2.5 DIVISION OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY

The division of Environmental Science and Technology currently numbers 7chairs and 16 laboratories, i.e. Chair of Comparative Agricultural Science which is researching on the regions from international viewpoints (Lab. of Comparative Agricultural Science), Chair of Bio-environmental Science which is based on the forest and biomaterial science (Lab. of Forest Ecology, Lab. of Forest Hydrology and Lab. of Forest Biochemistry), Chair of Agro-ecosystem Science which is based on bio-ecology and bioscience (Lab. of Tropical Agriculture, Lab. of Soil Science. Lab. of Environmental Mycoscience and Lab. of Ecological Information), Chair of Environmental development Engineering which aims engineering improvement of rural production site (Lab. of Agricultural Facilities Engineering and Lab. of Water Resources Engineering), Chair of Land and Water Resources Management which aims physical and social improvement of rural area (Lab. of Irrigation, Drainage and Hydrological Environmental Engineering, and Lab. of Rural Planning), Chair of Bioproduction Engineering which aims creation and application of various engineering techniques in fields (Lab. of Agricultural Systems Engineering, Lab. of Field Robotics and Lab. of Agricultural Process Technology), and Chair of Nuclear Science and Engineering (Research Reactor Institute) which aims application of radiation science to environmental science (Lab. of Radiation Safety Control).

This division has a large Graduate program with 150 students enrolled: (104 in the Master's Program including 3 foreign student and 46 in the Doctor's Program including 5 foreign students) in this year. This division welcomed three new professors: Dr. Kawashima (Lab. of Irrigation, Ddrainage and Hydrologiacal Environment Engineering) , Dr. Kondoh (Lab. of Agricultural Process Technology), and Dr. Hirai (Lab. of Comparative Agricultural Science), in July, September, and October in 2007, respectively.

Chair of Comparative Agricultural Science

2.5.1 Laboratory of Comparative Agricultural Science

Staff *Professor* : *Hirai, Nobuhiro, Dr. Agric. Sci.*
Associate Professor: Akamatsu, Miki, Dr. Agric.Sci.
Tanaka, Ueru, Dr. Agric. Sci. (Graduate School of Global Environmental Studies)
Miyake, Takeshi, Dr. Agric. Sci.
Assistant Professor : Morita, Katsuko
Students and research fellows
Doctor's program : (1)
Master's program : (4)

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Chemical ecology of plants

Some ectomicorrhiza form a fairy ring which shows the cyclic formation of fruit body. The inside of the fairy ring of *Tricholoma* is a whitish mycelium-soil aggregated zone, and called "shiro". The density of bacteria and fungi in the shiro is significantly lower than that of the outside of the shiro. The researchers of our University demonstrated in 1967 that the shiro had antimicrobial activity against bacteria. However, the antimicrobial compound(s) has been remained unclear. We have isolated an antimicrobial compound from the extract of *P. pinidensiflorae* roots forming ectomicorrhiza, and identified it as a diterpene, totarol. Totarol was not contained in the leaves and barks, suggesting that totarol is specifically formed in he ectomicorrhiza to protects it from bacteria.

b) Molecular technology of a plant hormone, abscisic acid

Abscisic acid (ABA) is an important plant hormone that induces adaptative responses in plants upon water stress and low temperature. However, the effect of ABA does not last since ABA is quickly inactivated by the degradating enzyme, ABA 8'-hydroxylase. The inhibitor of the hydroxylase may delay the inactivation of ABA to increase resistance of plants to environmental stress. We have developed a new hydroxylase inhibitor AHI 1 based on the substrate specificity of the hydroxylase with the researchers at Shizuoka University. A test of AHI 1 for water stress tolerence of apple trees was carried out by the researchers at Chiba University, and AHI 1 gave a water stress tolerence to apple trees as well as the known inhitbitor uniconazole-P. The endogenous level of ABA was higher than that of control trees. Development of the hydroxylase inhibitors with high specificity are under progress.

c) Permeation of various compounds across artificial membranes and prediction of permeability across monolayers of human intestinal epithelial (Caco-2) cells

It is important to examine transport of various chemicals across the intestinal epithelium from the point of view of not only the development of orally bioavailable therapeutic agents but also prediction of human exposure to hydrophobic compounds such as pesticides. In this year,

using the new statistical (Quantitative Structure-Activity Relationship: QSAR) model for prediction of the artificial membrane permeability poroposed by us last year the Caco-2 cell permeability and human oral absorption were well predicted. In addition, BCF (Bioconcentration Factor) was predicted based on the accumulation index evaluated by artificial membrane permeation experiments. (Akamatsu)

d) Mechanism of substrate recognition by P-glycoproteins (P-gp: ATP-dependent efflux pump)

P-gp is one of ABC transporters and acts as an efflux pump with broad substrate specificity. To clarify the substrate recognition mechanism by P-gp based on QSAR analyses, screenig of various pesticides as P-gp susbstrates was carried out. As a result, it was shown that several pesticides were recognized as substrates of P-gp. (Akamatsu)

e) Mechanism of substrate recognition by cytochrome p450s (Enzymes involved in metabolism)

Human cytochrome p450s (CYPs) are primarily membrane-associated proteins, located either in the inner membrane of mitochondria or in the endoplasