the Disaster Affected Area of Leyte, Philippines ”	
	<b>【 * Chairperson: Pinpinatt JUNHAENG 】</b>	
11:10-11:40	<b>Presentation (5)</b>	[ Special Conference Room, University Hall A ]
	• Eriko ANKYU, Doctoral Student, University of Tsukuba	
	◇ Topic: “ Oil-water Separation Technology for Postharvest and Food Processing -Improving Productivity and Environmental Quality- ”	
	<b>【 * Chairperson: Dora Fe H. BERNARDO 】</b>	
11:40-13:00	Lunch and Break ( Free )	
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>	[ The Soup Factory ]

**November 15 (Sat.)**

07:00-18:00 Departure from Japan

# List of Participants

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## **【Welcome Address】**

**Michiyoshi AE**  
Vice President  
University of Tsukuba

## **【Opening Address】**

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

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## **【Keynote Address】**

### **Keynote Speaker**

**Hiroyuki KONUMA**  
Assistant Director-General and the Regional Representative for Asia and the Pacific  
Food and Agriculture Organization (FAO) of the United Nations (UN)

## **【Address】**

### **Speaker**

**Hideo YOSHIDA**  
Assistant Professor, Agricultural and Forestry Research Center, University of Tsukuba

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## **【Invited Lecture】**

### **Invited Lecturer**

**Yutaka KITAMURA**  
Professor, University of Tsukuba   【Japan】

**Junko NISHIWAKI**  
Assistant Professor, Ibaraki University   【Japan】

**Slamet BUDIJANTO**  
Professor, Bogor Agricultural University   【Indonesia】

**Narongchai PIPATTANAWONG**  
Senior Researcher / Vice President for Special Project Coordination  
Kasetsart University   【Thailand】

**Lucille Elna Parreño DE GUZMAN**  
University Researcher, University of the Philippines, Los Baños   【Philippines】

**Kobra HEMMATY**

Lecturer, Balkh University 【Afghanistan】

**Chin Ping TAN**

Professor, Universiti Putra Malaysia 【Malaysia】

**Abby BENNINGHOFF**

Assistant Professor, Utah State University 【USA】

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**Abdulai Mumuni BAAKO < Graduate of University of Tsukuba, SRD Course >**

Management Information Systems Officer (MISO)

Ministry of Food and Agriculture 【Ghana】

**Shadreck MUNGALABA < Graduate of University of Tsukuba, SRD Course >**

Director, Department of Cooperatives

Ministry of Agriculture and Livestock 【Zambia】

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**【Young Researcher's Forum】**

**Presenter**

**Takahiro ITO**

Doctoral Student, Ibaraki University 【Japan】

**Faleh SETIABUDI**

Lecturer, Bogor Agricultural University 【Indonesia】

**Pinpinatt JUNHAENG**

Ph.D student, Kasetsart University 【Thailand】

**Dora Fe H. BERNARDO**

Assistant Professor, University of the Philippines, Los Baños 【Philippines】

**Eriko ANKYU**

Doctoral Student, University of Tsukuba 【Japan】

**Summaries**  
**for Keynote Address,**  
**Address and Invited Lectures**

# Contributors

## **【Keynote Address】**

- **Hiroyuki KONUMA** < *Food and Agriculture Organization (FAO) of the United Nations (UN)* >  
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## **【Address】**

- **Hideo YOSHIDA** < *University of Tsukuba* >  
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- **Junko NISHIWAKI** < *Ibaraki University* >  
Balance of Greenhouse Gas Emission and a Food Supply in Paddy Field ..... 16

[ Invited Lecturers from the Universities sharing Academic Exchange Agreements with the University of Tsukuba ]

- **Slamet BUDIJANTO** < *Bogor Agricultural University* >  
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[ Graduates of the University of Tsukuba, SRD course ]

- **Abdulai Mumuni BAAKO** < *Ministry of Food and Agriculture* >  
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**Hiroyuki KONUMA**

Assistant Director-General and the Regional Representative for Asia and the Pacific, Food and Agriculture Organization (FAO) of the United Nations (UN)

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## **Status of World Food Security and its Future Outlook, and Role of Agricultural Research and Education**

The world produces sufficient food to meet the need of everyone at present. Yet, despite of our continued efforts, progress in eradicating hunger has been very slow. The world is still a home of 805 million chronically hungry people and the vast majority of them live in developing countries. One in every nine people on the planet suffers from chronic hunger, and one in every three children in developing world is stunted. The proportion of global chronic hunger population has fallen from 18.7 percent in 1990-92 to 11.3 percent in 2014, and getting closer to the MDG hunger goal. However, remaining bottom of 11.3 percent constitutes the most vulnerable and disadvantaged group in our society. Unless we target our effort to these people for “Zero Hunger” towards total eradication, the world would not be able to achieve equitable growth, social stability, world peace and sustainable development.

In addition, the world is facing serious challenges in future food security. Present world population of 7.1 billion is predicted to exceed 9 billion by 2050, and the per capita average food consumption would exceed 3,000 kcal/day in 2050 from 2,770 kcal/day in 2005/07. To meet the rapidly increasing food requirements, the world food production needs to be increased by 60 percent worldwide by 2050. If we fail to achieve this target, there would be a high risk of food shortage, food riots, social and political unrest, and other negative consequences as we witnessed during the food price crisis in 2007-08. On the other hand, there is a very little potential to increase arable lands as agricultural lands have been almost fully exploited. Increasing scarcity of water resources, negative impacts of climate changes, frequent occurrence of natural disasters, high post-harvest losses and food waste, increasing competition on the use of land and water between food crops and bio-energy crops are other critical risks and uncertainties which would greatly influence future food availability and food security. FAO predicts that it would be possible to increase food production by 60 percent by 2050 on the assumption that nearly 90 percent of food production increase should come from existing arable lands through yield increase/agricultural research.

Hence, the agricultural research will have a key for the success in achieving food security and feeding the future world population, and accordingly, the role of agricultural education should be fully recognized. These challenges would take place in next 30-40 years, for which young generations, especially those presently studying at high schools and universities would hold a dominant role to lead the world in meeting the challenge.



**Hideo YOSHIDA**

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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.





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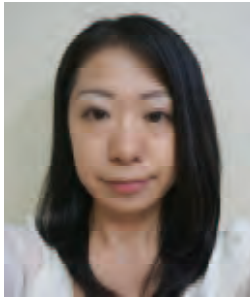
Specialty: Food and Biomass Engineering

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## **How About Rice Made Cheese? - Development of Value-added Rice -**

In recent years, a consumption trend of the Japanese food has been changing greatly by westernization of the meal. Especially a consumption increase in dairy products and a consumption decrease in rice as staple food are remarkable. Above all the consumption increase in cheese causes a lack of domestic fresh milk for the raw materials and results in the high dependence on overseas import about 80% of the cheese supply. On the other hand, the decrease in rice consumption raises serious problems such as the decline of rice growing farmers and fields which only support the domestic food supply in Japan. Therefore we propose a development of value added rice through the production of rice made cheese or cheese type food which utilizes brown rice as alternative raw materials. Especially the brown rice attracts us because it involves several kinds of nutrients and is considered to improve the human health condition. This challenge is expected to solve the problems of Japanese rice farming but also improve all Asian rice farmer income as it increase the value of rice.

In this study the possibility of the processing cheese-like food from rice slurry was investigated. The rice slurry is produced by milling brown rice and water simultaneously in a newly developed Micro Wet Milling System, and which is composed of a water proof stone mill, a feeder, a rotation controller and so on. The rice slurry has an advantage to be more convenient to process gel foods than rice flour. The cheese-like food is defined as the foodstuff that has some properties closed to general milk made cheese, and that is made from raw materials anything other than fresh milk. Accordingly lactic fermentation characteristic of rice slurry was investigated with comparing general cheese, and solidification method of rice cheese method was examined. The characteristic of rice cheese making process was unraveled in the important three steps of cheese processing which are sterilization, lactic fermentation, and coagulation. The experiment results show the best sterilization condition of rice slurry was to heat and keep the material at 65°C for 30 min. The lactic fermentation of rice slurry was found to be possible at the condition as the same as milk lactic fermentation. When the lactic fermented rice slurry was coagulated with gelatin after the physical dehydration, it had the same breaking strength as milk made cheese purchased form the market. At the sensory evaluations, the condition with 2.5 wt% addition of gelatin received the highest favorability rating of 41.6%. According to the experimental studies, we consider that the production of rice cheese is one of the possible methods to improve the vale added of rice.



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## **Balance of Greenhouse Gas Emission and a Food Supply in Paddy Field**

Global warming is one of the important issues because that impact on human life is very severe. Rice paddies are considered to be a major source of anthropogenic methane emission (Jacobson, 2005). There exist a big proportion of the paddy field throughout Asian region include Japan. We should control GHG emission from paddy field. Although it is clear that continuous environmental preservation is important, but production of food is also important. Yu and Patrick (2004) reported that there exist suitable oxidation-reduction potential (ORP) range that makes the minimum emission of CO<sub>2</sub> and CH<sub>4</sub> and N<sub>2</sub>O. Water management of paddy field would be one of the most important tools that can control ORP, or the emission of GHG from paddy field.

In this study, we investigated the effect of water management and organic matter application on the GHG flux in paddy field and the yield of rice.

We investigated the effect of water management on GHG emission and food supply at Meiji University Ikuta campus using a lysimeter mimicking a paddy field. The effect of organic matter application on them is investigated at a paddy field in Iitate village in Fukushima prefecture. We found flux and the yield of rice are different in each gas and vary at different water management. We also found they are different in each gas and vary at different organic matter application. Water management is one of the useful tools to control GHG flux at paddy field, and aerenchyma might work as an important GHG passage root. But water management has an effect on rice yield. Organic matter also has same effect on GHG flux at paddy field and rice yield. We should find the suitable treatment, include water management and organic matter application and so on, to control GHG flux and keep stable rice yield.



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## **Rice Analogue as Food Diversification Vehicle**

Indonesian government started the Food Diversification Program since 1974. However, up to now no significant results have been achieved. The country's rice consumption is still high. The reason can be that there is no suitable 'vehicle' yet which is able to deliver Indonesia's diverse local carbohydrate sources into an acceptable form of staple food. The proposed food diversification vehicle candidate should have the following criteria: (1) widely acceptable (2) no necessity to change local dietary habit (3) no necessity to change the way of cooking (4) able to use in Indonesian culinary cuisine (4) made from local carbohydrate source. The proposed product we offer is "rice analogue" (RA) which is prepared from various local carbohydrate sources other than paddy rice. RA fits the abovementioned criteria thus it is very prospective to be developed as food diversification vehicle. RA processing technology is a novel way of delivering a diverse local carbohydrate sources into staple food for Indonesian society. Upstream to downstream comprehensive research involving multi discipline experts and stakeholders is required to successfully develop RA. Upstream activities include seedling development and cultivation. Downstream activities include process optimization, RA machineries design, and developing RA with specific functional properties. Studies on functional properties of RA which currently under progress include: (1) low GI RA (2) high fibre RA with hypocholesterolemic activity (3) high sterols RA with chemo-preventive activity. These functional properties can be used as a driving force to promote RA. RA development is expected to switch Indonesian society perceptions that paddy rice is not the only staple food, and that consuming non paddy rice as staple food will not lower their social status. When this new paradigm is built, people will comfortably consume more diverse carbohydrate source, not only in the form of RA but also in various other processed food products.

Keywords: rice analogue, extrusion, food diversification, carbohydrate, food security



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## **Strawberry Production and the Royal Project Foundation, Thailand**

Strawberries have been grown for many years in the north of Thailand but became economically important from the early 1980s. An unknown cultivar introduced by the British in Chiang Mai province in 1934 (Sukumalanandana, 1988) with very soft flesh, small fruit size, poor color, and low yield nevertheless spurred widespread interest as a new fruit in Thai home gardens. Until the early 1970s, some commercial producers tried to grow it. The Royal Project Foundation was established in 1969 by His Majesty King Bhumibol Adulyadej of Thailand to develop and improve the economic and living standards of the hill tribe peoples in the north by using cash crops to replace opium cultivation and preserve the forests and environment. The Foundation and Kasetsart University researched strawberries as a replacement crop from 1974 to 1979. Strawberry cultivars were introduced mainly from the USA and planted at several research stations. The research showed that the hill tribe farmers could expect a high return on their investment 3 months after planting the crop.

The research outcomes gave the hill tribes and local peoples a source of income from the production of strawberries and daughter plants. Strawberries now offer a source of quick, high-return investment.



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**Diversified and Integrated Farming Systems (DIFS):  
Philippine Experiences for Improved Livelihood and Nutrition**

de Guzman, L.E.P., Zamora, O.B., Bernardo, D.F.H.

The Philippines is predominantly an agricultural country composed of small farms with a mean area of 1.5 ha per farm. Widespread poverty continues to be a big problem in the country and Filipino adults and children continue to be afflicted by various forms of malnutrition, such as underweight, underheight or stunting, and wasting or thinness. A viable agricultural solution to this problem is diversified and integrated farming systems (DIFS).

The practice of DIFS is not new, is time-tested, and locally adapted. For centuries, farming communities have painstakingly developed resilient and bountiful agricultural systems based on biodiversity and on their knowledge of how to work with them in equally complex biophysical and socio-cultural settings. One of the most stable, productive and profitable diversified cropping systems in the Philippines is the coconut-based multi-storey system developed and practiced in Silang, Cavite. Other case examples are organic farming as practiced by small-scale farmers, the bio-intensive gardening (BIG) developed by the International Institute of Rural Reconstruction (IIRR) in Cavite, the sloping agricultural land technology (SALT) promoted by the Mindanao Baptist Rural Life Center (MBRLC) in Davao del Sur, the vegetable-agroforestry systems of the World Agroforestry Center in Lantapan, Bukidnon, and the complex upland food-production systems of different indigenous peoples' communities all over the country.

In all these examples, the message is clear; farmers have provided stability and sustainability of the agricultural production system, and hence, food security through the utilization of functional diversity in their farms and farming systems. Researches have shown that compared with monocultures, polycultures are more productive, utilize natural resources and photosynthetically active radiation more efficiently, resist pests epidemics better, produce more varied and nutritious foods, contribute more to economic stability, social equality, and provide farmers' direct participation in decision making. Thus, although small-scale tropical farmers have generally been confined to farming in low quality, marginal and fragile soils with little institutional support, their systems provide valuable information for the development of sustainable agricultural production system.



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## **Current Status of Agriculture in Afghanistan**

Afghanistan is a landlocked country with arid desert and semi-arid steppe climate which makes a unique environment for plants and animals. Geographically, it is a mountainous country and the arable and permanent cropland area is about 8.5 million hectares, which it is 12 percent of total land area of Afghanistan. This country introduced as an agricultural country with various plants, fruits and animals. In recent years, agriculture sector usually shares the one-fourth or one-third of the Gross Domestic Production GDP, depending on annual output. The agriculture is a key factor in food self-sufficiency, economic growth, livelihood, and national security in this country while the majority of Afghan's population lives in the rural areas and they are doing farming by traditional methods.

Livestock activity is an important part of most farming systems in Afghanistan. There are two main types of livestock production system, those of sedentary villagers and transhumant (Kuchi) system. Kuchi system is a mobile system which uses regular movement between summer and winter grazing for small ruminants such as sheep and goats, and it is more common in the south, the west and the southwest of the country.

Decades of conflict have had a devastating damage to agricultural infrastructures. To revival of agricultural infrastructures, it needs to work on the agriculture capacity development of the country. Afghanistan's agricultural capacity development is contingent on three principles, first is management of natural source, second agriculture productivity and the third is process and marketing of agriculture products.

The main challenges of agriculture sectors are a weakness of management due to lack of specialist and agriculture's data, security, as it affects the migration of farmers, low investment in agriculture sectors, the slow development of alternative crops to replace poppy cultivation, water supply for agriculture, and pests and disease of plants and animals. To deal with these problems, the government of Afghanistan should provide an especial national strategy to rebuild the agricultural infrastructures and develop the agriculture sectors efficiency.



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## **Sustainable Development of Palm Oil Industry Via Process Improvement and Product Diversification**

Palm oil has been a key driver for economic development in producing countries in Southeast Asia, especially Malaysia and Indonesia. The rapid growth of palm oil industry has played an important role in the Malaysian economy. Today, sustainability is a concept that is making huge impact in palm oil industry. This industry is facing unprecedented scrutiny from governments, regulators, investors and consumers in terms of how its business practices, supply chain and products impact the environment and the world. While palm oil has been traded mainly in the form of crude palm oil, this commodity has been a catalyst for the development of downstream industry, from the refining of crude palm oil initially to the emergence of the specialty fats and oleochemical industry and more recently in the production of palm-based biofuels. In addition, palm oil and palm kernel oil and its by-products are important ingredients in food and non-food products.

Continuous improvements in our understanding of the refining process of this major edible oil will play an important role in the sustainable development of the palm oil industry. Safety and health issues related to palm oil products are also closely related to the sustainable development of palm oil industry. In addition, product diversification in the palm oil industry requires substantial understanding of the physicochemical properties of this globally important edible oil. This paper aims to give an overview on the recent research developments in refining process and product diversification. Recent technologies for the preparation of oils, fats and their derivatives using palm oil as a starting material will be discussed. An overview of research in the area of (1) development of low free fatty acid crude palm oil; (2) refining process improvement with reduced 3-monochloropropane-1,2-diol and glycidol levels; (3) development of new palm-based emulsion products; and (4) production of palm-based functional lipids will be reviewed in this paper.



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## **Fighting Cancer with Functional Foods: New Approaches to Investigate the Interactions of Dietary Bioactive Chemicals and Basal Nutrition**

Approximately 25% of all deaths in countries with a Westernized lifestyle are attributed to cancer. In case-controlled and cohort studies, the typical Western diet is associated with significantly higher rates of colorectal cancer (CRC) compared to a balanced diet. CRC is the third most commonly diagnosed cancer and the third most common cause of cancer-related death in both men and women in the United States. The Western dietary pattern is characterized by high intakes of red and processed meats, sweets, fried foods and refined grains, whereas a more balanced diet replaces these foods with fruits and vegetables, legumes, fish, poultry and whole grains. Importantly, this dietary pattern is generally deficient in many micronutrients, such as the B vitamins and folate. While some studies have investigated the health effects of chronic low consumption of single micronutrients, information regarding the impact of chronic low intake of multiple micronutrients on disease outcome is lacking, especially in the context of a typical Western diet.

The Western diet also diet lacks many of the foods and beverages that are purported to have anticancer properties by virtue of their bioactive constituents, such as polyphenols present in green tea and dark-colored berries. Most studies investigating the health benefits of bioactive food chemicals employ standard diets that are optimized in nutrient composition for rodent health. In order to improve translation of these pre-clinical studies to human trials, we believe that a rodent diet more representative of the diet consumed by Americans is necessary to appropriately evaluate risk CRC and to develop specific and effective prevention strategies. Failure to consider the micronutrient intakes typical of U.S. nutrition in animal studies seeking to evaluate the efficacy of botanicals for health will likely lead to results that have questionable translational applicability to human nutrition. To address this resource gap, our research team developed the new Total Western Diet (TWD) for rodents with energy and nutrient profiles that emulate a typical Western diet. This newly devised basal rodent diet that better represents typical U.S. nutrition is highly useful for studies employing animal models of health and disease.





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**Promoting on Farm Water Harvesting and Conservation Techniques for Sustainable Agricultural Production Systems through Capacity Development of Field Extension Officers and Farmers**

Water deficit constitute a major constraint in crop production generally and rice particularly, rainfall is therefore the most critical and least predictable among climatic factors. Both the distribution and amount of rainfall during crop season are therefore key determinants of crop yields particularly in areas with less than 2000 mm of annual precipitation such as the Northern Region of Ghana.

With an annual average precipitation of 1100 mm or less of torrential rainfall on less porous soils, coupled with undulating topography in the area, large amounts of water from rains is lost as runoff from the fields, resulting in moisture stresses at the most critical stages of reproduction to maturity, resulting in yield losses/crop failure as well as soil degradation through erosion and subsequent siltation of water bodies as well as loss of fertility of productive farm lands. This has resulted in serious environmental problems with devastating socio-economic impacts on the rural farming populations.

Simple on farm water harvesting techniques is therefore critical for Sustainable Agricultural production systems and constitutes one of the greatest challenges in developing countries now. Effective water harvesting which involves taking advantage of and making maximum use of the least rainfall for increasing moisture retention for production and productivity enhancement in view of climate change and erratic rainfall can be achieved by the use of earth bunds, tied ridges, contour tillage or ploughing across the slope to reduce runoff and improve infiltration.

Rain fall in Ghana and the Northern Region in particular is generally on the decline and unpredictable due to climate change. Per my action plan from the Graduate School of Life and Environmental Sciences, University of Tsukuba, the capacities of Agricultural Field Extension Officers (AEAs) were to be built through training in on farm water harvesting and conservation techniques for subsequent training of farmers for sustainable crop production systems. Admittedly, there are clear gaps between the development of improved technologies from Research institutions, its delivery to farmers through Agricultural field extension Officers and the ability of farmers to adopt and sustain the use of these proven agricultural technologies

It is these gaps that this training intended to bridge through the use of crop demonstrations on simple on farm water harvesting and conservation techniques that do not warrant any drastic changes in the farming systems of the farmers. The key objective of which is to ensure a sustained adoption and effective utilization of the technologies disseminated through farmer training sessions at the rural community level with this Action Research Methodology.



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## **Improving Yields and Profitability for Small-scale Farmers through Conservation Agriculture in Lusaka Province, Zambia**

Farming, especially crop farming may not be very attractive to many small scale producers in the agricultural sector in Zambia due to low yields and low profits. The Government of The Republic of Zambia through the Ministry of Agriculture and Livestock and its partners has promoted Conservation Agriculture (CA) for over ten years now to improve the crop yields.

This desktop study was meant to evaluate the contribution of Conservation Agriculture (CA) to improving yields and profitability among small scale farmers based on studies made in some districts of Lusaka Province in Zambia. One study in Chongwe District identified the differences between CA and conventional farming practices in terms of yields and profits which were found to be key factors in technology acceptance and adoption by small scale farmers. This particular study in Chongwe, had a total population of 348 small scale farmers with above 70% responsiveness.

Another review was based on the crop production data obtained from Central Statistics Office (CSO) for five cropping seasons.

The results showed that there were no statistical significant differences between CA and conventional farming methods in crop yields, crop production costs and the level of profits. The CSO data showed some marginal average improvements in yields of maize crop though it could not be established if the increases were from CA farmers or not. This may require a further study to establish the trend.

The review helps to recommend that CA interventions need to be coupled with capacity building of farmers in terms of mechanization and investment levels and also the extension services to deal with gender balance and inclusion of youths in CA programmes.

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

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**Pest Control by No-tillage Farming and Crop Rotation  
— A Study of Rice Cyst Nematode (*Heterodera elachista*) in Japan —**

Rice is the most important food crop in the world, being the staple food for more than half of the world's population, predominantly in Asia where more than 90% of the world's rice is grown and consumed. Many genera and species of parasitic nematodes are associated with rice. Rice cyst nematode, *Heterodera elachista* infests areas of upland rice production in Japan, and this caused serious yield loss in the both of upland and irrigated rice. Recently, *H. elachista* is a becoming wide spread pest in Asia and European countries. Host plants of *H. elachista* are rice, millet, corn and wheat, however, *H. elachista* is mainly parasitic on rice.

Root diffusate from rice plants caused greater hatching of *H. elachista* eggs. The population of released juveniles *H. elachista* in the soil is increasing from March to April, however, that decrease from August to the winter. After host plants invasion of juveniles *H. elachista* they develop the cyst for next generation. *H. elachista* juveniles do not hatch from eggs contained in the cysts remaining from previous seasons in response to lower temperatures and autumn rains. As the season progresses the *H. elachista* remain at the same infection site and begin to swell into the characteristic white spheres. This process takes six to eight weeks, and the *H. elachista* remain like this until the host plant begins to senesce. The females die and their cuticle hardens and turns brown to form a "cyst". *H. elachista* has two or three generations per year. However, each cyst contains several hundred eggs, so populations can increase rapidly on susceptible cereals.

Chemical control was effective and increased a yield of paddy rice, however this effect was not obvious in the next season suggesting from a rapid build-up of the cyst population at harvest time in the first year. Chemical control of *H. elachista*, is often fail to obtain the economic advantages because the economical return by upland rice production is not afford it.

Tillage systems also affect the population density of nematode. No-tillage system is another alternative, that has been increasingly used for crop production in the US, Europe, South America, and Asia during the past decade due to their significant environmental advantage over moldboard plow.



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**Effect of Dough Moisture Content and Extrusion Temperature on Gelatinization Degree and Crystallinity of Rice Analogue**

Rice is one of the most important staple foods in Asia, included Indonesia. Despite to great effort to increase the rice production, imported rice is still needed due to high per capita consumption coupled with population growth. One approach to overcome these problem is to prepare rice analogue by extrusion, using yellow corn flour and corn starch as the main material. The dough moisture content and extrusion temperature can influence the gelatinization degree of rice analogue which affect the hardness of rice analogue. This research aimed to study the effect of dough moisture content of 35, 40 and 45% and extrusion temperature of 70, 80 and 90 °C on the degree of gelatinization and crystallinity of the resulted rice analogue. Raw materials used in this study includes yellow corn flour, corn starch and water. Extrusion was done by using a double screw extruder operated at the screw speed of 75 rpm and the auger speed of 30 rpm. The gelatinization degree of the produced rice analogue was analyzed by DSC and the polarized light microscope and the crystallinity by XRD. Our results shows that the dough moisture content and extrusion temperature studied caused a complete gelatinization (100%). The corn flour and starch with the A type crystal changed into a V type crystal after being extruded into rice analogue may be due to the formation of lipid-amylose complex compound.

**Keywords:** Rice analogue, extrusion, gelatinization degree, crystallinity



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## **The Improvement of Barley Seed Quality by Priming Methods in Malt Industry**

Barley (*Hordeum vulgare* L.) seeds are used as raw material for malt production which is important in many industries such as brewing industry, non-alcoholic and alcoholic beverage industry, and food industry. In Thailand, barley has been introduced to Thai farmers for improving their income and substituting imports, but its seed quality is often found to be lower than the standard quality for malt production especially in the aspect of seed vigor. Thus, this study was conducted to evaluate the effects of different seed priming methods on barley seed quality improvement for malt production. Three experiments were conducted. The first experiment was hydro-priming - seeds were primed in de-ionized water for 6, 8, 10, 12, 14, and 16 hours. The second experiment was hydro-priming plus potassium nitrate treatment - seeds were primed in 4 different concentrations of  $KNO_3$  solution, ie. 0.25, 0.50, 1.00, and 2.00% for 6, 8, 10, and 12 hours. The third experiment was osmo-priming by PEG4000 - seeds were primed in 3 different osmotic potentials, i.e. -0.50, -0.75, and -1.50 MPa for 10, 12, 14, and 16 hours. The results indicated that all seed priming methods accelerated barley speed germination and increased seed vigor. Primed barley seed could germinate within one day. However, all these methods did not affect barley seed germination percentage. It can be concluded that these 3 seed priming techniques could be effectively applied as alternative methods to improve barley seed quality in malt industry. However, further study is needed to evaluate the effects of seed priming methods on barley seed storability and other barley quality for malt production.



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**Premium Agrifisheries for the Disaster Affected Area of Leyte, Philippines**  
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Super typhoon Haiyan, locally known as Yolanda, was the strongest storm that hit the Philippines. With storm surges reaching 4 m high, the storm that hit Eastern Visayas last November 8, 2013, severely devastated the region with high human mortality, loss of crops and property, and environmental damage. The most affected were the resident communities especially those in the coastal areas which are also planted with coconuts, rice, and bananas, livestock and fisheries.

It was estimated that the total damage to the agricultural sector was PHP 31,130 M (RAY, 2013); production losses to crops, fisheries and livestock was PHP 27,070 M and damage to infrastructure (irrigation and other facilities) was PHP 4,058 M. Fish catch declined dramatically due to loss and damage of boats, fish ports and fishery equipment. Coral reefs and mangrove forest, which serve as habitat, spawning, breeding, and feeding grounds of fishes were also severely affected.

Focused Group Discussions (FGDs) conducted in 11 local government units (LGUs) located in the provinces of Samar and Leyte show that the fishers need sustainable livelihood support systems to feed their families and send their children back to school. The top four fishery-based activities identified were mariculture, fishing, aquasilviculture and gleaning. Alternative sources of income identified include selling of scrap, tending variety store, rice and root crops farming, working as pedicab drivers and construction workers, and selling of mangrove propagules.

The proposed socio-economic projects identified, which needs start-up capital and raw materials or inputs as follows: (a) Livestock and poultry raising (hog/piggery, goat, poultry/egg); (b) Meat/food processing; (c) Fisheries, such as fish net and gear, feeds for milkfish, fishing boats, freezer for fisheries postharvest (preservation and handling), fish vending, repair of tilapia hatchery, and mudcrub culture; and (d) Other activities such as reconstruction of Day Care Center, capacity enhancement training, rice store, crop planting and farm machinery.





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## **Oil-water Separation Technology for Postharvest and Food Processing -Improving Productivity and Environmental Quality-**

Oil-water separation technology is a promising means to recover oil from wastewater treatment during the postharvest food processing. There are many technologies to separate oil and water, for example, centrifugation, floatation, flocculation, and absorption. Oil-water separation is also used in refinery of biomass energy such as palm oil industry where wastewater includes large amount of oil from refinery process.

The problem of wastewater treatment is oil included in wastewater, which causes the reduction in treatment efficiency of wastewater. In Japan, a law entitled as 'Water Pollution Control Law' determines the water quality standard of plants and factories with above certain amount of wastewater. The oil-separation technologies are used to recover oil from wastewater and observed the water quality standard of oil that is determined less than 30 mg/L of normal hexane of extracts. One of the potential of this recovered oil utilization is served for fuel and feedstock of tire. Under proper sanitary situation, the recovered oil can be used for cooking also. The separated oil from wastewater helped to reduce scale of wastewater treatment facility, leading to the reduction of construction cost.

Furthermore, recovering oil from wastewater contributes not only oil production but also increase the water quality. There is 1.4 billion km<sup>3</sup> of water in the earth and only 0.008 % of this exists at ground water, river water, lake, and marsh can be used for our daily life. We use water on various scenes of daily life such as drinking, cooking, cleaning, washing, bath, and toilet. In this perspective, we need to recycle limited water and reuse the water. Much amount of water is used for food processing and producing biomass energy. By recovering oil from wastewater, oil excluded water can be reused and install the recycling-oriented society.

Using Value Function and Separative Work Unit in the separation engineering, we evaluated economic efficiency of the oil-water separation system. The results defined a degree of improving of the oil-water separation system and used for decision support of introducing oil-separation technologies for postharvest and food processing.

**Abstracts**  
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# **The Decision Support of Introducing Oil-Water Separation Technology for Organic Wastewater Treatment based on Separation Engineering**

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The technologies to recover oil from wastewater including animal and vegetable oil are developed during the postharvest food processing. There are many technologies to separate oil and water, for example, centrifugation, floatation, flocculation, and absorption. Oil-water separation is also used in refinery of biomass energy such as palm oil industry where wastewater includes large amount of oil from refinery process. 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 and the oil-removed water as valuable resources. By introducing oil-water separation technologies, especially in food processing factories under proper sanitary condition, the recovered oil could be used as food and the recovered water could be used as water resource. However, in the actual food processing factories, it is judged based on their feelings to introduce the oil-water separation equipment into the factories, and technical evaluation is not enough to judge it themselves.

This study aims to propose engineering evaluation method and decision making support for introducing oil-water separation equipment to wastewater treatment from food processing factory. The evaluation method consists of two components; Separative Work Unit (SWU) and Value Function (VF) determined by oil concentration of wastewater.

Results of trial calculation for food processing factory, Naoetsu-Yushi Co., Ltd., showed that over 99.70% separation performance was required to obtain positive value for separation process and below 99.70% 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, from the result of SWU, the cost recovery period of the oil-water separation equipment and waste water treatment facilities was revealed. When the lifetime of the equipment and facilities are longer than the cost recovery period, it is judged that introducing the oil-water separation equipment into wastewater treatment in food processing factory is desirable.

# Characterization of Visible-Light-Driven Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub> Photocatalyst

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TiO<sub>2</sub> doped with noble metals (Ag and Au) has been investigated, resulting to effectively transfer the plasmon electrons from noble metals to titanium dioxide and then improve the separation of photogenerated electron-hole pairs. Recently, many narrow band photocatalysts, such as Ag-based semiconductors combined with TiO<sub>2</sub> have been paid more attention, as combination with these semiconductors could lead to expanding the absorption spectrum from UV to the visible light region to effectively utilize the solar light. More recently, a novel Ag<sub>3</sub>PO<sub>4</sub> photocatalyst with band gap of 2.43 eV has been reported, possessing remarkable photocatalytic ability for organic dye degradation. Therefore, in this work a highly efficient photocatalyst Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub> has been synthesized and followed by the characterization of SEM, XRD, EDS, XPS, UV-vis and PL respectively, in comparison of TiO<sub>2</sub>, Ag/TiO<sub>2</sub>, Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> and Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub>.

According to the results of SEM, the particle size of Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub> ranges from 500 nm to 2 μm, and XRD result shows that Ag and Ag<sub>3</sub>PO<sub>4</sub> have been successfully loaded on the anatase TiO<sub>2</sub>, which is in accord with EDS and XPS analyses of photocatalysts. To investigate the surface chemical states of Ag, XPS spectra of Ag 3d and O 2p regions are analyzed. It can be seen that the intensity of metallic Ag<sup>0</sup> is much stronger than that of Ag<sup>+</sup> ion in XPS spectrum of Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub>, which confirms the existence of metallic silver and silver orthophosphate, and the majority of Ag element in the form of metallic silver. The peaks located at 529.5, 530.9 and 532.2 eV are respectively ascribed to the lattice oxygen of TiO<sub>2</sub>, the oxygen of surface OH<sup>-</sup> and the oxygen of water molecules absorbed on the surface, while the peaks corresponding to O<sup>2-</sup> from Ag<sub>2</sub>O and AgO are not observed, indicating the surface metallic silver is not oxidized. Besides, Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub> composite exhibits the broader absorption in the visible region than the other photocatalysts, and also the band gap of Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub> is calculated to be 2.2 eV smaller than both of Ag<sub>3</sub>PO<sub>4</sub> (2.43 eV) and TiO<sub>2</sub> (3.2 eV). In addition, the PL intensity of Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub> photocatalyst is much lower than that of TiO<sub>2</sub> photocatalyst, indicating that the deposition of Ag/Ag<sub>3</sub>PO<sub>4</sub> particle has improved the charge separation effectively. In summary, Ag/Ag<sub>3</sub>PO<sub>4</sub>-TiO<sub>2</sub> photocatalyst has been successfully synthesized, showing improved photocatalytic ability which is ascribed to the plasmon resonance of metallic silver and the narrow band gap of composite photocatalyst.

# **A New Technique for Processing of Orange (*Citrus sinensis*) Powder by Vacuum Spray Drying (VSD)**

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Orange (*Citrus sinensis*) is the important sources of major groups of phytochemicals that have been suggested as a natural source of antioxidants may contribute to the total antioxidant activity of plant materials including polyphenols (e.g. Flavonoids) and vitamins such as vitamin C and E. The present study shows interest in the processing of a novel orange (*Citrus sinensis*) powder by the application of two recent and very new techniques, namely micro-wet grinding of fresh orange with pulp and then Vacuum spray drying (VSD) process to make powder. Orange juice with pulp contains fiber and more functional ingredients other than single juice. This is done by the blending the fruits with pulp, then micro-wet grinding and finally get the concentrated orange (*Citrus sinensis*) juice with the smallest particle size. Then the concentrated orange (*Citrus sinensis*) juice is subjected to the Vacuum spray drying process.

In this study a Vacuum Spray Drying (VSD) method is proposed as a new drying technique for producing orange fruit powder that will suppress the damage or loss of thermosensitive functional ingredients. Special features of the equipments is performing low-temperature dryness powderization of liquefied food by the uses of high superheated steam for heat source. The exhausted gas is condensed by a condenser, it is easy to maintain vacuum level and because of the superheated steam is used, it is possible to transport the powder under the depression condition. The heat exchange is performed in vacuum and evaporation temperature is a saturation temperature of the degree of vacuum. Vacuuming the drying tower of the VSD resulted in the lower drying temperatures (40-60°C) as compared to the existing drying system and food powder rich in high heat sensitive ingredients is expected to be obtained continuously. In comparison with freeze drying, VSD is low cost and reduce the time. Based on the above reason the experiment is designed for this study aim to determine the most suitable conditions for VSD method use in fresh orange (*Citrus sinensis*) fruit powder processing and to evaluate the physicochemical, functional properties of the powder produced, including the contents of ascorbic acid, phenolic compounds, organic acid, flavonoids, total sugar, carotene, moisture, water activity, glass transition behavior, color and antioxidant activity and also to evaluate the effect of using the carrier agent, maltodextrin addition in the orange (*Citrus sinensis*) juice.

## Can ‘Kuntan’, Carbonized Rice Husk, Application Mitigate Global Warming and Improve Rice Productivity?

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Application of biochar, biomass-derived charcoal, has been recognized as one of the effective methods for keeping carbon dioxide captured from the atmosphere into soil and improving crop production. ‘Kuntan’ or carbonized rice husk had a long history used as a soil amendment by the Japanese farmers. However, the recent researches on biochar provoke the renewal interests in its utilization for mitigating global warming. We evaluated the impacts of Kuntan application on rice productivity, soil carbon (C) sequestration and methane (CH<sub>4</sub>) emission from paddy field in order to achieve a sustainable agriculture through recycling of C and other nutrients in the soil.

The experiments were conducted at the Agricultural and Forestry Research Center, University of Tsukuba from 2012 to 2014. A pot experiment was carried out in 2012 with Kuntan (Ku) application at 0 (control), 0.2, 2, and 20 t ha<sup>-1</sup>, or rice husk (Rh) application at 2 t ha<sup>-1</sup>. Four rice seedlings per hill (*Oryza sativa* L. var. Nipponbare) were transplanted per pot with the recommended rate of chemical fertilizers. CH<sub>4</sub> emission, rice yield and total soil C were measured during rice cultivation. Field experiment was also carried out from 2012 to 2014 in a randomized block design with three replications with consecutive applications of the same rates of Ku or Rh. Rice yield and total soil C were measured for three years.

CH<sub>4</sub> flux from Ku at 20 t ha<sup>-1</sup> was increased significantly at the beginning of August while that of Rh at 2 t ha<sup>-1</sup> became significantly higher than the control during the end of August to the middle of September. As a result, cumulative CH<sub>4</sub> emission from Ku at 20 t ha<sup>-1</sup> was 9% higher; whereas the total emission of it from Rh was 45% higher than the control, the highest among the treatments. Soil C content was increased as almost the same amounts of C applied with Ku remained at harvesting. This indicated that C in Ku was persistent and stable in soil throughout rice cultivation. Rice yields in the pot experiment were increased proportionally with amounts of Ku applied. Ku at 20 t ha<sup>-1</sup> yielded significantly higher by 30% than the control. In field experiment, however, yield for the first two years were not statistically different among the treatments. These results show Kuntan application could mitigate global warming by increasing C sequestration in the paddy field without stimulating greenhouse gas emission. The effects of Kuntan application on rice yield should be studied further to elucidate the mechanism of the positive influence of Kuntan that observed in the pot experiment.

## **Potential Anticancer Properties of Polyphenols from *Helicteres angustifolia* L. Root in Normal and Carcinoma Human Lung Cells**

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Herbal products and other supplements derived from plants are widely consumed in many countries. The use of substances with natural origin as medicines, also known as phytotherapy or complementary and alternative therapy (CAM), are sometimes practice along with conventional western medicine as an alternative therapy to treat diseases such as cancers. Cancer is a major worldwide health problem due to the lack of comprehensive early detection methods and effective treatment. Lung cancer is one of the most lethal cancers in terms of mortality and incidence worldwide and this malignancy accounts for approximately one sixth of all cancer deaths globally.

*Helicteres*, a genus belongs to the plant family of Sterculiaceae, distributed throughout both tropical Asia and America, are shrubs or small trees and comprises about 60 species. Several species of this genus have been used in traditional medicine system for centuries. *Helicteres angustifolia* L., is a small shrub with grey green puberulent branchlets and small, brown seeds. Its bark is a source of useful fibers, and the roots and leaves are used in folk medicine for the treatment of flu, pain, bacterial infections, inflammatory and cancer.

In previous study, we demonstrated the cytotoxic effect of aqueous extract of *Helicteres angustifolia* L. root against various carcinoma cells in vitro. Here, we separated the polyphenols part from the aqueous extract and investigated the anticancer properties of different isolates of polyphenols using normal fetal lung fibroblast MRC5 and adenocarcinomic epithelial cells A549 as well as NCL-H1299. Polyphenol isolates were provided with stepwise elution through HP20 macroporous resin by water, 20% ethanol, 40% ethanol, 60% ethanol and 80% ethanol. And anticancer properties were analyzed using cell viability assay, crystal violet assay and colony forming assay. To investigate the possible mechanism of action of the active fraction, we also analyzed the effect on apoptosis and migration morphology of normal and carcinoma cells. This study provides in vitro evidence for the use of *Helicteres angustifolia* L. root in clinical treatment of cancer based on the low utilization of the plant, moreover, to find the added value of this plant is another purpose.

# A Portable Fluorescence Fingerprint Sensor for Rapid Meat Spoilage Monitoring System

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Main factor for meat spoilage is the microorganism content. Thus, microorganism monitoring on meat is important. On the 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).

Our previous research shows an appropriate Aerobic Plate Count (APC) estimation ( $R^2=0.975$ ;  $RMSECV = 0.849 \log \text{CFU}/\text{cm}^2$ ) were achieved by FF coupled with fiber optics for beef samples. Partial Least Square Regression (PLSR) validation model for the system shows high prediction with  $R^2$  validation and RMSEP are 0.813 and  $0.881 \log \text{CFU}/\text{cm}^2$ , respectively. High related coefficient comes from several wavelength regions related to three kind of intrinsic fluorophores (NAD(P)H, Porphyrins, and Flavin).

Major drawback for the system was experiments were conducted on laboratory. Thus, it is not applicable for ex-situ sampling condition. Moreover, this procedure requires the measurement of full FF, which is wide dimension data and quite time consuming. Therefore, our objective is to develop a portable FF sensor for monitoring the meat spoilage during storage.

A portable FF system consists of LED light sources, Fiber Optics, and Band Pass Filter (BPF) was developed. The BPF reducing the dimension of FF to optimal combination of excitation and emission wavelengths for tryptophan measurement.

Tryptophan solutions with different concentrations ( $10^{-3}$ ,  $10^{-4}$  M,  $10^{-5}$  M, and  $10^{-6}$  M) were prepared. The Fluorescence signal of tryptophan solutions were measured using portable FF system. The results shows the fluorescence signals were 76, 222, 136, 133 a.u for tryptophan concentration of  $10^{-3}$ ,  $10^{-4}$ ,  $10^{-5}$  and  $10^{-6}$  M, respectively. The results shows signals detected were correspond to tryptophan concentration. However on high tryptophan concentration ( $10^{-3}$ M) the concentration quenching effect was occurred. Concentration quenching is a phenomenon where a molecule quenches its own fluorescence at high concentration.

The ability of portable FF system to detect different tryptophan concentration is a promising fact that the system could detect tryptophan changes of meat spoilage.

# Oocyte Centrifugation before or after ICSI Using Freeze-dried (FD) Sperm Is Not Beneficial to *in vitro* Fertilization of *in vitro* Mature (IVM) Porcine Oocytes

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Mammalian sperm preservation by freeze-drying has been considered as a safe and cheap approach relative to cryopreservation in recent years. In the previous study, we reported that boar sperm freeze-dried in a medium containing 15 mM trehalose maintain their DNA integrity better than in a medium without trehalose but there were no differences in fertilization and blastocyst formation rates. Porcine oocytes are characterized by a dark, granulated ooplasm due to its high lipid content and thus, considered much difficult to manipulate compared with other species (e.g. human and mice). Centrifugation (CF) to stratify cytoplasm facilitates the observation of sperm release in ooplasm (Wall et al, 1985). Our hypothesis is ‘the redistribution of cytoplasm after CF may facilitate the interaction between sperm and oocyte, thus, increase fertilization efficacy’. In experiment 1, mature oocytes were centrifuged at 10000 rpm for 20 min at 37 °C to investigate the relative distance of chromosome-spindle complex (CSC) to polar body (PB), compared with before CF. Three types of location were classified (A, B and C, type C shows the most distant between CSC and PB) and 3 distinctive layers were observed as described by Fahrudin et al, 2007 (no organelle, mitochondria and lipid). The percentage of oocytes with type B was 2-fold higher in CF-oocytes compared with before CF as a result of CF. In experiment 2, mature oocytes were subjected to CF before injection, then FD sperm freeze-dried without trehalose were injected into 3 different layers of CF-oocytes. The effect of oocyte CF before injection was assessed. One hour after injection, electric activation (EA) was applied to injected oocytes. The oocytes were then cultured *in vitro* for 9 h and then fixed and stained to examine fertilization status. There was no difference in normal or abnormal fertilization among all groups compared with control (oocyte without CF). In experiment 3, the effect of oocyte CF after injection with sperm freeze-dried with 15 mM trehalose was examined. One hour after injection, the oocytes were subject to CF combined with or without EA (CF+EA+; CF+EA-) or without CF combined with or without EA (CF-EA+; CF-EA-). Fertilization status was assessed as in experiment 2. There was no effect of CF on any parameters of fertilization. However, normal fertilization rate was significantly improved in groups with EA applied ( $P < 0.05$ , one-way ANOVA). These results confirm the importance of additional electric stimulation to activate pig ICSI-oocytes. Notably, the percentage of non-activated oocytes (re-arrested-oocytes at metaphase stage) was significantly higher in the groups without EA. This suggests that mechanical injection procedure is not sufficient to induce oocyte activation to proceed to the pronuclear stage.

# Effects of Integrated Application of Composts and Chemical Fertilizer on Nitrogen Recovery, Internal Nitrogen Use Efficiencies and Yield of Potato (*Solanum tuberosum*) in an Andosol Soil

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Potato, the third most important crop globally after rice and wheat in terms of human consumption, requires adequate available nutrients to be productive. Potato production in Fiji just started, where most growers use chemical fertilizers (CF) for potato production but are faced with high costs of them. As a result, total input of CF is not enough for getting a good yield. In this research, sources of nitrogen (N) including CF (21% N), swine manure (SM, 1.8% N) and poultry manure (PM, 2.5% N) composts were applied in a continuous potato production system for evaluating their effects on yield, apparent N recovery and the internal N use efficiencies.

The experiment was carried out at the Agriculture and Forestry Research Center, University of Tsukuba from March, 2012 to November, 2013. Ten fertilization treatments including sole SM, PM, CF, six integrated levels (SM or PM with CF) and Zero (no application) were laid out in a randomized block design with three replications. Applications were set at 12 kgN/10a for spring planting and reduced by 25% for fall planting. Plot sizes were 18.72m<sup>2</sup>. Plant and row spacing were 0.3m and 0.8m, respectively except in the spring of 2012. Treatments were conducted in the same area and potatoes were cultivated continuously. Cultivar “Danshaku” was used in spring planting while cultivars “Nishiyutaka” and “Dejima” were planted in fall of 2012 and 2013, respectively. Plant length, SPAD and LAI were measured after 23 days after planting (DAP). Whole plants were harvested two weeks before the tuber was harvested at the maturity level for measuring apparent N recovery and internal N use efficiency. Total tuber yield and yield production efficiency (kgFW per unit N applied) was measured at maturity (100 -110 DAP). Marketable tubers were those that weigh more than or equal to 50g.

Plant growths in SM plots were the same as CF 100% in terms of growth while it was lower in PM plots. Composts had a significant effect by increasing total tuber yields. Compared to CF (100%), SM (100%) had 3% more total tuber yield in 2012 spring and PM (100%) had 14% more in 2013 spring planting. The integrated fertilization plots increased yield in continuous cropping while continuous CF application did not. The total tuber production efficiency had a positive correlation to tuber yield. Generally, most integrated fertilization plots had higher apparent N recovery efficiency in the continuous cropping. The total internal N use efficiency of PM (100%) was above 700 gFW/gN in spring of 2012. The integrated plots also had higher total internal N use efficiency. Continuous application of CF negatively affected crop productivity by declining both total and marketable yield of tuber. Sole application of SM or PM composts and their integration levels with CF increased tuber yield. It might be concerned slow mineralization and residual fertility of composts, which had an advantage of integrating composts to supplement CF. The study concluded that the composts can be effectively use to supplement of CF in potato production.



# **Integrated Plantation Model for Sustainable Food, Feed and Fuel Production**

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One of world problem in the future is how to sustain the availability of food, feed and fuel. Many people assume that, environmentally friendly of energy can be provided by bioenergy. But unfortunately, bioenergy production is feared to disrupt the feedstock of food for humans and feed for animals. For example today, the largest bioethanol source is supplied from sugarcane and biodiesel is delivered from edible oil (corn, sun flower, palm oil). In this proposed concept, the integrated plantation is able to supply food, feed and fuel in a large scale. Palm oil plantation is taken as a model by reason of a world main source of edible oil, large scale commercial plantation across the world and release huge amount of solid waste and liquid effluent. Meanwhile, in some countries such as Indonesia and Brazil currently relies heavily on the biodiesel derived from palm oil. In Indonesia, Oil palm plantations stretch across 9 million hectares. The country plans until 2025 to expand additional 6 million hectares towards oil palm based biodiesel production. There are a number of ways to diminish acceleration of land and rain forest conversion to industrial plantations as occurs in oil palm plantation devoted to the biodiesel production. Government might develops other prospective bioenergy source, namely microalgae. As an alternative, microalgae is believed to be a source of the third generation bioenergy, which not interfere with the food supply chain, great productivity and can grow on non-agricultural land. However, microalgae is a plant that needs large amounts of water and nutrients in cultivation phase and requires excessive energy at the downstream processes. In this study, we will offer a concept on how to accomplish of the above problems in an integrated plantation. This research analysed material and energy balance of crude palm oil and microalgae based biodiesel production cycle. Energy inputs had lessen as a result of outputs from one system can serve as inputs to other by integrating Palm Oil Mill Effluent (POME) treatment, biomass power plant, biogas production, microalgae cultivation, and co-products utilization. Consequently, the energy and material balances of the integrated system could significantly outperform those from the single system. Furthermore, sustainable integrated food, feed and biofuel production could be achieved.

## **Enhancing Biohydrogen Production from *Ipomoea aquatica* by Optimization of Inoculum and Substrate**

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Towards overcoming the impending shortage of readily available fuel and supplementing fossil fuels; bioenergy is an unavoidable option and precisely biohydrogen can be an alternative source of energy due to its eco-friendly nature. One option would be to use biological means such as potential substrates to produce hydrogen through fermentation. In this research *Ipomoea aquatica*, a semi aquatic, tropical plant grown as a leafy vegetable is used as the substrate for biohydrogen production. It's known to remove pollutants from polluted waste water, but becomes unfit for human consumption. Nevertheless, its high carbohydrate content (54%) makes it a viable substrate for biohydrogen production. A sustainable approach towards fermentation of *I. aquatica* with digested sludge for the first time, in order to produce biohydrogen is the objective of this research. Digested sludge (DS) used as inoculum in this research is a mixed culture containing both hydrogen producing bacteria (HPB) and hydrogen consuming bacteria (HCB). In order to inhibit the HCB, the DS was subjected to thermal pretreatment. From the results thermal pretreatment showed 2.7 times higher hydrogen production than the control. Further experiments were carried out using Response surface methodology software, to investigate the best thermal conditions for pretreatment from a series of condition. Thermal pretreatment at 90°C for 60 min showed the highest hydrogen yield (HY) and was used for optimization of inoculum. Optimized inoculum was then used to produce biohydrogen from *I. aquatica*. The plant was optimized using various pretreatment conditions like freezing, boiling, drying and NaOH pretreatment, to attain the highest HY. Frozen dried *I. aquatica* demonstrated the highest HY of 217.2 ml/g-VS which was manifold higher than other substrates like corn stalk and wheat straw. In conclusion, this fermentation system is cost effective and sustainable. It's the first time *I. aquatica* is used as substrate to produce hydrogen, which can solve energy needs as well as environmental problems like eutrophication.

## Preventing Effect of Polyion Complex on Runoff Generation and Soil Erosion under Raindrop Impact

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It is said that more than 50% of soil degraded area is due to water erosion, which is resulted from the detachment and transport of soil particles by raindrop impact and runoff flow. Reducing soil erosion is essential for sustainable food production and environment.

We examined the preventing effect of polyion complex (PIC), the complex of polycation and polyanion against raindrop erosion using a rainfall simulator and a compact soil box. The used PIC solution was composed of polycation (Polydiallyldimethylammonium chloride), polyanion (polyacrylic acid), electrolyte (KNO<sub>3</sub>) and pH adjuster (KOH). In the PIC solution with appropriate salt concentration, attractive electrostatic interaction between polycation and polyanion is suppressed, so that the transparent PIC solution is formed. Lowering salt concentration changes the equilibrium state of the PIC solution to the gel state.

The Tottori masa soil (decomposed granite) was packed into an acrylic box with 40.0 cm length, 15.0 cm width and 12.5 cm depth. Infiltrated water can be drained through the holes made on the bottoms of upper and lower reaches. The soil in a box was saturated with tap water from the bottom by capillary suction. Then, the PIC solution was applied to the soil surface under three different doses of PIC solution 0, 1, 3 L m<sup>-2</sup>. The runoff was collected from an outlet port located at the downstream edge every 10 minutes. The volume of runoff and the mass of washed soil were measured. The duration and intensity of rainfall were 120 minutes and about 70 mm h<sup>-1</sup> respectively. This intensity was very low compared with the hydraulic conductivity of the saturated soil. Therefore the occurrence of runoff reflects the change of soil structure and the formation of crust.

The experimental results clearly show that the cumulative runoff and the cumulative soil loss were affected by the applied amount of the PIC solution. That is, the runoff and the soil loss decrease with increasing the amount of applied PIC solution. The soil loss is generally generated by soil detachment and subsequent transport of soil particles by raindrop impact and surface runoff flow; the surface runoff is brought about by decreased hydraulic conductivity resulted from the crust formation on soil surface. Therefore our results suggest that insoluble PIC gels, which are formed by decreased of salt concentration due to rainfall, act as a binding agent between the soil particles and then stabilize soil structure.

## **Effects of Extreme Event on Agricultural Production Efficiency in Bangladesh**

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**Keywords:** *cyclone, efficiency*

Bangladesh is a global hotspot for extreme event and the United Nations Development Programme (UNDP) has ranked as the world's most vulnerable country to the adverse impacts of tropical cyclones. The coastal zone of Bangladesh is particularly prone to the risks of natural disasters due to a high exposure of extreme natural events such as severe cyclone and storm surges. The cyclone Aila was such kind of natural hazards hit to south west coastal region leading to a long term crisis situation and causing unprecedented sufferings in particular areas of farm families. Most of agricultural lands were inundated with saline water from cyclone-induced storm surges and the major crops such as boro rice, vegetables, fish and shrimp farms etc. were devastated. Farmers were extremely challenged with salinity and they could not cultivate crops. This study try to investigate the agricultural production status of farm households, what type of farms were mostly damaged and examine the effects of extreme event on the efficiency of agricultural farms. The cost minimization model of farm households will be used to know the efficiency of agricultural production. The study has conducted a pre-test with farmers and final data were randomly collected from 84 farm households through the use of structured questionnaires on face to face interview in Koyra Upazila mostly known for agricultural production and damaged by cyclone. From the study it is found that hired labor contribute the highest expenditure for farm production compare to other costs for per planted area. It is generated that income and profit of the farm households are negative in different villages and most of rice farms were fully damaged by Aila hit. This research will provide key connections between extreme event and agricultural production efficiency, produce findings on cost function and efficiency analysis for farm production and measure the impacts of extreme event on agricultural production of farm households in Bangladesh.

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## 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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It was proposed that the well growing rice ratoon after harvest should be used as ruminant's feed because of its potential in biomass and high quality with high crude protein and digestibility as roughage (Arifusa *et al.*, 2012). It is expected that biomass of rice ratoon is going to increase, because the increasing 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 have been 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 the present study.

An ambient [CO<sub>2</sub>] (AMB: control) and an elevated [CO<sub>2</sub>] (FACE, AMB+200μmol mol<sup>-1</sup>: treatment) plots were set with 4 replications, respectively, in Tsukuba FACE site established in farmers' rice field in Tsukubamirai City of Ibaraki Prefecture, Japan. [CO<sub>2</sub>] in FACE was elevated from 28 May to 13 September, 2013. Akitakomachi was tested as a cultivar which was cut on 30 August remaining 10cm height stubble in AMB and FACE. Rice ratoon cultivated 2 weeks after the cutting was sampled in each site on 13 September. In growth survey conducted on 30 August, 2, 6, 13 September, stem number (SN) and plant length (PL: only 2, 6 September) were recorded. After the sampling, dry matter weight (DMW) of samples was recorded. Crude protein (CP), ether extract (EE), neutral detergent fiber (NDF) and crude ash (CA) in the samples, and sugar and starch content (SSC) in the stubble were analyzed. ANOVA and correlation analysis were conducted for statistical analysis.

SN and PL in all growth survey schedules, DMW, and SSC in the stubble increased significantly in FACE than those in AMB. CP was significantly smaller in FACE than AMB. Positive correlation between SSC and DMW was detected ( $p < 0.01$ ).

These results suggested that the effects of high [CO<sub>2</sub>] before harvest might facilitate the growth of rice ratoon during 2 weeks after harvest *via* carryover effect of SSC stocked in stubble.

## **Wine Production from Whole Blueberry (*Rabbiteye*) 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 its substrate such as resveratrol and anthocyanin. Therefore, it is said to be effective for recovery of eye strain, anti-oxidation, anti-aging, and prevention of lifestyle-related disease. Currently, in addition to raw food eating, blueberries are supplied as materials of a 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 that are abundant in pericarp and seeds, were lost by filtration and squeezing process. In this study, we proposed a wet milling process which makes filtration and squeezing unnecessary in order to keep rich in functional ingredients of the new wine product.

The approach to make whole blueberry wine could be divided into three processes. First, pretreatment, the miniaturization of washed blueberries, harvested from Tsukuba area was approached by the blender and wet milling machine. The milling characteristic of the blueberries was analyzed as particle size distribution. Second, the fermentation process was initiated by addition of sugar and yeast, and the dilution ratio of the juice with water was changed in order to find the better dilution to make good wine. In 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 examined by implementing a functional test based on the food sensory test method. By this new process, the production of delicious-functionality wine with whole blueberries is expected to provide a positive effect on the human health and decrease lifestyle-related disease.

The successfully process of whole blueberry wine production is expected to contribute to the six primary industries of blueberry producer in Tsukuba area. The value of blueberry is hopefully increased.

## **Study on the Temporal Change in Regional Characteristics of Agriculture and Livestock Production in Inner Mongolia of China**

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The present study was conducted to reveal the temporal changes of agricultural and animal production in Inner Mongolia using Inner Mongolian Statistical Year Books between 2002 and 2013.

It has been reported that Inner Mongolia can be subdivided into six climate zones by the grassland types. The climatic condition of each zone was determined by Köppen-Geiger Climate Classification (KGCC) and representative grassland, and agriculture and urban region was selected in each zones

By using KGCC, it was shown that two regions at zone 1 are defined as Dwb (snow, winter dry, warm summer) and three regions at zone 6, are defined as BWk (arid, desert, cold). Eleven regions in zone 2 - 5 are classified as BSk (arid, steppe, cold) except only one Dwb and Dwa (Snow, winter dry, hot summer).

It was revealed that the cattle, goats and sheep are priority animal products in all six zones. On the other hand, agricultural production (grain, cereal, corn, oil-bearing crops, wheat, beans and tubers) is high in zone 1, 2, 4 and 5. In these four zones, the pig, horse, donkey and mule are the priorities, whereas camels are mainly at zone 1, 3, 5 and 6. Further analysis is required to disclose the temporal changes in the agricultural and animal production of each zone in Inner Mongolia.

## **Parthenocarpy for Improving Fruits Production: Isolation of Pistil or Early Fruit Specific Genes of Tomato**

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Tomato is widely produced in the world, and its production is the largest among all vegetables, although it is easily suffering from harsh environmental condition. Parthenocarpy is a unique feature of fruit development, the conversion of pistil to fruit, in the absence of pollination and/or fertilization. It's a highly desirable trait for fruit-bearing crops. Up to date, several genetically engineered parthenocarpic tomato lines have been produced by manipulating levels of phytohormones. However, these induced parthenocarpic tomato lines still have undesirable pleiotropic traits on the vegetative organs and taste. Controllable parthenocarpic fruit development without undesirable side effects would be of great value for sustainable fruit production.

To develop effective engineering tools for inducing parthenocarpy in tomato, this research is focused on the isolation and characterization of pistil or early fruit specific genes and their promoters. We performed RNA-Seq based transcriptome analysis using 25 samples of different tissues and developmental stages, identifying genes specifically expressed within the pistils of before/after-anthesis stages. The transcriptome data were compared between that of pistil and that of the other organs by the RPKM (reads per kb per million) level. In this analysis, 945 genes were initially identified as pistil-specific genes. Then highly expressed 20 genes of six different developmental stages of pistil were selected, while the after-anthesis stage had only 8 candidates. Finally, non-redundant 80 genes were subjected for the RT-PCR analysis, revealing that 14 genes were highly and specifically expressed only in the pistil. Four genes were further selected as candidate of engineering tools for induction of parthenocarpy and research on fruit formation. Production of transgenic parthenocarpic tomatoes using promoters of these four pistil specific genes is in progress. Furthermore new tissue specific peptide hormone like protein, which might be important for fertilization or senescence of reproductive organs, was isolated.

Our research will be useful for developing a beneficial tool for pistil-specific gene modification and also progressing study of fruit set, while isolated pistil specific genes would provide a new insight on fruit formation of tomato.



## Colloid Transport in Partially Saturated Sand Column

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Colloidal particles like clay minerals and microorganisms adsorb contaminants, which migrate with the particles in subsurface environment. Therefore, to predict the fate of contaminants, it is necessary to understand the transport properties of these colloidal particles. In previous studies, factors affecting colloid transport such as solution chemistry, and water velocity so on are investigated. However, most of previous studies were carried out under water-saturated condition. The effect of charging properties of colloidal particles and soil matrix on colloid transport in unsaturated condition has not been sufficiently examined. In this research, we conducted column experiments by using well-characterized colloidal silica (128 nm) and Toyoura sand (0.27 mm) in various water contents. Both the silica particles and the Toyoura sand have negative charge varied by solution pH; we can control the magnitude of surface charge by changing solution pH. Water content of sand was adjusted by controlling suction and applied flux of colloidal suspension. Schematic view of experimental setup is shown in Fig.1.

Obtained results are shown in Fig. 2, where the horizontal axis is dimensionless inflow volume and the vertical axis is the relative concentration of outflow silica particles. The results revealed that the temporal variation of effluent silica concentration was affected by solution pH. In higher pH condition, the deposition of colloidal silica to Toyoura sand is inhibited by electrostatic repulsive force, which arises from highly charged colloidal particles and soil matrix. As a result, silica particles quickly pass through the column media. In addition, deposition amount is slightly increased with decreasing saturation. On one hand, in low pH condition, repulsive force was diminished owing to the less charge of soil matrix and colloidal particles, thus colloidal silica can deposit onto Toyoura sand. As a consequence, the effluent concentration of silica slowly increases at early stages. Deposition amount of silica dramatically increase with lowering water contents.

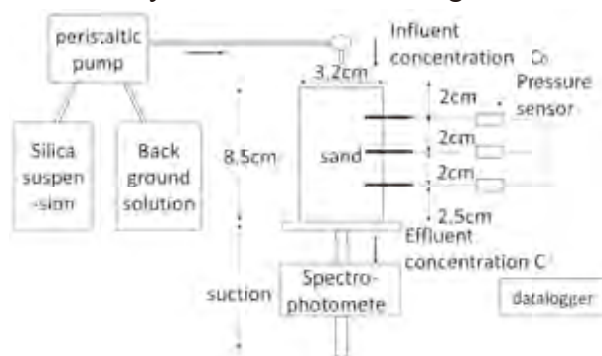


Fig.1 Schematic view of column experiments setup.

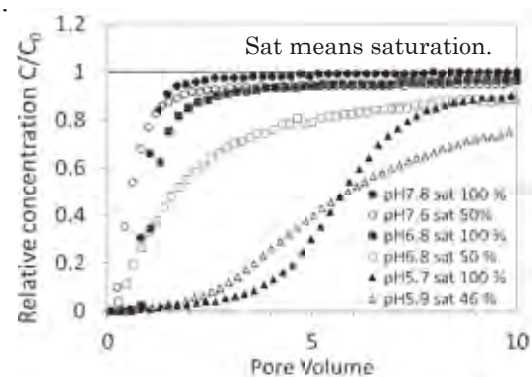


Fig.2 Colloidal silica breakthrough curves.

## Screening of Anti-cancer Stem Cell Agents from *Eucommia ulmoides* Leaf

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Du zhong tea is made from *Eucommia ulmoides* leaves and is drunk as herbal medicinal drink. Many types of effects have been shown for the tea including estrogen-like activity. In this study, we conducted search for anti-cancer stem cell agents from an extract of du zhong powdered tea made from *E. ulmoides* leaves using cultured cell lines with cancer stem cell (CSC) properties. Cancer stem cell is present in minute quantity in cancer tissues and has low ability to divide. It has multilineage potential and self-renewal ability, and exhibit resistance to conventional anticancer agents. Therefore, it is considered to be the main cause of recurrence and metastasis. Preliminary experiment has shown that the PBS extract of du-zhong powdered tea has an effect to inhibit CSC growth. This study aimed at isolation and identification of the anti-CSC agents.

In this study, we used cultured CSC-like cell line, iCSCL-10A, developed by Professor Ryo at Yokohama City University. In the assay, breast cancer cells MCF7 and MM231 were also used as control cancer cell lines in order to search for the specific inhibitors of CSCs growth.

By solvent partitioning, the anti-CSC activity was recovered in the water phase after n-butanol extraction, indicating high polarity of the active components. The active fraction was further fractionated by HILIC using Diol column, and successive ODS HPLCs. Finally the active fraction was purified to be a single peak on an ODS HPLC. NMR analysis of the active fraction showed that the fraction has high purity. Different types of NMR spectroscopies as well as mass spectroscopy have been obtained. I am now analyzing the spectroscopic data to determine the structure. I am also preparing the same active compound to facilitate other types of analyses.

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## **Study on Migratory Ability of Gonadal Germ Cells (GGCs) from 7-day-old Chick Embryos**

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*Keywords: Gonadal Germ Cells, Migratory Ability, PBS[-] method*

The conservation of genetic resource is extremely important for maintaining biological diversity. This is true for avian, where 13.25 % out of 10,065 known species are reported to be endangered. Therefore, there is an urgent necessity to develop a system to conserve avian genetic resources. In chicken, a system of conserving avian genetic resources through germline chimera using primordial germ cells (PGCs) or gonadal germ cells (GGCs), which are ancestral cells for sperm and egg, has been developed. Recently, a phenomenon of spontaneous GGCs discharge was reported when embryonic gonad was incubated in PBS[-] (Nakajima *et al.* 2011). It was considered, however, that not all GGCs in the embryonic gonad are discharged during incubation in PBS[-]. Therefore, present study was conducted to compare the nature of discharged GGCs (d-GGCs) into PBS[-] and undischarged GGCs (u-GGCs), which remained in the embryonic gonad after incubation in PBS[-].

Results showed that the migratory ability of d-GGCs and u-GGCs toward developing gonads did not differ significantly after transfer into recipient embryos at all four possible sex combinations ( $P > 0.05$ ).

The future study should be directed toward examining the temporal changes in the cellular association of d-GGCs and u-GGCs with gonadal somatic cells during embryogenesis.

## **Isolation and Histological Characterization of Heat Tolerant Mutant Lines from Micro-Tom Mutant Collections**

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Abiotic stress including high temperature, salinity and drought has been serious problems for food production in the world. Heat stress higher than 35/25°C day/night temperature reduces the pollen fertility and seriously affects tomato fruits production. According to the research of Intergovernmental Panel on Climate Change (IPCC), the temperature of global surface will get 0.2°C forward 10 years. Then the high temperature stress will be a major problem in the future society. Although currently some heat tolerant tomato varieties are available, their quality and yield of fruits are not sufficient. It motivates us to create a new material for heat-tolerant tomato breeding. In this research, we isolated heat tolerant tomato lines conferring improved fruits setting ability at high temperature condition from Micro-Tom mutant collections generated by EMS treatment.

In the first year, we grew the mutant collections under high temperature condition, and isolated 82 mutant lines. In second year, we evaluated those mutant lines and isolated higher tolerant 15 mutant lines showing higher tolerance to the higher temperature. In third year, the 15 mutants were grown at high temperature again, and characterized for fruits setting rate, fruits productivity and pollen viability. Among the 15 mutant lines, four lines (HT1, HT4, HT10, HT15) showed parthenocarpy, resulting in high percentage of fruit setting at high temperature condition. Fruits setting rate of wild type (WT), HT1, HT4, HT10, and HT15 was about 6.0, 18.9, 21.4, 20.6, and 22.4%, respectively. Fruits size of HT1, HT4 and HT15 are smaller than that of WT. On the other hand, HT10 fruits size was nearly identical to the WT.

Although fruits harvested from all lines contained seeds, HT7 had higher number of fruits with seeds than WT. It was likely that HT7 succeeded in pollination under high temperature condition due to the production of more viable pollen than WT. Total pollen number and pollen viability of WT and HT7 were measured by TTC (2,3,5-Triphenyltetrazolium chloride) staining. Total pollen number and viable pollen number of HT7 were higher than that of WT. To find out what causes the improved pollen number and quality, sections of anther were made at anthesis stage. As a result, the anther wall of HT7 was dehisced, but that of WT did not. In general, heat stress induces failure of anther dehiscence and most of pollen cannot be released from the anther. Altogether, it is likely that HT7 can produce high amount of viable pollen and make anther dehiscence and pollen release, resulting in better fruit setting even under heat stress condition. These mutant lines will be breeding materials for novel heat tolerant tomato cultivars.

# Enhancement of Ultrasonication and Photocatalysis Synergy for Treating Refractory Organic Wastewater by Using PEG<sub>m</sub>-TiO<sub>2</sub> Coated Glass Beads

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**Keywords:** Photocatalyst; ultrasonic irradiation; PEG; TiO<sub>2</sub>; organic wastewater.

Wastes from industries, farms, and so on are increasing year by year. Many efforts have been devoted in removing undesirable components, materials and inclusions from these wastes to decrease damages to the environment. A variety of biological and physicochemical processes have been proposed depending on the properties of the wastes. To date, the most widely used physicochemical methods in water treatment systems are chlorination, ozonation and germicidal lamps (UV). However, they have their own limitations therefore, rapid and efficient processing of refractory organic waste water is left unsolved.

Heterogeneous photocatalytic oxidation using TiO<sub>2</sub> as photocatalyst is one of the attractive practice for wastewater purification as it has the characteristics of high efficiency, low cost, and easy operation under ambient conditions. However, its practical application is seriously limited by aggregation and tedious post-separation of TiO<sub>2</sub> nanoparticles. Chemical activation for the occurrence of the reaction can also be achieved by sonochemical activation.

In the present study, TiO<sub>2</sub> coated glass beads was used which has a larger surface area thereby, enhanced the treatment of organic waste water. The TiO<sub>2</sub> layer coated on the glass beads is easy to separate and fall into the solution during ultrasonic treatment. For enhancing the coating effect of the synthesized TiO<sub>2</sub> thin film on the glass beads, polyethylene glycol (PEG) was added as a binder and dispersant.

Addition of PEG-2000 in the sol obviously enhanced the stability of TiO<sub>2</sub> thin film on the glass beads among the PEG 300, 2000, 6000, 20000. The degradation rate of RhB after 2h treatment using UV followed by US was 93.91%, which was 1.14 times higher than UV treatment 43 and 6.24 times higher than US treatment.

The synergy of photocatalysis using the PEG-modified TiO<sub>2</sub> glass beads as photocatalysts and UV+US irradiation proved to be a promising option for purification of organic wastewater.

## Role of Polyphenols in the Regulation of Sirtuin1

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Daily diet is closely related to our health. Polyphenols are the most abundant antioxidants in the diet and various beneficial effects of polyphenols on our health have been demonstrated. It was confirmed that polyphenols are capable of preventing degenerative diseases, particularly cardiovascular diseases and cancers. Resveratrol is one of the polyphenols contained in red wine, and it is getting popular because of its ability to activate Sirtuin1 (Sirt1). Sirt1 is a NAD<sup>+</sup>-dependent histone protein deacetylase that is activated by caloric restriction and plays an important role in the regulation of cellular metabolism, inflammatory, and antioxidant responses. Sirt1 may also interfere with mechanisms implicated in pathological disorders. The most unique feature of Sirt1 is to regulate mammalian longevity and aging. Previous studies indicated that Sirt1-overexpression mouse showed significant life span extension. That is why Sirt1 is a longevity gene. Our laboratory has proved that multiple polyphenols as well as resveratrol can induce the expression of antioxidant enzymes and nitric oxide production in vascular endothelial cells (VECs), which means that those polyphenols have protective effects against vascular diseases. However, we have not investigated whether Sirt1 is implicated in those effects. Therefore, this study was performed to find polyphenols that can activate Sirt1 like resveratrol.

Polyphenols used in this study were the following: hydroxytyrosol (HT; from olive), epigallo catechin gallate (EGCG; from green tea), carnolic acid (CA; from rosemary) and 3,5-di-caffeoylquinic acid (CQA; from coffee), all of which have been shown to increase antioxidant enzymes expression and reduce reactive oxide species (ROS). To screen these polyphenols at first, RT-PCR and western blot analysis were performed, using resveratrol as a positive control. Relative Sirt1 expression at both mRNA and protein levels was increased by these compounds. Next, to investigate whether Sirt1 plays a crucial role in VECs, wound healing tests were performed. As a result, each polyphenol promoted wound repair, which was blocked by the Sirt1 inhibitor Ex-527, suggesting that Sirt1 is critically involved in wound repair in VECs.

Taken together, these results indicate that not only resveratrol but also other polyphenolic compounds exhibit their biological activity by activating Sirt1.

## Effects of Ashitaba Supplementation on Physiological Responses in Holstein under Heat Stress

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Cattle reply to inclement climate by immediate behavior and physiological responses. Acute heat stress is an immediate response to the high temperature above 72 Temperature Humidity Index (THI) by cattle, which affects respiration rate, vaginal temperature, dry matter intake, water intake, milk yield, protein percent, and fat percent of milk. In terms of animal welfare and performance of livestock, well design shade, sprinkler and fan in the cattle barn may help to reduce the heat stress.

Recently, an alternative method to alleviate heat stress was reported in female rat by supplementing ashitaba (*Angelica Keiskei Koidzumi*) into feed. The underlying mechanism of the reduction of heat stress is considered to be due to potent anti-oxidative effects of 4-hydroxyderricin(4HD) and Xanthoangelol (XA) contained in ashitaba.

However, effects of feeding ashitaba on the alleviation of heat stress in dairy cattle have not been evaluated so far. Therefore, a series of experiments will be conducted to evaluate the physiological and behavioral responses of ashitaba supplementation to the heat-stressed milking cow at Agricultural and Forestry Research Center, University of Tsukuba

Changes in ilk production and quality, blood composition, and behavioral responses will be analyzed before and after feeding ashitaba in heat stressed dairy cow.

## Functionality of “Teadenol,” a New Polyphenolic Compound Extracted from a Tea Leaf Fermented by *Aspergillus* PK-1

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As lifestyle-related diseases grow into serious problems, the importance of dietary habit is getting more attention and studies on the functionality of natural compounds, especially polyphenols, are conducted well. In our laboratory, we have shown the beneficial effects of some polyphenols from red wine, olive, black tea and so on. Taking those compounds through the daily diet is expected to be helpful for preventing diseases and for leading a healthy life.

Teas, some of the most beloved beverages in the world, are made from a plant named *Camellia sinensis* L., and they are roughly categorized into four groups by fermentation conditions: unfermented teas, semi-fermented teas, fully-fermented teas, and post-fermented teas. While semi- and fully- fermented teas are made by endogenous-enzyme-mediated fermentation, post-fermented teas are made by microorganism treatment. Polyphenols in the tea leaves such as Catechins are altered to other products during fermentation, and especially in post-fermentation, various kinds of polyphenolic derivatives are newly synthesized depending on species of microorganism. Teadenol is a typical example of such polyphenols isolated from post-fermented teas made by *Aspergillus* PK-1.

Previous studies have shown that an extract of this post-fermented tea has anti-obese and anti-diabetic effects; however, only a few researches with Teadenol itself have been reported due to limited availability, so an evidence of its functionality is hardly obtained. Therefore, to evaluate the functionality of Teadenol, we conducted experiments with cultured cells and disease-model animals using purified compound in the present study.

We focused on adiponectin, which is well known as “good hormone” secreted from adipose tissue and plays an effective role in preventing metabolic syndrome. Recent studies demonstrated that blood adiponectin level is decreased in obese patients, which is considered as one of the major causes of an occurrence of several disorders. In a series of experiments, we found that Teadenol is capable of promoting an expression of adiponectin in adipose cells. Furthermore, Teadenol reduced glucose level and neutral fat (triglyceride) in the blood in a mouse model of obesity and diabetes. These results suggest that Teadenol has a protective effect against obese-related diseases, implying that having Teadenol on a daily basis will contribute to better health and quality of life.



## **Effects of Rice Husk Charcoal on Growth and Yield of Rice in an Andosol Soil**

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Rice husk is a byproduct of rice production and over 30% of it is not used effectively in Japan. Rice husk contains Ca. 15% of silicic acid, which has positive effects on rice growth. Promotion of the reutilization of rice husk in rice cultivation might to be one of the constructing ways to enable sustainable agricultural practices. Rice husk charcoal is one of the carbonized biomass known as 'Biochar'. Biochar is mainly used as soil improvement materials, and recognized as a way to achieve environmental-friendly agriculture. Therefore, we investigated the effects of rice husk charcoal application into a paddy field to measure the growth and yield of rice for establishing a sustainable agriculture system.

Experiments were carried out at the paddy field located in the Agricultural and Forestry Research Center, University of Tsukuba in 2013. Rice husk Charcoal was applied at 1t (HC1), 2t (HC2), 4t (HC4) per 10a, and rice husk was applied at 2t (H2) per 10a before rice transplanting. Five treatments including a control with no application were laid out in a randomized block design with three replications. Rice seedlings, cultivar 'Koshihikari', were transplanted with four seedlings per hill at 22.2 hills/m<sup>2</sup> on May 23<sup>th</sup>. Plant length, stem number, SPAD and leaf area index were measured during the growth period. Yield and yield components at the maturity stage were evaluated. After harvest, soil bulk density and three phases of soil at the depth of 5-10cm were measured.

Plant length was slightly longer in the HC2 compared to the control. Stem number in HC2 and H2 was slightly higher than the control after 35 days after transplanting (DAP). The number of grains per m<sup>2</sup> in HC2 was 6% higher than the control. It caused due to increase of the number of panicle and the number of grains per panicle. Grain yield in HC2 was 1% higher, while the other treatments showed lower compared to the control. By the application of rice husk charcoal and rice husk, soil bulk density was decreased than the control. These results show that application of rice husk charcoal at the level of 2t/10a into paddy field could be an effective way to improve the growth and yield of rice in addition to soil physical properties.

## Membrane microdomains are present and compositionally altered following by cryopreservation in avian sperm

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Decrease in fertilizing ability of cryopreserved chicken sperm is a persisted problem. Membrane rafts are functional membrane microdomains enriched in sterol and ganglioside G<sub>M1</sub> (G<sub>M1</sub>). Recent studies demonstrated that membrane rafts exist in plasma membrane of mammalian sperm and play important roles in fertilization. On the other hand, low fertility in cryopreserved sperm is caused by sterol efflux from plasma membrane. Considering with that sterol regulates organization of membrane rafts, the low fertility might result from disruption of them. However, it's not known whether membrane rafts exist in chicken sperm. These led us to examine the presence of membrane rafts and its compositional changes after cryopreservation in chicken sperm.

Sperm and testicular frozen sections were collected from Rhode Island Red raised at Agricultural and Forestry Research Center, University of Tsukuba. Localization of G<sub>M1</sub> and sterol were visualized by Alexa488-conjugated cholera toxin subunit B and filipin in live or fixed sperm, or testicular sections. Utilizing the biochemical definition that membrane rafts represent insolubility to TritonX-100 treatment, membrane rafts were separated from sperm membranes mainly composed of non-raft membranes and subjected to slotblotting for quantification of G<sub>M1</sub> (TX100 assay). Cryopreservation of sperm was performed using glycerol as a cryoprotectant (Tajima *et al.* 1989). Artificial insemination (AI) was performed with fresh or frozen-thawed (FT) sperm once in a week for 3 weeks.

In fixed sperm and testicular frozen section, the plasma membrane overlying sperm head was highly enriched in G<sub>M1</sub>, although it was not observed in live sperm. Sterol was localized in same area to G<sub>M1</sub> in fixed sperm. TX100 assay showed that G<sub>M1</sub> content in membrane rafts was significantly greater than in non-raft membranes. AI showed that fresh sperm had greater fertilizing ability than FT sperm. G<sub>M1</sub> localization pattern in FT sperm was distinct from that seen in fixed sperm. TX100 assay using fresh and FT sperm showed that G<sub>M1</sub> content in membrane rafts significantly decreased by FT procedure.

This study demonstrates the presence of membrane rafts in chicken sperm, and suggests that cryopreservation affects the organization of membrane rafts leading to loss of fertilizing ability.

## **Effects of Double Superphosphate and Ammonium Sulfate Fertilization on Productivity and Total Phosphorus in Plant in Inner Mongolia**

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The grassland degradation in Inner Mongolia of China has been a serious environmental problem and its cause has been studied in many researches. We proposed a hypothesis that a deficiency of soil phosphorus could be one of the causes (Kasuga et al. 2012). The objective in this study, therefore, was to evaluate the effects of phosphorus and nitrogen fertilizations on productivity and total phosphorus in plant.

Fertilizing trials were performed in three areas excluding livestock for 5 years in Siziwang banner. Two sites fertilized with double superphosphate or double superphosphate (P) and ammonium sulfate (N) were set in each area. (Site P and P+N, respectively) Each site was divided into five plots (5m×5m) with application levels of P at rates of 0, 2.5, 5, 10 and 20 g m<sup>-2</sup> on 12 May 2013, respectively. P was manually applied to the both Site P and P+N. In Site P+N, N was also manually applied at 25 g m<sup>-2</sup>. Three sampling quadrates (1m×1m) were set in each plot on 4, 5 and 6 August. Aboveground biomass was weighed in each quadrate to determine the productivity (t DM ha<sup>-1</sup>). Plant samples were collected and dried for 48 h at 60°C in a drying oven. Total phosphorus in plant was measured by coloring with molybdenum acid after nitric acid and perchloric acid digestion.

Productivity increased significantly with increasing P rates in Site P and P+N (P<0.05). However, N itself had no significant effect (P>0.05) on above ground productivity. Total phosphorus in plant increased significantly with increasing P rates in both Sites (P<0.05). Our study showed that productivity and total phosphorus in plant was increased by P. Moreover, our results may indicate that main limiting factor is phosphorus for plant growth and second is nitrogen in Inner Mongolia grassland because the interaction was observed between P and N.

# Milling Kinetics of Micro Wet Milling System for Value-Addition of Rice

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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 Micro Wet Milling (MWM) system. Rice slurry can be used to make processed food for which rice flour is unsuitable, such as pudding, ice cream, and beverages. MWM system is suitable for value-addition of rice.

The milling condition (sample feeding rate and milling speed) of MWM system has been decided semi-empirically and the milling energy has been not clarified. Therefore, it is difficult to control the particle size of rice slurry, and compare MWM system with Dry Milling (DM) system systemically. Bond’s law is mainly used to investigate kinetics and estimates 80% passing particle size for the product (Eq.1). However, 50% passing particle size is in general for particle size evaluations. The purposes of this study were to investigate the correlation between the milling conditions and  $W$ ,  $W_i$  in Bond’s law, and to establish an estimating equation for 50% passing particle size for MWM and DM system.

In DM system, the high correlations between the milling conditions and  $W$ ,  $W_i$  were obtained ( $R^2=0.911$ ,  $0.946$ ). However, the estimating equation for 50% passing particle size didn’t show a high correlation ( $R^2=0.47$ ). In MWM system, the high correlations between the milling conditions and  $W$ ,  $W_i$  were obtained ( $R^2=0.926$ ,  $0.839$ ). And, the estimating equation for 50% passing particle size showed a high correlation ( $R^2=0.73$ ).

DM system was able to produce only about 300  $\mu\text{m}$  size products, not wide range. However, MWM system was able to produce wide range particle size products from 5 to 60  $\mu\text{m}$ . These results suggested that MWM system can apply the estimating equation for 50% passing particle size and lead to value-addition for rice.

$$W = W_i(10/\sqrt{P} - 10/\sqrt{F}) \dots\dots\dots(\text{Eq.1})$$

[ $W$ : milling energy (kWmin/g),  $W_i$ : work index (kWmin/g),  $P$ : 80% passing particle size for the product ( $\mu\text{m}$ ),  $F$ : 80% passing particle size for the feed. ( $\mu\text{m}$ )]

## **Comprehensive Evaluation Method for Rice Husk Combustion to Establish Biomass Recycling System**

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This study proposed a comprehensive evaluation method for rice husk combustion in rural areas. Rice husk is expected for not only as energy resource but also production of Rice Husk Charcoal (RHC) for soil amendments. The past research dealt with the values of energy "or" environmental impact of hazardous substances separately. However, the value of energy "and" environmental impact of hazardous substances should be considered as essential factors simultaneously to evaluate rice husk combustion comprehensively. Furthermore, the economic value of RHC is also important for diffusion of the rice husk burner in rural areas. Therefore, the objective of this research is to establish a comprehensive evaluation method considering three aspects of rice husk: economic value of energy, environmental impact, economic value of RHC.

Inventory analysis was conducted to estimate material and energy flow for inputs and outputs of a rice husk burner (Kaneko Agricultural Machinery Co. Ltd. Saitama, Japan). Inventory data was collected for the combustion experiment using the rice husk burner. Amount of rice husk supply was a controllable parameter in the experiment. The range of rice husk supply was set from 13.1 kg-fuel/h to 20.3 kg-fuel/h. Environmental impact due to rice husk combustion was evaluated as damage cost by using LIME2 (Life-cycle Impact assessment Method based on Endpoint modeling).

Results revealed that 14.4 kg-fuel/h of rice husk supply was the highest value of overall evaluation, because of producing valuable rice husk charcoal as by-product and small quantity of harmful substances in rice husk combustion. Trade-off relationship between economic value of energy, environmental impact, and the economic value of rice husk charcoal was observed in variations of the integrated result. The comprehensive evaluation method showed versatile result compared with a conventional evaluation method. Thus, it was clarified that the comprehensive evaluation method contributed to achieve high economic value of energy, low environmental impact, and high economic value of RHC, simultaneously.

## Removing Ammonia by Developing a Novel Modified Zeolite Absorbent

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Now days, with the development of industries and agriculture, large amounts of wastes are produced, such as manure, food wastes, and rice straw. Anaerobic digestion of organic waste is an attractive practice as it can solve the problem of waste contamination and produce renewable energy. In the process of anaerobic digestion, ammonium is a main inhibitor, which is produced as a common metabolic end product during the anaerobic digestion of high nitrogen containing organic loading substrates.

Until now, including air stripping, reverse osmosis, chemical precipitation, break-point chlorination, ion exchange, and biological nitrification, have been used to remove ammonium nitrogen from wastes. Zeolite products are widely used for its high absorption efficiency, but it has obvious drawbacks, limited functions and high cost. The aim of this study is to develop a modified zeolite which is based on two important functions, one is absorbing ammonia which can shorten the startup time of methane fermentation, and second is activating the growth of microorganisms and providing suitable areas for microorganisms to live. Four materials are used to modify zeolite, CaCl<sub>2</sub>, starch, organic lime, and carbene. Four samples are set in the research: sample 1 : A3 zeolite; sample 2: Zeolite (80%)+ CaCl<sub>2</sub> (10 %) + starch (10%); sample 3: Zeolite (81%)+ Organic lime (9 %) + starch (10%); sample 4: Zeolite (76%) + Organic lime (9 %) + Carbene (5 %) + starch (10%). Through the ammonium adsorption experiment, the sample 4 showed the highest adsorption capacity which can reach up to 62 mg/g. The capacity of sample 4 is higher than that of sample 1, sample2 and sample3, which are 57.2mg/g, 22.8mg/g and 49.5mg/g respectively. The scanning electron microscopy was used to observe the external and internal structure of the material. The surface of sample 4 is rough and the size of the hole is suitable. This could be an ideal structure for both the absorption of ammonium and the living of microorganisms. Moreover, carbene is a kind of carbon mineral possessing high chemical activity which can enhance the ion-exchange capacity of absorbent. The modified zeolite is suggested to be a favourable absorbent for enhancing the anaerobic digestion efficiency of ammonium-rich wastes and could contribute the sustainable development of agriculture and industry.

# Purification and cDNA Cloning of a Polygalacturonase-inhibiting Protein (PGIP) from *Apios americana* Medikus Tubers

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*Apios americana* Medikus is an edible tuberous legume native to eastern North America. *Apios* tubers contain a higher content of proteins than other plant tubers and various bioactive proteins such as protease inhibitors and lectins have been identified so far <sup>[1, 2]</sup>. In the process of the purification and proteomic research, we discovered the presence of a polygalacturonase-inhibiting protein (PGIP) in the tubers. A PGIP is known as a plant cell wall protein that is found in many plant species and involves in the transformations of pectin substances during the growth of plants and ripening of fruits. In this study, a PGIP from *Apios* tubers is purified and characterized in order to investigate the bioactivity.

A PGIP from *Apios* tubers (34 kDa) was purified by column chromatographies on a DEAE-cellulofine A-500 column and Butyl-cellulofine column. The PGIP activity was measured using two kinds of PG from fungi, but no inhibitory activity was detected. To perform the cDNA cloning, the PGIP was digested with lysylendopeptidase and 11 peptides were obtained. The amino acid sequences of the peptides were determined and the PCR primers were designed. RT-PCR, 3'-RACE and 5'-RACE gave 450 bp, 650 bp and 350 bp PCR products, respectively, and the nucleotide sequences were determined. The cDNA of a PGIP from *Apios* consist of 1229 nucleotides and encoded a protein with 339 amino acid residues. The amino acid sequence showed high similarity to known plant PGIPs.

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## The Screening of the DSE Isolates Which Controls Cesium Absorption to Lettuce Seedlings

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In 2011, Fukushima Daiichi nuclear disaster caused contamination of radionuclides, such as <sup>137</sup>Cs on the extensive agricultural fields around this area. Currently, decontamination of <sup>137</sup>Cs particularly in agricultural field or forests is not progressing properly. For that reason, it is important that not only decontamination but also interception of cesium transfer from soil to agricultural products

Dark-septate endophytic fungi (DSE) are known to live with plants symbiotically, and some DSEs influenced cesium uptake of host plant in previous studies. My objective is screening DSE isolates to decrease cesium accumulation of lettuce.

The eighteen DSE isolates including *Cadophora finlandica*, *Exophiala sp.*, *Herminthosporium veltinum*, *Heteroconium chaetospira*, *Phialocephala fortinii*, *Phialocephala helvetica*, and *Scolecobasidium sp.* from our laboratory stock were randomly selected for the screening. The inoculated lettuce plant with DSEs were grown on oatmeal agar medium (MgSO<sub>4</sub>·7H<sub>2</sub>O 1g, KH<sub>2</sub>PO<sub>4</sub> 1.5g, NaNO<sub>3</sub> 1g, Oatmeal 10g, Agar 15g/L) including 50ppm cesium. After 3 weeks, the leaves and the stalk of lettuce were recovered, and were measured cesium concentration by Atomic absorption photometer.

*Phialocephala fortinii* J2PM8, BPC1, *Exophiala sp.* JAnPC4, unidentified isolates BPC3, and BC1PC1 decreased cesium concentration of the plant. Among them, *Exophiala sp.* JAnPC4 and unidentified isolate BC1PC1 particularly increased biomass of the plant. These selected isolates should be promising to cultivate the plant in terms of both increasing yield and decreasing health risk of radiocesium.



## **The plant growth promotion caused by associated bacteria with dark septate endophytic fungus *Veronaeopsis simplex* Y34**

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Dark septate endophytic (DSE) fungi colonize various plant species and provide the growth promotion, disease inhibition and tolerance of environmental stress for the host plants. Although several bacterial species associated with the hyphae of *Veronaeopsis simplex* Y34 and K45, we believed that these abilities would be provided to the hosts only by the fungus. The community structure of the bacterial species on/in both *V. simplex* isolates was exact similar and the ability of growth promotion of the host plant decreased when these bacteria were removed from the fungal hyphae (Khastini, 2013). Moreover, the growth of other plant species was significantly promoted when the plant treated with other DSE and these associated bacteria (Mahmoud, 2014). From these findings, the plant growth promotion should be caused by the association with *V. simplex* and bacteria via nitrogen fixation and/or auxin synthesis. Nevertheless, this mechanism wasn't revealed fully. Thus, the objectives of this study are 1) to isolate each bacterium from hyphae of *V. simplex* Y34, 2) to identify nitrogen fixation genes of bacteria.

For the isolation of each bacterium, *V. simplex* Y34 cultured in 1/2 CMMY medium with filter paper. The mycelium was harvested and crushed with metal crusher in eppendorf tube with sterile water. After crushing, bacterial growth was examined, *Stenotrophomonas* sp. and *Rhizobium* sp. was succeeded to be obtained. Then, I did phylogenetic analysis of *rhizobium* and *Agrobacterium*. From phylogenetic analysis, *Rhizobium* strain obtained *V. simplex* Y34 is closely related to *Agrobacterium*. For identification of nitrogen fixation gene, total DNA was extracted from the two isolated bacterial species for using PCR. The PCR was performed with *nifH* primers PolF and PolR, but *nifH* genes weren't amplified.

Two isolates do not have nitrogen fixation gene, but there is a possibility that they have other genes associated with nitrogen fixation. Therefore, it is necessary to check other genes associated with nitrogen fixation and confirm the nitrogen fixation activity of bacteria. It was suggested that *Rhizobium* strain is closely related to *Agrobacterium*, but it is difficult to classify *Rhizobium* and *Agrobacterium* by using only 16S rRNA. Therefore, it is necessary to identify this strain by using other region.

## **Development of Production Method of New Type of Sake using Micro Wet Milling**

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Consumption of Sake and number of sake brewery decrease now and it becomes the problem. Sake is traditional industry in Japan and contributes to local economy. So 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 unrefined sake. But there are two problems. First, saccharification takes time because rice bran includes a lot of protein. Second, texture of unrefined sake is bad due to include big particle into Moromi. Miniaturization process, "Micro Wet Milling (MWM)" was proposed brown rice and Moromi to solve these problems. MWM is method to mill materials with liquid. Texture and quality of Sake improvement is expected by using MWM.

"Rice slurry" is liquid food material which applied wet milling to brown rice. Rice slurry is suspension and different protein, lipid and glucose contents from rice. Therefore it is thought that brewing properties are different. Condition of good texture of unrefined Sake is maximum particle size is 100  $\mu\text{m}$ , 10  $\mu\text{m}$  particle is more than 50%.

So the purpose of this research is to make clear the brewing properties of the rice slurry and milling properties of Moromi.

Traditional Sake brewing method is not good because characteristics of Rice slurry is different from rice. So method of brewing rice slurry is examined. Glucose concentration, EtOH concentration and pH are measured to make clear the brewing properties of the rice slurry.

Moromi include big particle because of cohesion and sedimentation of Moromi. Factors of MWM are number of revolution of stone mill and supply of ingredient. So particle size distribution of Moromi milled MWM is measured with changing factors stepwisely. Clear the influence of factors and MWM condition that become good texture Sake.

At last, made new type of Sake is evaluated by sensory test.

## Characterization of Endobacteria Harboring in Nitrous Oxide-producing Soil Fungal Strains

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Sato *et al.*, (2010) reported that nitrous oxide (N<sub>2</sub>O) producing *Mortierella elon-gata* FMR23-6I-B1 isolated from an upland soil harbored a bacterium belonging to the family *Burkholderiaceae*. Recently, Naraoka *et al.* (2013) showed that upland soils under the long-term cattle slurry application possessed fungus-dependent N<sub>2</sub>O-producing activity, and further isolated a number of N<sub>2</sub>O-producing fungi. The purpose of this study was to examine whether those fungal isolates harbored endobacteria or not. In this study, 107 N<sub>2</sub>O-producing fungal strains were used, which had been isolated from upland soils at National Agricultural Research Center for Kyusyu Okinawa Region, Japan. To detect endobacteria, firstly, DNAs were extracted from fungal cultures and tested for the presence of bacterial 16S rRNA genes by PCR amplification. Secondly, fungal mycelia were stained with a LIVE/DEAD® BacLight™ Bacterial Viability kit and observed by fluorescence microscopy.

The PCR amplification of bacterial 16S rRNA genes and the subsequent fluorescence microscopy revealed that four of the 98 fungal strains were positive for the endobacterial presence. From the ITS sequence analysis, the two strains (S600-2 and S600-41) were identified as *Hypocreaceae* sp. and *Myrothecium cinctum*, respectively, in the Ascomycota and the others (S600-11 and S600-42) as *Trametes hirsute* and *Schizophyllum commune*, respectively, in the Basidiomycota. In the resting cell experiment with nitrite as the substrate, the N<sub>2</sub>O-producing activity of these strains ranged from 0.004 to 8.3 ng N<sub>2</sub>O-N (mg dry weight)<sup>-1</sup> min<sup>-1</sup>.

S600-2 and S600-41 belonged to the phylum *Ascomycota* and the others were the member of the phylum *Basidiomycota*. In our previous culture-independent analyses, the phyla *Ascomycota* and *Basidiomycota* accounted for 61% and 1%, respectively, of total PCR-amplified 18S rRNA gene sequences recovered from the soil, suggesting that the cultural recovery of *Ascomycota* was not so high as the sequence recovery.

Further studies remain to be performed to characterize the endobacteria harbored in the fungal strains.

## **GIS and Remote Sensing-based MCA Modeling to Assess Agricultural Land Use Change and Suitability Mapping of Industries**

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Bangladesh is the second largest supplier of ready-made cloths industries after China. The annual export amount is approximate US\$21,515 million where the largest importer is USA followed by European countries like Germany, UK, France, and Japan. Agriculture oriented country Bangladesh is now highly depended on Ready-Made Garments industry(RMG) as it is giving more than 79% of export earnings. In 1980, there was only 80 factories whereas it is now 5600 and annual growth rate is 4%. All the factories are situated in two major division of Bangladesh- Dhaka and Chittagong. More than 4400 production units has been established in the capital city Dhaka and nearby areas. The rapid expansion of this cloth industry is generating employment in one hand and on the other hand expansion of this industry is covering to suburb regions and occupied agricultural land. However, this industry need proper guidance for sustainable development. For example, Savar, which is one of the most important area of Dhaka division for both agriculture and industries is now facing environmental degradation for the untreated waste water of the garments industries and land transformation crisis for the expansion of the industry like RMG. The economy of Savar area is depended 23.6% only on agriculture whereas 59.6% on industry mainly RMG. Moreover, the untreated waste water of garments industry (especially chemical dying) and other RMG wastes are polluting the surrounding water channels and agricultural field causing serious degradation in both agriculture and environment. Therefore, the purpose of this study was to identify, a place in Bangladesh to build up a new industrial zone for RMG industry to provide all the facilities which will help to build an ecofriendly industrial zone. First of all, the expansion of RMG factories in a study place, Savar (280.13 km<sup>2</sup>) was indicated using the GIS mapping, which helped to know the density of this industry over the past decade and the effect of the unplanned rapid expansion and loosing of agricultural land. The satellite remote sensing data is proposed to incorporate to understand the land cover areas and agricultural land variations. A survey was conducted in the 50 factories to know the essential facilities needed for establishing an industrial zone. The multi-criteria analysis (MCA) was done to map the suitable location in Bangladesh to expand the cloth industries over time. Finally the whole assessment helped to recommend policy for the RMG industries for their sustainable growth over time period with ensuring the quality of environment and agriculture.

**Keywords:** GIS (Geographic Information System), Remote Sensing, MCA (Multi-criteria Analysis)

## **Generation Characteristics of the Gastrointestinal Mucous Membrane Protection Ingredient by the Machine Biochemical Reaction**

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Aging advances rapidly in Japan and more than about 1/4 of the population become more than 65 years old now. The increase of the medical expenses of the elderly person becomes the social problem in that. The medical expenses increase on pace to surpass national income, but cannot find the effective solution now. Therefore I suggest the development of "therapeutic food" as one of these solutions in this study. The therapeutic food is the food for the purpose of prevention or curing for a disease by an everyday meal.

In this study, I paid my attention to vegetable phosphatide, phosphatidic acid (PA), said to be effective against GI tract disturbance. GI tract disturbance is so-called gastric ulcer and develops for the eating and drinking of alcohol and the stimulant, drugs such as the aspirin, a mental stress. If such an imminent GI tract disturbance can be treated with a food intake, the social significance will be big. When it crushes the organization of vegetables and cereals, PA is generated by a biochemistry reaction of the endogenous phosphatide and a plant enzyme. Therefore I elucidate PA generation properties in the farm products by the biochemistry reaction, the machine biochemical reaction, which mechanical operation accelerates and contribute to PA-rich food development.

Cabbage contains rich endogenous phosphatide and a plant enzyme. In this experiment, I crushed cabbage in a mixer and a stone mill, and compared PA content of each sample. It was found the influence that particle size and temperature of crashed cabbage give to production of the PA

The establishment of the processing method to PA rich food by elucidating generation properties of PA by the machine biochemical reaction is enabled. Therefore two following effects can be expected. 1) Development of the food including the functional ingredient allows differentiation with other farm products and food. In other words, as for this, high added value of farm products and the food leads to becoming it. 2) Development of "therapeutic food". PA of the quantity necessary for treatment can be provided by regulating quantity of PA at a stage of the processing. Treatment of GI tract disturbance is enabled without depending on pharmaceutical products by developing food including LPA of the quantity to be required for treatment.

## Mapping of QTLs for Flower Color Intensity and Genes Related to Anthocyanin Biosynthesis in Morning Glory

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Japanese morning glory (*Ipomoea nil*) is a common ornamental plant in Japan. The flower color of *I. nil* are various because there are many flower color mutants accumulated in long history of cultivation. The original flower color of cultivated *I. nil* is blue and deeper than that of its wild relatives. In this study, we tried to reveal genes causing the difference of flower color intensity between a cultivated *I. nil* Tokyo-Kokei-Standard (TKS) and an *I. hederacea* Q65 (Q65). Then, we performed QTL mapping of flower color intensity using a F2 population with 192 individuals derived from the cross between TKS and Q65. And we also mapped genes related to anthocyanin biosynthesis (AS genes) on the same linkage map.

At first, genotypes were determined using SSR and SNP markers. Then, a linkage map was constructed by software AntMap (Iwata and Ninomiya 2004). QTLs were detected by R/qtl (Browman 2003) and the absorbance of the fresh petal was used as a trait data. For mapping AS genes, we compared nucleotide sequence between TKS transcripts and Q65 transcripts and developed SNP markers based on the sequence differences. The gene expression was analysed by using real-time PCR.

We detected three major QTLs, *ADM1*, *ADM2*, *ADM3* and these three QTLs accounting for 97% of phenotypic variation. We also mapped 19 AS genes. The map position of *ADM2* coincided with *C* (*InMYB1*) gene. *C* is known as a transcriptional regulator activating AS genes, so *C* became a candidate gene of *ADM2*, which had the highest effect for the flower color intensity. In petals 12 hours before flowering, the expression level of *C* was higher in TKS than in Q65 and this result supported our hypothesis that *ADM2* is *C*

## GIS-based Logistics Modeling for Sustainability Assessment of Local Food

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Sustainability is important to the local food system and has three explicit dimensions, domains, or pillars: Social, Economic, and Environmental. Local food systems have the significance influence to the pillars of the sustainability, which noted as socio-techno entrepreneurship. This concept leads to link the farmers, enterprise, and community to sustain the local food system. There are a number of barriers to develop of local food system. One of the boundaries of the sustainable of local food is the spatial boundary or geographic information of a region or district. In these geographic boundaries, access and proximity are important. This research was designed to develop an assessment method to estimate the suitable location for local food production and supply capacity related with the spatial variability in production. This assessment collaborated as food matrix that consists of availability, accessibility, affordability, and profitability. In this study, local production system was considered to analyze with geographical boundaries starting from the growers, local traders and marketing information for Cassava and Sweet Potatoes in the Banten Province of Indonesia.

In these assessments, geographic proximity has been related to sustainability for a variety of reasons, encompassing the ecological, economic and social dimensions of the food system. This research work attempted to find out the potential suitable areas for local food production and distribution using Geographic Information System (GIS) and Multi Criteria Decision Analysis (MCDA) based on Analytical Hierarchy Process (AHP). Administrative level of GIS mapping was projected in the regional level. A survey was conducted during the summer of 2014 with structured questionnaires. The survey was focused to identify the sustainability indicators for local food availability, accessibility affordability, and profitability. The multi-views of sustainability diagram was proposed to understand the sustainability indicators for the local food matrix over the time period.

The GIS-based integrated database included soil type, land cover, urban areas, local food growers, community, and entrepreneurs related to the availability. The community assisted famers market and local entrepreneur were involved with processed and distributed local food identified as affordability. The model was proposed to integrate between statistical, geospatial and survey data related to local food production to meet the food needs of population centers in the minimum possible distance for the consumers as accessibility and maximum profit for the producers and providers as profitability. Integrated GIS and logistics model would be useful for government to identify the potential lands to increase local food capacity in the Banten Province. In the further research, the network path analysis for the local foods will be conducted to minimize the cost of transportation and increase agro-tourism and socio-techno entrepreneurship in Indonesia.

**Keywords:** *AHP, GIS, Local Food Matrix, Socio-techno Entrepreneurship.*

## **The Effect of a High Energy Plane Feeding on the Ovulation Rate in Sonid Ewe, a Local Breed of Inner Mongolia**

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It was suggested that the higher twinning rate observed in local sheep (Ujimqin) fed halophytes in Hargebi of Xillingol League of Inner Mongolia could be caused by higher digestible energy intake, known as “flushing”(Kimura, 2011). The twin production, however, has not been documented in the other areas of Inner Mongolia. The breed difference in the potential ability controlling ovulation rate in response to nutritional status might be one of possible reasons why similar management has not been employed in the other areas. The aim of study, therefore, was to determine the effect of high energy feeding on the ovulation rates in Sonid ewes, a representative breed of eastern area in Xillingol League. Ujimqin ewes were also tested to observe the differences of the effect due to breeds.

The feeding trial and examination of ovulation rate were carried out in individual pens of Inner Mongolia Academy of Agricultural and Animal Husbandry Sciences. Eleven Ujimqin and twelve Sonid ewes were used in the present study performed during breeding season (September ~ December 2014). Ewes received hay of 55~78% Metabolic Energy for Maintenance (ME<sub>m</sub>) defined by NRC (2010) for one month as adaptation period. After that, each breed was randomly allocated to two groups. Hay equivalent to amount of 78%ME<sub>m</sub> was offered to five Ujimqin and six Sonid ewes as a maintenance group, respectively. Hay and concentrate equivalent to total amount of 200%ME<sub>m</sub> were offered to six Ujimqin and six Sonid ewes as high group. Statistical analysis on mean ovulation rate was done by chitest.

Mean ovulation rate in maintenance and high groups of Ujimqin ewes were 1.0 and 1.33 (133% of that in maintenance group,  $p=0.15$ ) at 20days after the start of the feeding trial, respectively. But at 30days of the trial, both of them were 1.0. Mean ovulation rate in maintenance and high groups of Sonid ewes were 1.16 and 1.50 (129%,  $p=0.22$ ) at 30 days of the trial, respectively. There were no significant differences between maintenance and high groups in each breed. Mean body weights of Ujimqin and Sonid ewes gained up to 4.5 and 7.7% for 30days. It is said that the effect of nid ewes gainedvely. There were no significant differences Scaramuzzi et.al. 2006). More increasing body weight might be needed to get the effect of creasing body weight might ffect of nid ewes gainedy feeding on the ovulation rate in Sonid ewes could not be determined in this study.



## **Accessibility Difference to Different Phosphorus Source within Rice Genotypes**

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Rice (*Oriza sativa* L.) is one of the main food crops in tropical to sub-tropical regions of Asia and Africa. This region contains highly weathered, infertile soils with low levels of plant available P. Therefore, breeding cultivars which have more accessibility to P source along with P application to unfertile soils is required. In previous experiments, we have identified some highly root efficient (RE) rice genotypes. This experiment was attempted to clarify their ability to solubilize more unavailable P in the soil.

Experiment was conducted in a greenhouse at JIRCAS during June to July. Seven genotypes of rice including two high RE and three low RE were grown in 3-L pots filled with river sand and 10% substrate. Three treatments of different P sources were applied: NPK chemical fertilizer (Ctrl), Burkina Faso rock phosphate (RP), and phytic acid (Phy). The amount of P applied was adjusted to 240 mg P/pot. Plant height and tiller number were measured weekly from thinning to harvesting. Dry weight of shoot and root, root length and surface area, and P content of shoot were measured after harvesting.

As a result, there were 20% and 50% growth reduction in RP and Phy, respectively, compared to Ctrl at DAS 40. Although plant height did not differ among treatments, tiller number decreased by 10-30% in RP and 40-60% in Phy. There was no significant difference among genotypes in the growth of any treatments; however, genotypic difference was observed in R/S ratio in RP. From growth reduction levels, it was suggested that P deficiency level in Phy was appropriate, while RP requires more P deficiency stress for screening. The rock phosphate used in this experiment had 20% Citric acid available P (C-P) but there were still enough plant available P supplied, which may be because sand was used as medium. For better testing if high RE rice genotypes have better P solubilizing ability, reduced amount of rock phosphate and another lower soluble P source such as iron phosphate will be applied in next experiment.

# Water Temperature Prediction Model in River Basin Including Paddy Area

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Water temperature in river basin is an important factor in agricultural production and growth environment of aquatic organisms. The global average of air temperature is expected to rise between 2.6 to 4.8 degrees by 2100. Increased temperature has an impact on river water temperature. River water temperature changes depend not only on air temperature and radiation but also heat exchange between air and ground. Especially, in Japan, where a lot of water is used for paddy irrigation, the changes in water temperature may be caused in the processes of flow, water distribution, submerging paddy plots and drainage reuse in the paddy area. Shimmura and Taniguchi (2013) showed that water temperature decreases in the processes of submerging the paddy plots or flowing down through the drainage canals in August. In the results, the return flow from paddy area caused decrease of river water temperature. To predict river water temperature accurately, it is necessary to consider the water temperature change in the paddy area.

In this study, we applied a water temperature model to the river and irrigation canal as the first step of developing the river water temperature model including the paddy effects.

The study area was Kokai basin, which flows a total length of 112 kilometers. The model applied is a river water temperature model considering heat exchange among surface water, air and soil in the riverbed (Kondo, 1995). Calculation parameters: volume of latent heat, sensible heat, soil heat and radiation on the surface water are calculated by meteorological data and river parameter. Volume of heat used to increase or decrease water temperature is calculated by subtracting calculation parameter from net radiation. AMeDAS data at Tsukuba and Utsunomiya, which are located close to the target basin, were used as input meteorological data consisting of net radiation, maximum temperature, minimum temperature, mean specific humidity and mean wind velocity. River parameter consists of water depth, flow velocity and distance of a flow passage. They were determined based on the observation at the following points by water level and temperature sensors: a) upstream, midstream and downstream of Kokai river, b) intake and return points of some paddy irrigation districts, and c) upstream, midstream and downstream of the main irrigation canal. These measurement results were also used for verification of the developed model.

The water temperature in the river and the irrigation canal were estimated by the model at the period from 15th to 17th of August in 2013. The water temperature change in the river flow process could be represented accurately. On the other hand, estimated value always dipped below observed value about 1 degree in the irrigation canal. Tentatively, calculation parameters for irrigation canal were set one tenth of the original value for river. The mean difference between recalculated value and observed data was 0.2 degrees. It can be assumed that influence on water temperature (by latent heat, sensible heat, soil heat and radiation) on the surface water is smaller at the irrigation canal than river due to the differences of material and structure between the river and the irrigation canal.

## **Synthesization of Ni/TiO<sub>2</sub> Nanocomposite Photocatalyst for Water Purification under Solar Light**

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TiO<sub>2</sub> is one of the most preferred materials for photocatalytic application, because of its high photochemical stability, strong oxidizing capability, hydrophobicity, non-toxicity and low cost. However, the photocatalytic activity of TiO<sub>2</sub>, which can be excited only by UV light, is usually hampered by the rapid recombination of photogenerated electron-hole pairs. Doping metal nanoparticles on TiO<sub>2</sub> could suppress the recombination of electron-hole pairs and increase availability of solar light. Transition metal Ni compared to noble metals such as Au, Ag and Pt is relatively inexpensive for the practical application. The aim of my research is to synthesize Ni/TiO<sub>2</sub> nanocomposite by sol-gel method and investigate the optimum mole ratio of Ni to TiO<sub>2</sub>. The photocatalytic activity of Ni/TiO<sub>2</sub> nanocomposite was evaluated by monitoring the photodegradation of Rhodamine B (RhB) under solar light. When doping Ni nanoparticles on TiO<sub>2</sub> with mole ratio ( $n(\text{Ni})/n(\text{TiO}_2)$ ) of 1.5%, 2.5%, 4.5%, 6% and 10%, the percentage degradation of RhB was 39.38%, 56.95%, 77.67%, 34.99% and 51.55%, respectively. The result indicated that doping Ni nanoparticles effectively improved the photocatalytic activity of TiO<sub>2</sub> under solar light, and the optimum mole ration of Ni to TiO<sub>2</sub> was 4.5% in this study. To solve the post-separation problem of nano-sized photocatalyst, Ni/TiO<sub>2</sub> nanocomposite thin film was coated on glass tubes. More than 97% of RhB was degraded under solar light by using the Ni/TiO<sub>2</sub> thin-film glass tube even after 10 cycles. Hence, the Ni/TiO<sub>2</sub> nanocomposite synthesized in this study holds great potential for the degradation of organic pollutants in wastewater under solar light.

# Flow-induced Aggregation Rates of Well-Characterized Colloidal Particles: Experiments vs. Theory

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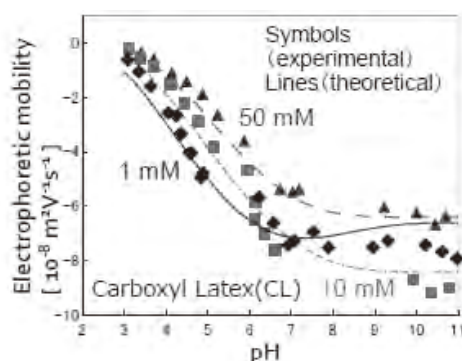
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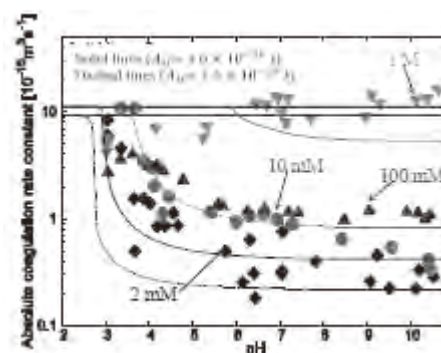
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**Keywords:** Aggregation; Charging behavior; Flow-field; Trajectory analysis.

Aggregation is important phenomenon to separate a turbid water into clear supernatant water and concentrated phase composed of colloids such as clay minerals and natural organic matter. These colloidal materials are in general negatively-charged and thus interact electrically with each other. In the presence of such electrical interaction, the aggregation rate is impeded. To understand the aggregation and related phenomena in detail, we analyzed flow-induced aggregation rates of well-characterized carboxyl latex particles, which have negative charge developed by carboxyl head-groups similar to the natural organic matter, as a function of pH at different ionic strength. **Figure 1** shows the experimental electrophoretic mobilities (symbols) and theoretical values (lines) calculated with standard charging models. From **Fig. 1**, we see that experimental values can be described by the theoretical models. Using the same charging models and trajectory analysis, we calculated theoretical aggregation rates (lines)[1] which are compared them with the experimental rates (symbols) in **Fig. 2**. In 2 and 10 mM KCl, the experimental values are in good agreement with theoretical ones. However, in the calculation we assume the decrease of Hamaker constant,  $A_H$ , with increasing with ionic strength. We consider that such decrease may be due to ion screening effect.



**Fig.1** Electrophoretic mobility vs. pH: symbols and lines are experimental and theoretical values, respectively[1].



**Fig.2** Relationship between absolute coagulation rate constant and pH: symbols and lines are experimental data taken from Sugimoto *et al.*[1] and theoretical calculation with trajectory analysis.

[1] T. Sugimoto, M. Kobayashi, Y. Adachi, *Colloids & Surfaces A* 443 (2014) 418– 424.

## Transformation of Chicken Somatic Cells Using Circular DNA

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Recent rapid progress of the stem cell technology allows to unveil the process of cellular differentiation. It may be possible to manipulate cellular differentiation by inducing the transient expression of key factors at critical point. In the present study, therefore, an attempt was made to induce stem cells from somatic cells by transfecting circular DNA in domestic chicken.

Ten White Leghorn eggs, produced at Agricultural and Forestry Research Center, University of Tsukuba, were used in the present study. Skin section was collected from 7-days-old embryos and fibroblasts were subcultured. Fibroblast was transfected with Reprogramming Minicircle DNA (Re-MC DNA) by lipofection using 3, 4.5, 6, or 7.5 $\mu$ l of Lipofectamine2000 (LPA) for 3 times at day 1, day 4 and day 6 after culture.

Two days after LP, 4 fibroblast samples which exhibited GFP signal was passaged on WL feeder cells and expression of endogenous Oct4, Sox2, Nanog, and Klf4 was detected by RT-PCR.

For comparison, one fibroblasts culture was transferred with pCAGGS-EGFP by electroporation (EP) at 3 voltages (125V, 150V, and 200V).

No significant difference was observed in number of GFP positive cells among 4 levels of LP ( $P>0.05$ ). Even though fibroblast samples were stained with ALP, expression of Oct4, Sox2, Nanog, Klf4 were not observed. The efficiency of transfection was higher in EP ( $P<0.05$ ), but cellular damage was higher as well.

These results may indicate the necessity to modify the promoter of Re-MC DNA. It will need to examine feeder cells and medium suitable for iPSCs using circular DNA in future.

## **Situation of Water Balance in Agricultural Areas in the Nile Delta**

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The Nile Delta has low annual rainfall; 200 mm at the coastal areas, 50-100 mm at the middle of the delta, and 10-30 mm at Cairo. Egypt depends most of the water on the Nile River, which it can take 55 billion m<sup>3</sup> each year based on the international agreement with Sudan. Meanwhile, increase of food production is a major problem due to rapid population growth. The Egyptian government is conducting a programme to develop 260 thousand ha of new agricultural land at the arid areas by 2017. Therefore it is necessary to estimate the possibility of allocating water to the new lands and consider the effect on agriculture in the Nile Delta where much of the water is used for irrigation. Clarification of water usage and water balance in the Nile Delta is also needed. Furthermore, the development of a water balance model that can represent the actual condition of water use and water balance is essential for future measures.

The objective of this study is to clarify the actual situation of water balance within the Nile Delta to verify the accuracy of the water balance model that will be applied to this area.

The study site is the Nile Central Delta, which is located between the Rosetta River and the Damietta River. The whole area is a double cropping area consisting of summer and winter crops. The former crops are rice, maize, cotton and fava bean, whereas the latter ones are wheat, forage (Egyptian clover), and sugar beet. Especially, rice is a former crop and is cultivated at irrigated paddy fields. Rice cultivation is permitted only at lower areas of the central delta to reduce water consumption. Two test sites that are main drain basins irrigated paddy cultivation is permitted were selected at the middle of the Nile Central Delta.

We obtained continuous data of water discharge by using flow meter and water level sensors at the inflow and outflow points of each target site. The water balance was calculated from the data obtained.

The total annual outflow from the main drains of the Nile Delta that flow into the Mediterranean Sea was estimated as 5.5 billion m<sup>3</sup>. Among the water Nile River carries from the Aswan High Dam, 10 billion m<sup>3</sup> is taken into the Nile Delta according to the Egyptian government. Meanwhile, if daily evapotranspiration (ET) is estimated as 3 mm/d, annual ET from the Nile Delta will be 10 billion m<sup>3</sup>. This means that there are some aspects that cause incoherence to the water balance.

## Mesophilic Methane Fermentation with Wood Drying Wastewater

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Nowadays, recycling wastes and decreasing environment loads are required in terms of making the recycling-based society around the world. Creating energy such as bio-ethanol or bio-gas from biomass is especially focused in Japan, because there is no fossil resource such as natural gas or petroleum oil and so on. Now much waste is recycled. For example, in some sewage center or food factories, the generated organic wastes are transformed biochemically to biogas or methane by anaerobic digestion and burned to generate electricity. However in the huge lumber mill, the wood drying wastewater (WDW) is not utilized as biomass energy resource now. WDW is discharged in the wood drying process and the amount of WDW is about 1000 t/month in a lumber mill. WDW is now treated with activated sludge process or coagulation method and then discharged into sewers. Therefore, a new recycling method of WDW is necessary to be used as organic resource. WDW is liquid and contains many organic matters so that anaerobic digestion is considered to be suitable for WDW, because the composition of is similar to sewage or some food wastewater. In this study, the purpose is finding characteristics of anaerobic digestion with WDW by batch and continuous experiments.

The characteristic of WDW is that the pH is 3.66, TC(Total Carbon) is 1271 mg/L, TN(Total Nitrogen) is 7.904 mg/L, TS(Total Solid) is 0.32 wt % and CODMn is 3102 mg/L. As the reactor, a glass bottle (1L vol) is used. Operating temperature is set around 37 °C for mesophilic fermentation. The ratio (seeding sludge to WDW) is changed from 9:1, 7:3, 5:5, to 3:7 with volume. The seeding sludge is inoculated with WDW for a month. pH, VFA(Volatile Fatty Acid), TC, TN in the fermented broth and amount and methane concentration of the produced gas are measured every day.

The batch experiment is conducted. After this experiment, I will do semi-continuous experiment with WDW by the high performance reactor (UASB or fixed bed and so on), and evaluate the characteristics of anaerobic digestion with DLW.

## Photocatalytic Disinfection of *E. coli* in Surface Water by Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> Coated on the Substrate under LED Irradiation

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As a major fraction of natural bacteria in surface waters, the *E. coli* is notoriously known for their detrimental effects. For instance, excessive levels of *E. coli* in drinking water are one of the main health and safety issues in developing countries, and using the drinking water contaminated by *E. coli* can cause many diseases, such as stomach, vomiting, diarrhea and fever. Usually, the most commonly used techniques for water disinfection, such as chlorination and ozonation have shown disadvantages related to the formation of potentially hazardous disinfection. In addition, in recent decades the advanced oxidation processes (AOPs) have been a promising wastewater treatment for its efficient oxidation ability, and among various AOPs, photocatalysis has attracted considerable interests for its remarkable disinfection performance.

According to our pervious study, a novel Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> photocatalyst has been successfully prepared and shown remarkable photocatalytic efficiency for organic dye degradation. What's more, in this work bacteria disinfection by Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> photocatalysts coated on the substrate are evaluated through inactivating *E. coli* under LED irradiation, and some factors that effluent the *E. coli* inactivation are taken into considerations, such as the amount of photocatalysts, light intensity, initial concentration of *E. coli* and irradiation time. In addition, hydroxyl radicals play an important role on the mechanism of *E. coli* inactivation. In conclusion, after 8-hour photocatalytic inactivation of *E. coli* with initial concentration of 10<sup>9</sup> CFU/mL, the sterilization rate reaches above 90% under LED irradiation, and further the additional disinfection experiments are repeated three times showing the high stability of the photocatalyst. Finally, an in-depth understanding on the role of active radicals during bacterial inactivation is essential to devise, therefor the ESR spin-trap technique (with DMPO) will be employed to characterize the photogenerated reactive oxygen species over Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> photocatalyst under visible light irradiation. If the characteristic four peaks of DMPO–OH• with intensity 1:2:2:1 are clearly observed in the ESR signal elucidating that OH• is really generated on the Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> surface under visible light irradiation. Therefor the novel Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> photocatalyst may be a promising material not only for organic dyes photo-degradation but also for bacteria photo-inactivation.



# Study of R2R3-MYB Transcription Factor Regulating Anthocyanin Biosynthesis in corolla of *Primula sieboldii* E. Morren

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*Primula sieboldii* is a perennial plant of the family *Primulaceae*. Many varieties have been produced as one of Japanese traditional horticultural plants, since its wild stock was cultivated in the Edo era. These cultivars have various characteristics, especially colors and patterns of flowers. These cultivars with colored flowers accumulate anthocyanin pigments. It is recently reported that Accumulation of pigments are influenced by the expression of transcription factor genes such as R2R3-MYB. In this study, to obtain basic information to elucidate coloration mechanism in the corollas of *Primula sieboldii*, we performed expression analysis of R2R3-MYB transcription factor genes.

‘Nankin-Kozakura’ corollas of each developmental stage were used as plant materials. We searched sequence information involved in R2R3-MYB transcription factor genes using the next-generation sequencing data of *Primula sieboldii*, and designed their specific primers for real-time PCR analysis.

We obtained twenty homologs of R2R3-MYB from the next-generation sequencing data. By real-time PCR expression analysis, it was categorized into four groups by the expression tendency of each gene. Expression levels of the genes in first group were highest at the stage of pigmentation initiation, and those of genes in second group was high at just before or after flowering. Transcripts of the genes in third group transiently increased at the stage of pigmentation initiation, and increased again after flowering. Transcripts of fourth group genes increased as flowering progressed. We considered that the genes of second and third groups might be correlated with floral pigmentation because the expression increase of these genes was concomitant with anthocyanin synthesis.

In future, we are going to isolate the full-length R2R3-MYB transcription factor genes of the second and third groups and perform the transient expression analysis to confirm a regulation of anthocyanin biosynthesis.

## **System Dynamics Model for Sustainable Palm Oil Production in South-east Asia**

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Palm oil is made from FFB (Fresh fruits bunches) and has various uses such as food, oleo-chemical, bio-diesel fuel (BDF) and so on. Global yield of palm oil in 2010 is 47.26 million tons. Palm oil production in Malaysia increase from 6.06 million tons per year in 1989 to 17.50 million tons per year in 2010. And palm oil production in Indonesia increase from 1.97 million tons per year in 1989 to 23.60 million tons per year in 2010.

Palm oil production causes various environmental problems. For example, growing plantation area with increasing palm oil consumption causes deforestation. Palm oil mill effluent (POME) discharged from palm oil factories causes water pollution, odor, and so on. Moreover biogas such as methane and carbon dioxide emitted from POME is greenhouse gas which promotes global warming. Palm oil production is closely related with environmental problems.

The purpose of this research is to investigate the factors influenced on palm oil production and to develop system dynamics model of palm oil production. System dynamics model is used for the integration of partial factors, and has two kinds of casual loops. R (Reinforce) loop is that factors are continuously increasing or decreasing and B (Balance) loop is that the factors finally are plateau. By system dynamics model, it is obvious how partial factors affected the whole system. The simulation model and its estimation method of process were developed on the system dynamics software, Studio 8 (Powersim).

Partial factors affected on palm oil production quantity were “Population”, “Economic growth”. These factors increased “Palm oil demand” and influence the development of plantation area. “Economic growth” caused “Consumption of palm oil for food, oleo chemical, and bio-diesel fuel”. On the other hand, “Repellence of inhabitants”, “Environmental preservation movement” controlled the development of plantation area.

# **The Effect of Added Arginine on the Meat Color and Texture of Meat Batter**

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*Keywords: Arginine, Meat color, texture, Myoglobin, Mutton, Texture*

Nitrite and polyphosphate have been used to improve the meat color and water holding capacity of season means like ham and sausage. However, too much of them can cause health concern such as carcinogenesis by nitrite and osteoporosis by phosphorus. Their alternative products therefore are in development to reduce the risk of illnesses caused by additives in Japan. Arginine, which is a basic amino acid and protein denaturant, is regarded as one of the most excellent food additive among possible alternative products. However, the effect of arginine on the meat color and texture of meat products is poorly understood.

Our aim in this study was to obtain some information about the color development and texture modification of meat by the adding of arginine.

At first, the influence of arginine on the physicochemical properties of whole mutton patty. As a results, arginine improved the texture as shown by increasing the gel strength low concentration of sodium chloride ( 0.2 M NaCl).

Moreover, arginine changed meat color from brown to brilliant red. The modification of meat color and texture were also shown at pork patty, indicating that, arginine plays an important in the quality improvement of meat products.

We are now studying the mechanism of the change in meat color by adding arginine. It is known that meat color depends on the state and content of myoglobin in sarcoplasm. We are examining by comparing commercial myoglobin with sarcoplasmic fraction of meat prepared as crude myoglobin. To date, we found that arginine affects directly the state of myoglobin by measurement of transmission spectrum. Further, the spectrum by arginine was different from that by nitrite, suggesting arginine would change meat color by an action mechanism different from nitrite having nitrosylation reaction.

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# Novel Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> Thin Film on Glass Substrate for Efficient Decomposition of Recalcitrant Organic Waste Under Solar Light

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**Keywords:** Photocatalysis; Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub>; Thin film; Solar light; Decomposition.

Recently, TiO<sub>2</sub> photocatalysis has attracted considerable interest for water and air purification. However, some drawbacks still hinder the practical application of TiO<sub>2</sub> for photocatalytic degradation of refractory wastewater: the fast recombination of photogenerated electron-hole pairs, low utilization of visible light and tedious post-separation of TiO<sub>2</sub> nanoparticles. Therefore, it is necessary for us to develop a new material for solving these problems. In this study, Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> thin film on glass substrate was synthesized by hydrothermal method to avoid the separation process, and Ag was used as a dopant for improving its visible light photosensitivity and inhibiting the recombination of electron-hole pairs. The synthesis of Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> thin film was optimized by investigating the effects of different amounts of Ag dopant, calcination temperature along with time and number of coating layers. The characteristics of the material were analyzed by X-ray Diffraction (XRD), UV-vis spectrophotometer and Scanning Electron Microscope (SEM). The photocatalytic activity of synthesized Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> thin film was evaluated by level of degradation of Rhodamine B, a model recalcitrant of organic waste, under simulated solar light. The synthesized Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> composite exhibited smaller crystallite size than pure TiO<sub>2</sub> and an obvious wider visible light absorption spectrum. Comparing with TiO<sub>2</sub> material, it showed much higher visible light driven photocatalytic activity, which is more than one time higher than pure TiO<sub>2</sub>. In the repetitive test, the thin membrane coated glass substrate did not exhibit any significant loss of activity even after five cycles of repeated experiments (all with removal rate higher than 99.5%). The synthesized Ag/Ag<sub>3</sub>PO<sub>4</sub>/TiO<sub>2</sub> thin film coated glass substrate treatment system operates at low cost with high-efficiency, reusable and promising material for water purification by using solar light.

## **Introduction of Horticultural Activity to Ibaraki University Farm -Significance of Stress Reduction through the Horticultural Activity-**

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Recently, horticultural activities are paid attention not only for production but also stress reduction to the participant. However, the information is limited regarding the methodology of horticulture therapy and scientific their effects. In Ibaraki University Farm has continued horticulture therapy activities from 2004 collaborated with a mental hospital in Ibaraki. In this paper, we introduce the outline of our activities and discuss the effects of these activities.

We are promoting horticultural activity field by organic way using university farm. The farm size is 20m×50m, we are planting over the 20 kind of vegetables though the year. Participants are patients at the mental hospital, nurse, and volunteers. The activities are done in every Wednesday morning for about 90 minutes. Participants have opportunities for farming practice such as seed bed preparation, seeding, weeding, harvesting, orchard management, and cooking. In this program, we also introduce the activities regarding animal assisted activity before or after horticultural activity. In animal assisted activity, participants were spending time with goats and cows in university farm. Average numbers of participants were from 20 to 25 persons.

During the program, air temperature and climatic condition and number of participants are recorded. Participants are measured the blood oxygen level and heart rate using a plus oximeter (PULSOX-Lite, Konica Minorlta Co.Ltd.) every time before and after horticulture and animal assisted activity. In addition, once a month, we also measure the salivary amylase activities using a salivary amylase activity monitor (CM-2.1 NIPRO Co. Ltd.). Stress response scales are also done at the same time.

We have finished about the half of this program in this year. From April to August, there were hottest day was on August 20th when temperature was 33.2 °C and coolest day was on April 9th when that was 14.4 °C. Although significant variable temperature condition, most participants were joined in this program. The differences of heart rate change were varied before and after this program. However, positive effects were observed the point of stress response scale. We conclude that the moderate horticulture activities are effective for stress reduction.

# **Tillage Can Reduce the Radio-Cesium Contamination of Soybean After the Fukushima Dai-Ichi Nuclear Power Plant Accident**

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A magnitude 9.0 earthquake and subsequent large tsunami hit the northeastern coast of Japan on March 11, 2011. This resulted in serious damage to the reactors of the Fukushima Dai-ichi Nuclear Power Plant (FDNPP), operated by the Tokyo Electric Power Company. Large amounts of radionuclides were released from the FDNPP, a proportion of which were deposited over a wide area of the Tohoku and Kanto regions.

In particular,  $^{134}\text{Cs}$  and  $^{137}\text{Cs}$  lead to internal exposure through consumption of crops since cesium and potassium are both group 1 metals and are thus easily taken up by plants.

In this study, we investigated soil radio-cesium contamination of soybean fields in Ibaraki, ~200 km away from the FDNPP. After this accident, we compared the radio-cesium contamination of soybean between the different tillage and cover crop managements.

This experiment was used the part of long term study site on the humid subtropics field, located on a volcanic soil in the Japanese province of Kanto region. The experiment variants are: moldboard plow/rotary harrow (MP), rotary cultivator (RC), and no-tilled (NT), three cover type in winter (FL: fallow, RY: rye, and HV hairy vetch) and two nitrogen fertilization rate (0 and 20 kg N ha<sup>-1</sup> for soybean production).

MP and RC reduced the radio cesium contamination ( $\text{Cs}^{134} + \text{Cs}^{137}$ ) in upper soil layer, although NT leaves large amount of radio cesium on the soil surface. Radio cesium contamination in soybean grains was significantly decreased in MP and RC than in NT in both of 2011 and 2012. We concluded NT system has many benefit for environment conservation, however, inversion of tillage is significant to decrease radio cesium contamination to the crops in several years after nuclear power plant accident.

## Study on Inhibitory Activity of Amyloid $\beta$ Aggregation by Kukoamines

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Alzheimer's disease (AD) is one of the most common forms of dementia. Amyloid  $\beta$ -proteins ( $A\beta$ ) are considered to play an important role in the pathogenesis of AD.  $A\beta$  is generated from amyloid- $\beta$  precursor proteins (APP) by proteolysis and aggregate into amyloid fibrils which cause neurodegenerative disorder. We have recently reported that some polyphenols exhibit inhibitory effect on  $A\beta$  aggregation and the catechol moiety in these active compounds has been proved to be essential for the inhibitory mechanism. Kukoamines A and B are phenolic alkaloids containing with two catechol moieties in dihydrocaffeoyl groups. Kukoamines A and B have been reported to restore human neuroblastoma cells damaged by peroxide. However, there has been no report on the inhibitory activity of Kukoamines A and B towards  $A\beta$  aggregation. Therefore, we would like to investigate whether Kukoamines A and B have the potential to inhibit  $A\beta$  aggregation and elucidate their structure-activity relationship in this study.

Kukoamines A and B are widely distributed among the Solanaceae species and are predominant constituents in *Lycii Cortex* (*LyC*), root barks of *Lycium chinese*. Therefore, we isolated Kukoamines A and B from *LyC* which is a traditional oriental medicine that exhibits hypotensive, antioxidant and antitrypanosomal activity. The dry powder of *LyC* was extracted with MeOH, and the MeOH extract was partitioned between BuOH and H<sub>2</sub>O. The water soluble portion was subjected to Sephadex LH-20 column to afford a crude fraction including Kukoamines A and B. The crude fraction was separated by the reversed-phase HPLC to afford Kukoamines A and B. The structures of Kukoamines A and B were confirmed by using NMR and ESI-MS analyses.

To evaluate the role of Kukoamines A and B in  $A\beta$  aggregation, thioflavin-T (Th-T) assay is carried out.  $A\beta$  with or without Kukoamines A, B or dihydrocaffeic acid are incubated for 8 h, 24 h and 48 h. We expect that Kukoamines A, B and dihydrocaffeic acid exhibit inhibitory activity towards  $A\beta$  aggregation, while Kukoamines A and B possess stronger inhibitory effect than dihydrocaffeic acid because Kukoamines A and B have more catechol moieties than dihydrocaffeic acid. If the result is same as described above, it will be the first report to show the inhibition of  $A\beta$  aggregation by Kukoamines A and B. These results indicate that applying Kukoamines A and B and its derivatives in medicine will be a promising strategy to treat and prevent AD.

# Analysis of Extraction and Fermentation Characteristics of Herbal Plant

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## Introduction

Social issues such as westernization of food, increased stress and aging raise the risk of disease. Owing to containing multiple active ingredients, Chinese medicine act overall to the human body and is effective for prophylaxis. In response to the improvement of health-conscious in recent years, the market for Chinese medicine has been expanded to 113.1 billion yen scale in 2007. Raw materials of Chinese medicine are called herbal medicine. Types of herbal medicines are wide-ranging, but ginsenosides saponins contained in the Korean ginseng and *Gynostemma pentaphyllum* (hereinafter, ginsenoside) has attracted attention because it has various effects such as nutritional fortification anti-cancer effects, and anti-aging. *Gynostemma pentaphyllum* which is produced inexpensively contains a lot of ginsenosides and has been used as a tea to be boiled in hot water. However, this health food is not currently on the market. This is probably because the inefficiency of ginsenosides caused by destruction in boiled water or insufficiency of aglycone of ginsenoside by floras that help the intestinal absorption. In this study, by elucidating the properties of heat resistance and aglycone of *Gynostemma pentaphyllum* ginsenoside, attempting the development of health food which everyone can enjoy the effect. From some literatures, it has been found that to promote the absorption of ginseng ginsenosides, lactic acid fermentation is effective to degrade ginsenosides to aglycone. In this research, based on the hypothesis that lactic acid fermentation will also decompose *Gynostemma pentaphyllum* ginsenoside, we aim to elucidate the optimal extraction temperature and fermentation conditions of *Gynostemma pentaphyllum*, to develop a new health fermented tea of low price and high quality.

## Research method

The most efficient extraction temperature condition and feed/solvent ratio without disassembling the ginsenoside of *Gynostemma pentaphyllum* are elucidated by using HPLC. Time course of ginsenoside of *Gynostemma pentaphyllum* extract made by different concentration and temperature condition is determined. For *Gynostemma pentaphyllum* extract, which is extracted under optimal conditions, the effects on ginsenoside decomposition caused by operating conditions such as ginsenoside initial concentration, lactic acid fermentation temperature and operating time is elucidated theoretically and experimentally.



# **Bio-gasification by Methane Fermentation Using the Agricultural Waste Discarded from a Farm in Tsukuba City**

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Recently, renewable energy has been attracting attention in the background that the depletion of fossil fuel and the abolition of nuclear power plant are advocated. The renewable energy is superior energy that we can use repeatedly without depletion of resources and it does not emit almost carbon dioxide that causes global warming during heat utilization and power generation. They include solar, wind, hydro, geothermal, biomass, and so on.

In this study, I focus on biomass that it is an organic resource of biological origin, and familiar to our lives. Annual generation amount of biomass in Japan are about 89 million tons livestock excreta, 75 million tons sewage sludge (concentrated sludge), 32 million tons human waste sludge, 22 million tons food waste, and 14 million tons waste paper in descending order. Biomass has not been utilization in Japan so far, and most of them have been incinerated or landfilled. This is attributable to the fact of 1) Biomass are widespread and thin, moisture content is large, and the collection is difficult, 2) Development of conversion technology with high efficiency is insufficient, 3) Profitability of the business is low.

As the usage of biomass, power generation by combustion, composting, making livestock feed, bio-gasification, and conversion to liquid fuel represented by bioethanol are shown. I pick up the bio-gasification by methane fermentation this time. The methane fermentation has an advantage that a large amount of raw material such as sewage sludge, garbage, and livestock excreta is supplied stably throughout the year.

I decided to use an agricultural waste discarded from the farm in Tsukuba city as a raw material for methane fermentation. Because I have been involved with the farmer in part-time job of farm work, and I have seen the vegetables to be discarded 10 ~ 30 kg every day without being put on the market. The purpose of this study is to know the amount of biogas obtained when all agricultural waste discharged in the farm throughout the year is converted into biogas. In order to vary the type of discarded vegetables and external temperature depending on the season, these two are set to variation factors, and experiment is carried out using the four reactors.

## **Imagine the Agriculture and Food from “Tonpikurin”!**

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We think it is important that many people to have interest and concern about agriculture. We, **Tonpikurin**, is a club that grow vegetables in flower beds at Area 2 and farm near the Hirasuna Residence Hall. We plant vegetables near in the road in order to get to feel close to agriculture and food to people on campus. We hope many people to be have an interest about agriculture and food from this abstract. And we want to work with more people.

We want to get to feel close to agriculture to surrounding people. So we thought that we want to know people about the "taste of vegetables freshly caught" and "fun of agriculture". Then, we often eat dishes that contain fresh vegetables that harvested in the fields or flower beds with friends of members. We are calling this activity "**Picnic**". And after picnic, we carried out some activities with participants.

Members of Tonpikurin are less than 10 people. Therefore, it is difficult to do activities (sign making, pond making, etc) that we want to do. But, if work with friends of members, or other organizations, we can do that we want to do. And, there is also a new idea comes out if a lot of people get together. In addition, it is possible to do with the agricultural work, and get to feel close to agriculture and food to person who came. In addition to these activities, we made the Tanabata decoration by piercing the flower beds of bamboo about 3 m, and we are considering to be let out a sense of the season with Christmas lights in the winter by the Gold Crest got from the Agricultural and Forestry Research Center. We cherish the idea of members, and did seriously that people do not do, and we want to people let focus on the farms and flower beds in the wake of it. When the picnic or during activity of flower beds, we were accosted by the students, staff of office and school cafeteria so we have introduced about Tonpikurin a lot. In addition, some people sent us message like "I want to try to work together!" by Facebook even if in the first interview with. In this way, developing ideas and thoughts, a wide range of flexible, we have a variety of activities.

The fact that people who coming to the picnic every time, and a lot of people talking during activity, we thought that a lot of people on campus are interested for agriculture and food. So, we want to continue to act more aggressively than ever, and aim to collecting the members of students with a variety of backgrounds and a wide range of department. In addition, we want to do with children in the region of Tsukuba City, which events to harvest sweet potatoes in October of next year. With the aim of agricultural education and food education to the children, we would like to expand into the region not only campus!

## Comparison of Egyptian Salt-tolerance Cultivars and Analysis of the Physiological Mechanism

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In recent years, food demand is increasing rapidly in Egypt due to the population increase. However, the agricultural field is limited in the Nile Delta, and the salt accumulation in northern part of the Delta is serious. The salt accumulation influences the production of wheat (*Triticum aestivum* L.) which is an important crop for food or forage in Egypt. This study purpose was to compare the salt-tolerance of 6 Egyptian cultivars and to analyze the physiological mechanism of their salt-tolerance.

Germination test: In 2013, the germination test under salt stress condition was conducted about 6 Egyptian cultivars (Baniswif 1, Baniswif 5, Sakha 93, Sids 1, Sohog 3 and, Giza 168) with 1 Japanese cultivar (Nourin 61). These tests were at 25 °C and in the dark condition. The salt treatments were 0, 100, 200, 300, and 400 mM NaCl. 100 seeds were in a culture dish, and 3 replications were in each treatment.

Cultivation test: From November, 2013, 3 Egyptian cultivars (Sakha 93, Sids 1 and, Giza 168) with 1 Japanese cultivar (Nourin 61) were cultivated under salt stress condition. The salt treatments were 0, 3000, 6000, and 10000 ppm NaCl. 2 plants were in a pot, and 4 replications were in each treatment. The salt treatments were started with Hoagland culture solutions on November 29 when the plant had become 30 cm long. The solutions were treated by every week. Plant length, number of stem, photosynthetic rate, SPAD value, and dry weight of each part were measured during the treatment period, and the amount of Na, K, Mg, and Ca in each part are being analyzed.

In the germination test, Giza 168, Sakha 93, and Sids 1 showed higher salt-tolerance, and especially Giza 168 showed the highest germination percentage and rate. In the cultivation test, under 3000 and 6000 ppm, panicle weights of all Egyptian cultivars were larger than the others, and especially Giza 168 and Sakha 93 tended to be higher. On the other hand, plant lengths of Giza 168 and Sakha 93 under stress condition were lower than these of control. In addition, higher photosynthetic rates of Giza 168 and Sids 1 under salt stress condition were higher than these of control. These results indicate that the salt-tolerance of Giza 168 is the highest and it will be the most useful variety under salt stress condition.

## **Molecular Breeding of Salt-tolerance Potato Harboring the *fasciclin-like arabinogalactan protein* Gene (*SeFLA*) from *Salicornia europaea***

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As the world population continues to grow recently, food production is more demanded. However, the influence of desertification and salinization makes the land where crops are not able to grow. To solve this problem, it is required to develop some abiotic stress tolerant crops such as drought and salinity. Potato (*Solanum tuberosum* L.), the fourth-largest food crop in the world, and also is valued as industrial raw materials. However, classical breeding in potato has concentrated to improve productivity, tuber quality and biotic resistance. Almost modern cultivars are sensitive to abiotic stresses such as drought, salinity, and low temperature. Besides, potato is an autotetraploid and vegetative propagation crop, so that it takes a lot of efforts and time to confer the abiotic stress tolerance by conventional breeding. Therefore, the objective of this study is the generation of transgenic potato lines with salinity tolerance by genetic engineering technique and the tolerance evaluation of them.

The gene introduced into potato is the *fasciclin-like arabinogalactan protein* gene (*SeFLA*) derived from *Salicornia europaea*. *SeFLA* is isolated by screening of *Escherichia coli* with the cDNA library from *S. europaea* under salinity condition. To make a transgenic potato, a leaf was wounded by a scalpel and was infected with *Rhizobium radiobacter* (Agrobacterium) strain LBA4404 harboring the pAB7113-*SeFLA*. After that, shoot induction *via* callus has been carried out. As first screening, amplification of the *SeFLA* fragment was checked by PCR from each regenerated shoot. When the agrobacterium still exists in regenerant, it is indicated that the detected fragment is derived from agrobacterium in this screening. For this reason, that the residual check of agrobacterium was performed to each regenerant. Then, Southern blot hybridization was carried out to confirm the number of inserted transgene in each transgenic plant.

It is expected that tolerance level of each transgenic line is different due to the number and the position of the inserted transgene. Therefore, high tolerant lines should be screened using *in vitro* or potted plants.

## **The Effect of Shokuiku to Food Education Activities for Millets -Pupil's Perception and Thoughts on Food Nutrition-**

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‘Shokuiku’, food and nutrition education is necessary to learn and know about food, diet and eating for us to live sound and healthy. ‘Shokuiku’ raises adequate food and nutrition knowledge, and food choice skills for children and adults for the practice of healthy dietary habits through various experiences. Intellectual, moral and physical education are basic and extremely important components of education, but ‘Shokuiku’ might be the most important education and covers these three educational areas. Actual activities in ‘Shokuiku’ are conducted in numerous fields and by various methods. But most of activities are focused on nutritional education or life-style related diseases. Agriculture is one of the most basic human activities concerned with food, so we tried to carry out ‘Shokuiku’ by a series of crop cultivation. We are using millets as crops because energy crop is the essential for living ourselves. But there are so many activities using rice, for example, rice cultivation using bucket so we don’t want to use such a major crops.

Millets are small and minor grain crops which are classified into Gramineae such as common millet (*Panicum miliaceum*), foxtail millet (*Setaria italica*), barnyard millet (*Echinochloa utilis*), finger millet (*Eleusine coracana*), sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum americanum*), Job’s-tear (*Coix lacryma-jobi* var. *ma-yuen*) and so on. On the other hand, buckwheat (*Fagopyrum esculentum*), grain amaranth (*Amaranthus caudatus*), quinoa (*Chenopodium quinoa*) are not Gramineae but they are recognized as cereals (pseudocereals) and millet, too. We focused on common millet because it is the first crop which are cultivate in a slash-and-burn agriculture. It is the most famous crop in Japan because every Japanese know the folk story ‘Momotaro’ and it is the key food on its story. Actually the word ‘Shokuiku’ had started to use in the beginning of 20<sup>th</sup> century but Ministry of Agriculture, Forestry and Fisheries of Japan started its activity in 21<sup>st</sup> century. But the advantageous effect of it is not clear.

We conducted a series of ‘Shokuiku’ activities for the first-year and sixth-year pupil at Toride Elementary School in Tsuchiura City in 2014. They started to cultivate common millet as well as foxtail millet for cooking materials after harvesting. Students cultivated the other millets for studying the characteristics and learning biodiversity. A series of cultivation of millet production, for example broadcasting fertilizer, making ridges, sowing seeds, weeding, thinning, harvesting, threshing and milling was performed. Once the cultivation is completed, students would prepare few dishes from millets. A questionnaire-based investigation would be conducted several times in a year for evaluating the effect of its activities. In the survey, we are expected to understand the changes of pupil’s feeling and thoughts on food and agriculture. We also proposed a questionnaire-based investigation for their parents.

## Electrophoretic Mobility of Carboxyl latex Particles: The Significance of Existence of Divalent Counter-ions

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Aqueous colloidal dispersions in natural environments contain multiple ionic species with different ionic valences. The existence of multivalent ions in a suspension affects charging and aggregation behavior of colloidal particles. However, systematic measurements and analyses of the electrophoretic mobility (EPM), which is used for characterizing the charging behavior of colloidal particles, are still lacking in mixed electrolyte solutions of divalent and monovalent counter-ions.

We measured EPMs of carboxyl latex particles in mixed solutions of KCl and CaCl<sub>2</sub>. Experiments were carried out as functions of the solution pH, the mixed molar ratio of Ca<sup>2+</sup> to K<sup>+</sup> ( $X = \text{Ca}^{2+}/\text{K}^{+}$ ), and the ionic strength. Experimental EPMs were analyzed by using 1- $pK_H$  with or without Ca<sup>2+</sup> association/dissociation ( $pK_{c_a}$ ) model, diffuse double layer model, and the Ohshima equation including the relaxation effect [1-3]. The magnitude of the mobility is large at high pH due to deprotonation of carboxyl groups on the particle. As the ratio  $X$  increases at fixed ionic strength and higher pH, the absolute value of the EPM decreases. At low pH, on the other hand, EPMs are on a single curve irrespective of the ratio  $X$ ; the charging behavior is controlled by ionic strength at low pH even in the presence of Ca<sup>2+</sup>. In comparison with experimental EPMs, theoretical ones calculated by 1- $pK_H$  without Ca<sup>2+</sup> association model are large. On the other hand, theoretical EPMs calculated by using 1- $pK_H$  with Ca<sup>2+</sup> association model quantitatively agree with experimental ones. Our results suggest that the binding of Ca<sup>2+</sup> with deprotonated carboxyl groups on the particle reduces the effective charge. Therefore, the modeling of the binding of Ca<sup>2+</sup> with deprotonated carboxyl groups is crucial for the evaluation of charging behavior of the particle.

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## Effects of Intercropping of Maize and Soybean on Growth, Photosynthesis and Yield in Egypt

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In Egypt, effective land use of crop production is needed because of the rapid increase of population. Intercropping is one of the efficacious ways to increase the yield of crops in limited land. Also getting forage from residue of intercropped crops can be expected. Therefore the objective of this study is to analyze the differences between maize/soybean intercropping and each mono culture on growth, photosynthesis and yield.

Maize (*Zea mays* L. cv. 30K8; Zankalon, Three ways cross 324; Sakha) and soybean (*Glycine max* (L.) Merr. cv. Giza111) were sown in Zankalon and Sakha field in Nile delta, Egypt in June 2014, respectively. At Zankalon field; mono culture of maize (MM) with 2 lines in a bed, mono culture of soybean (MS) with 4 lines in a bed and 2 patterns of intercropping (MM + 2 lines of soybean in a bed (I1), MM + MS in a bed(I2)). Maize was planted at the middle of the slope of bed (160 cm width) to avoid salt stress, and intercropped soybean was planted just inside of the lines of maize. Line distance of soybean in MS and I2 was 20~25 cm. Plant distance of maize was 22 cm while soybean was 12 cm (MM, I2) or 6 cm (I1). At Sakha field; MM, MS and intercropping (one line of maize + one line of soybean in a bed (I3)). Line distance was 70 cm in MM and MS while 35 cm in I3 plots. Plant distance was 15 cm in all treatments. Both experiments were conducted with three replications. The irrigation interval was 10 to 15 days in both fields, and total amount of irrigation water was recorded. Photosynthetic rates were measured with a portable photosynthesis system (LI-6400, LI-COR) at vegetative stage and reproductive stage. Measurements of growth elements, chemical analysis and yield survey at sampling times are still on going.

As a result, under natural light condition at vegetative stage, higher photosynthetic rates of mono-cropped maize and soybean than those of intercropping were observed in both fields in a few hours during a day. Although photosynthetic rates of intercropped maize under low light intensity were higher than those of mono-cropped maize in Zankalon field, this tendency could not be found in Sakha field. However, the photosynthetic rates of intercropped soybean under low light intensity level were higher than those of mono-cropped soybean in both fields. It was estimated that intercropped soybean adjust to low light intensity because of the shade of larger maize plants.

# **Rheological Change of Food Hydrocolloids Studied by NIR and THz Spectroscopy**

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Food hydrocolloids form a gel by heating and cooling, and its rheological property changed remarkably. Thus, hydrocolloids play an important role in improving texture of food products. For example, control of texture is necessary to develop care food for elder people. For the rapid aging society, texture control by hydrocolloid will become more and more important in the near future. In this study, rheological properties of food hydrocolloids such as soymilk, gelatin, and agar were analyzed by using NIR and THz spectroscopy. Commercial plain soymilk was heated from 20°C to 80°C at 10°C intervals, and cooled to 20°C. During this heating-cooling process, diffuse reflectance NIR spectra and viscosity of the soymilk were acquired every 30 seconds with a FT-NIR spectrometer and a rotational viscometer. Correlation between the viscosity and the NIR spectrum was explored with S. Golay second-derivative and PLS regression analysis. The viscosity of soymilk decreased with heating and increased with cooling, and viscosity at 20°C increased 1.4 times before and after the heating-cooling process. In the NIR spectra, bands at 1150, 1450, and 1940 nm, arising from OH group, were showed blue shift. These shifts mean that hydrogen bonding was broken along with change in microstructure of soymilk. In addition, the second-derivative NIR spectra, a NH band was detected at 1460 nm. The PLS regression model of the viscosity showed high determination coefficient (0.97) and small RMSE (0.44 mPa · s), using up to third latent variables.



## NIR Spectral Change of Fruits Stored under Anaerobic Conditions

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Japanese fruits are very popular throughout the world. To prevent quality deterioration of fruits during storage and transportation, a modified atmosphere (MA) packaging technique is used. However, poorly designed MA packaging results in anaerobic respiration and off-flavor development. In the present study, NIR spectroscopy was used to detect deterioration of fruits quality induced by storage under anaerobic conditions. Fresh strawberries were sealed individually in airtight glass containers with a deoxidant, and stored for up to 4 days at 35 °C. Brix and NIR spectra of 6 fruit samples were measured daily. A digital hand-held refractometer was used for the brix measurement. The O-H band of water was dominant in the NIR spectra of the liquidized strawberries, and any bands indicating deterioration in strawberry quality during storage could not be observed. However, the second derivative of the NIR spectra showed obvious changes in the 4500–4200 cm<sup>-1</sup> region. Prior to storage, bands at 4396 and 4308 cm<sup>-1</sup> are observed and these bands are assigned to sugar components such as sucrose, glucose, and fructose, present in the strawberries. During storage, the NIR spectra changed drastically were observed. These bands were assigned to anaerobic metabolites such as acetaldehyde, ethyl acetate, and ethanol. On the basis of these bands, especially the bands at 4308 and 4344 cm<sup>-1</sup>, any quality deterioration under anaerobic conditions can be detected. Figure 3 shows the results of PCA using the second derivative in the 4500–4200 cm<sup>-1</sup> region of the NIR spectra. The first and second principal components (PCs) correlate the storage time and Brix of the samples. In the first PC loading, the bands increasing in intensity with storage time showed positive values and those assigned to sugars, which were decreasing in intensity, were negative. This result means that the first PC describes the relative change in sugar and metabolite concentrations during storage. The second PC loading showed higher positive values for the 4400 cm<sup>-1</sup> band arising from sugars, indicating the spectral variance of this band, regardless of the anaerobic respiration shown by PC1. From these results, it is demonstrated that NIR spectroscopy can be used to detect anaerobic metabolites easily and will contribute to the development of a well-designed MA packaging technique.

## **Different of Biogas Productivity Efficiency under Various Raw Material Management**

Neeranut VINIJCHEVIT<sup>1</sup>, Pitipong THOBUNLUEPOP<sup>1\*</sup>, Nop TONMUKAYAKUL<sup>1</sup>, Pranot MANI-IN<sup>1</sup>, Komkrit THANYAVACHIRAWIT<sup>1</sup>, Jutarat CHANGKAEWMANEE<sup>1</sup>, Artit PONGTIP<sup>1</sup>, Jakkarin MUANGPAN<sup>1</sup>, Patsara KULASUWAN<sup>1</sup> and Piyanuch KAMWEAN<sup>1</sup>

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The experiment studied for the production of biogas for renewable energy by post-harvest management and cutting intervals on 3 napier grass cultivars. The experiment conducted to Split-Split plot in Randomized Complete Block Design with 3 replications. Main plot were 3 post-harvest managements; fresh, silage and dried materials. Sub plot were 3 napier grass cultivars; Pak-chong 1 (PC1), Bana and Mott. Sub-sub plot were 2 cutting intervals; 45 and 90 days after first cut. The experiment found that dried materials produced highest biogas yield for 125.12 ton.m<sup>-3</sup>. Mott grass produced highest biogas for 100.70 ton.m<sup>-3</sup>. Additionally, the biogas yield was highest by the used of napier grass raw material when it was cut at 90 days after first cut. Moreover, the biogas was produced highest yield by the management of Mott raw material was cut at 90 days and then submitted to make silage. Furthermore, during biogas production, digesting to Bana grass could maintain pH of digestion process for approximated 7 then this process could produce the highest biogas yield for 30 days. On the other hand, PC1 and Mott materials could not maintain that pH of digestion process then biogas yield was lowed, and produced only 5 days after digesting. Interestingly, the methane component was produced from Bana grass higher than that PC1 and Mott. Finally, highest of CO<sub>2</sub> concentration was found by biogas production of PC1 material.

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# **New Wine Processing Obtained from the Whole Mulberry with Micro Wet Milling System**

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Mulberry belongs to the genus *Morus* of the *Moraceae* family. It is widely distributed in Asia, mulberry is a fruit not known only for its nutritional qualities, but also for its traditional use in natural medicine as it has a high content of active therapeutic compounds and significant effects on antioxidant activity. Due to its fragile structure and low stability in storage, it is usually processed as freezing food. Another possibility is to commercialize its fermented product. It has been widely reported that cardio protective effect can be achieved by moderate consumption of wine. Mulberry also has more nutrition content such as anthocyanin, polyphenol which compared to red grape.

However, the nutrition in raw material pomace and seeds will lost in traditional wine processing because it only use squeezing juice to ferment, on the other hand, the root and seeds of mulberry can't separate at all. Due to this special feature of mulberry. In this study we proposed to use micro wet milling system to produce mulberry wine in order to keep full of nutrients by milling the whole mulberry into smaller particle size.

The comparison experiment between micro wet milling system and traditional wine processing could be divided into two parts. First part is only to blend mulberries in 1,2,3,4,5 min which harvested from Shimane province in Japan by CuisinartSBC-1000 blender. The particle size of sample was measured as median diameter by particle counter in order to analyze the relationship with blending time. Second part is to mill the juice by stone milling machine after blending. The milling mortar was set up at 100,120,140,160,180 rpm which in order to make particle size smaller. The grinding feature of mulberries were analyzed as particle size distribution.

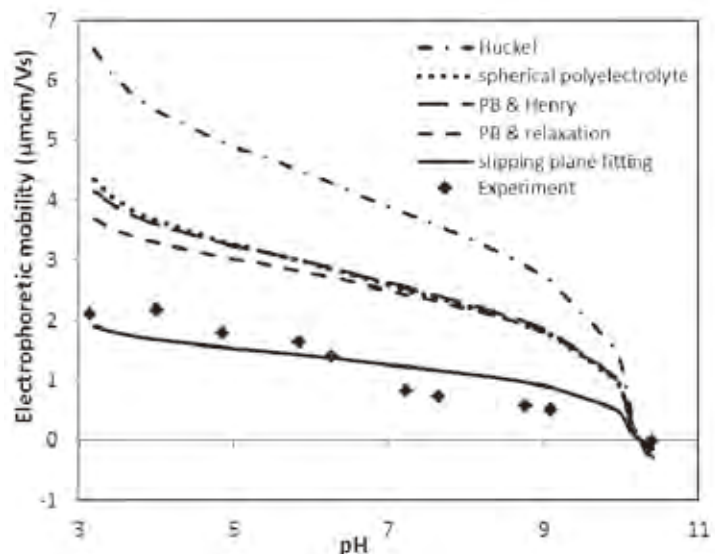
## Comparison of Experimental and Theoretical Electrophoretic Mobilities of Lysozyme

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The electrophoretic mobilities of hen-egg-white lysozyme were measured as a function of pH and KCl concentration. In addition, the theoretical mobilities were calculated from the charge density obtained from proton titration. We used a set of equations for a small rigid particle including the effect of double layer relaxation and a formula for spherical polyelectrolyte neglecting the relaxation effect (Fig. 1). All theoretical mobilities overestimate experimental ones. We presume that these discrepancies are caused by the reduction of effective charge by counter-ion binding to lysozyme and/or by the shift of slipping plane from the surface. Therefore, we examined these two effects on the mobility in the set of equations for a small rigid particle with the Poisson-Boltzmann (PB) model and relaxation effect. Our analysis demonstrated that introducing the 40-75 % reduction of effective charge from the original proton charge or the 0.75-2 nm shift of slipping plane generates the quantitative agreement between theoretical mobilities and experimental ones.



**Fig. 1** Electrophoretic mobilities of lysozyme in 5 mM KCl solution as a function of pH. “Huckel” is based on the Huckel equation without the Poisson-Boltzmann (PB) model. “spherical polyelectrolyte” is calculated by the Hermans-Fujita formula for spherical polyelectrolyte. “PB & Henry” is including PB model and Ohshima’s approximate Henry’s equation. “PB & relaxation” is based on Ohshima’s approximate electrokinetic equations for a small rigid particle including PB model and the effect of double layer relaxation. “slipping plane fitting” is by the same set of “PB & relaxation” with the 1 nm

## Preparation and Characterization of Oil-in-Water Emulsions Stabilized by Food Fibers

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Various synthetic emulsifiers are commonly used nowadays, but they have some disadvantages. While some of them have allergenic properties, others are denatured by heat, and so on. Therefore, using fiber, which is resistant to heat and non-allergenic, as emulsifier, more healthy emulsion could be obtained. Moreover, such emulsions can be used in foods, cosmetics, and medical products. Therefore, the purpose of this study is to prepare the emulsion using fiber as emulsifier and analyze characteristics of that.

First of all, we prepared the fiber aqueous solutions, containing either carboxymethylcellulose (CMC) or pectin made from apple. CMC was dissolved in pure water, and pectin dissolved in 5 mM phosphate buffer (pH7). The concentration was between 0.001 and 1 wt%. In addition, solutions containing 0.1 wt% of each fiber in pH 2 to 7, were also prepared.

Then, oil-in-water emulsions were prepared as follows: the dispersed phase consisted of soybean oil, and the continuous phase consisted of either 0.1 wt% or 0.5 wt% fiber solution. The oil-to-water weight ratio used was 1:9. The O/W emulsions were prepared in two different ways: using a high-speed homogenizer (Polytron PT3100), or combination of high-speed homogenizer and high-pressure homogenizer (Nanovater NV200). After that, the droplet size and droplet size distributions of each sample in different storage temperature and pH for 1 – 40 days were measured using a laser diffraction particle size analyzer (Beckman Coulter LS 13 320).

In agitating emulsifying, the droplet size was between 10 and 100  $\mu\text{m}$ , regardless of the fiber source, concentration, temperature or pH. Also, in most of samples, there was phase separation between the oil and fiber solutions within 3 days of storage. Additionally, in case of high-pressure homogenization using CMC, all samples were stable with mean droplet size around 1  $\mu\text{m}$ , even though some of them had creaming. By contrast, in pectin-stabilized samples, although they had a peak on 1  $\mu\text{m}$  on the first day, instability increased with time. Besides, regarding the initial pH of fiber solution, lower pH values caused more droplets coalescence.

In conclusion, in case of using fibers as emulsifier, very stable emulsion with mean droplet size of 1  $\mu\text{m}$  can be obtained by high-pressure homogenization, especially when stabilized by CMC. Also, more stable emulsions can be prepared in lower pH values.

## **Mitigating Ammonia Inhibition in Thermophilic Anaerobic Digestion by an Appropriate Irradiation Process**

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Anaerobic digestion is considered to be a promising process for generating biomethane, since both pollution control and energy recovery can be achieved by the process. However, even though ammonia is an essential nutrient for bacterial growth, at higher concentrations it acts as a strong inhibitor of methane production during anaerobic process.

In this study, for mitigating ammonia inhibition to improve the efficiency of anaerobic digestion, an appropriate irradiation process was developed. Although most conventional anaerobic digestors are operated under dark conditions, the use of fixed-bed anaerobic digestors operated under thermophilic light conditions has been studied. It has been reported that optimal illumination time of 60 minutes per day, on a thermophilic anaerobic reactor plays an important role in activating methanogens. There has been few studies on methane production through anaerobic digestion under illumination, especially regarding high ammonium concentration conditions. In this experiment, a series of batch anaerobic digestion experiments under 55°C were carried out. Using ammonium-rich synthetic medium (ammonium nitrogen concentration: 2211 mg/L) as the substrate, the bioreactors were illuminated at 60 minutes per day followed by treatment at dark conditions. A control operation was performed by using a synthetic medium without high ammonium concentration and were regularly illuminated 60 minutes per day and operated under dark condition respectively. The results showed that the bioreactors that were regularly illuminated 60 minutes per day in both groups achieved higher methane production and methane concentration after 15 days of fermentation. The ATP value of the corresponding bioreactors also demonstrated higher microorganism activity than that of dark conditions. This result indicated that optimum illumination time improved the activity of the methanogens even with high ammonium concentration. Therefore, irradiation proves to be an appropriate method in mitigating ammonia inhibition from anaerobic digestion.

## **ESD Programs that Leverages the Characteristic of an Integrated High School and International Collaborative School Network**

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Senior High School at Sakado, University of Tsukuba

### **Characteristic of an Integrated High School**

The educational goal of Senior High School at Sakado, University of Tsukuba (UTSS) is to provide students with a comprehensive general and specialized education so that they are able to be life-long learners who are able to adapt and continue making contributions in an ever-changing society. This goal is in line with the goals of education for sustainable development (ESD). Integrated high schools are notable for the fact that students choose elective subjects in consideration of their future career and social connections, and create and follow their own study plan. In addition, there are many established school subjects and flexible curriculums. Integrated curriculum high school can play an important role in advancing the ESD concept in both secondary and higher education.

### **Our International Collaborative ESD Programs**

Supported by University of Tsukuba Education Bureau of Laboratory School, we have invited some students and teachers of the high schools that had collaborative program with Senior High school at Sakado in every November since 2012. The purpose of inviting them is to share, discuss and act the ideas of solving environmental problems in each country from the students' point of view. This year, UTSS have High School Students' International ESD symposium, Super Global High School Project(Supported by Ministry of Education, Culture, Sports, Science and Technology), ESD Rice Project(Supported by Asia-pacific Cultural Center for UNESCO). We will report these international collaborative projects in this symposium.

The schools participating these programs are as follows:

- Center for Forestry Education and Training, Republic of Indonesia (Indonesia)
- Kasetsart University Laboratory School (Thailand)
- Kornita High School, Bogor Agricultural University (Indonesia)
- University of the Philippines Rural High School (the Philippines)
- Wattana Wittaya Academy (Thailand)
- Senior High School at Sakado, University of Tsukuba (Japan)

### **Contact us**

It would be a great pleasure if you could give us a lot of comments, reactions and suggestions for improving and making International collaborative ESD programs with each other, via email at:

tatemoto@sakado-s.tsukuba.ac.jp / takara@sakado-s.tsukuba.ac.jp

# **A Comparison of Kraft, Pre-hydrolysis-Kraft and Pre-hydrolysis Kraft by Addition of Anthraquinone and Polysulfide of *Acacia mearnsii***

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*Keywords: Kraft cooking, Pre-hydrolysis, Polysulfide, Anthraquinone, Pulp properties*

Kraft process is the most popular method in pulp and paper industry which is believed to obtain an ideal pulp yield and stronger pulp properties when compares with other cooking processes. Kraft cooking maintains an effective sulfidity which is also important for the fiber properties. On the other hand, increasing pulp yield is highly desirable. Addition of polysulfide (PS) and anthraquinone (AQ) to the kraft process is well known as an effective method to increase the pulp yields. Hence, this research has focused on minimizing the degradation of carbohydrates during pre-hydrolysis (PH) kraft cooking and improving the pulp yield, and on getting better fiber properties by modifying cooking conditions with addition of PS and AQ into kraft cooking process.

In this study, the most effective cooking conditions of polysulfide (PS), anthraquinone (AQ) and pre-hydrolysis were investigated in order to improve pulp yield and properties. The kappa numbers and pulp yields of conventional kraft pulps were compared under different cooking conditions. Then, the four points which give the highest and lowest points of pulp yields at certain points of kappa numbers were selected for analyzing pulp properties. Lorentzen-Wettré fiber tester was used to test the fiber properties. In addition, carbohydrate composition and hexenuronic acid (HexA) content were determined for each pulp.

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(As of Oct.1, 2014)

- 筑波アジア農業教育セミナー及び  
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## 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・太平洋州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。

2013年は、「農学ESDにおける大学の役割」をテーマに第6回目のシンポジウム（Ag-ESD Symposium 2013）を開催し、11月25日から29日までの間に7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、ケニア及び日本）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 2014 ( Ag-ESD Symposium 2014 ) の概要

1. 題 目  
「農業・食料・食品のプレミアム化」  
(Premium Agriculture and Food Project)  
〔 APEID 計画統一テーマ：「世界的なESD実践プログラムに向けて」  
( Ag-ESD Symposium for Global Action Program ) 〕
2. 期 間  
平成26年11月10日(月)～11月14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、  
(独) 国際協力機構筑波国際センター (JICA 筑波)  
(独) 国際農林水産業研究センター (JIRCAS)
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
  - ・ バルク大学 (アフガニスタン)、プトラ大学 (マレーシア) 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2014 (Ag-ESD Symposium 2014) の日程表

月 日	時 間	プ ロ グ ラ ム
11月09日(日)		招聘外国人の成田空港到着・宿泊 <span style="float: right;">[ 成田のホテル ]</span>
11月10日(月)	08:30~10:00 10:30~12:00 12:00~13:00 13:15~13:30 13:30~14:00 14:00~14:15 14:15~15:15 15:15~16:15 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(1)・・・集合写真 開会式 記念写真撮影(2)・・・中庭側の外階段での撮影 基調講演 <b>【FAO】</b> 受付・オリエンテーション(概要説明) 歓迎パーティ <span style="float: right;">[ 本館棟1Fレストラン ]</span>
11月11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 15:20~16:00 16:00~16:10 16:10~16:50 16:50~17:30	講演 <b>【筑波大学農林技術センター】</b> 招待講演(1) <b>【筑波大学】</b> 招待講演(2) <b>【茨城大学】</b> 休憩・昼食 学生との対話(「専門語学I」に対応) <span style="float: right;">[ 大学会館ホール ]</span> 休憩 招待講演(3) <b>【ボゴール農科大学】</b> 招待講演(4) <b>【カセサート大学】</b> 招待講演(5) <b>【フィリピン大学ロスバニオス校】</b> 休憩 招待講演(6) <b>【バルク大学】</b> 招待講演(7) <b>【プトラ大学】</b> <span style="float: right;">[ 大学会館特別会議室 ]</span>
11月12日(水)	09:00~09:40 09:40~10:20 10:20~11:00 11:00~11:30 11:30~ 16:30~18:30	招待講演(8) <b>【ユタ州立大学】</b> 招待講演(9) <b>【SRDコース修了生1】</b> 招待講演(10) <b>【SRDコース修了生2】</b> <span style="float: right;">[ 大学会館特別会議室 ]</span> 展示ポスター視察(ポスター・ビューイング) <span style="float: right;">[ 総合交流会館多目的ホール ]</span> 移動(マイクロバス) *浅草へ 昼食 エクスカージョン 移動(マイクロバス) *大学会館別館へ
11月13日(木)	09:00~13:30 13:30~15:00 15:00~	ポスター発表(昼食時間含む) <span style="float: right;">[ 総合交流会館多目的ホール ]</span> 坂戸高校海外活動報告 優秀ポスター賞等表彰式 <span style="float: right;">[ 大学会館特別会議室 ]</span>
11月14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) <b>【茨城大学】</b> 発表(2) <b>【ボゴール農科大学】</b> 発表(3) <b>【カセサート大学】</b> 休憩 <span style="float: right;">[ 大学会館特別会議室 ]</span> 発表(4) <b>【フィリピン大学ロスバニオス校】</b> 発表(5) <b>【筑波大学】</b> 昼食・休憩 閉会式(優秀発表賞等表彰式を含む) <span style="float: right;">[ 大学会館特別会議室 ]</span> フリータイム 送別パーティ <span style="float: right;">[ スープファクトリー ]</span>
11月15日(土)	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 シンポジウム 2014

平成26年  
11月10日(月)～11月14日(金)

農業・食料・食品のプレミアム化

APEID計画統一テーマ：世界的なESD実践プログラムに向けて

- 主催 筑波大学農林技術センター
- 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  
(独)国際協力機構筑波国際センター (JICA筑波)  
(独)国際農林水産業研究センター (JIRCAS)
- 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
- 会場 筑波大学 大学会館 (特別会議室ほか)

国際農学ESDシンポジウム組織委員会

発行者：筑波大学農林技術センター

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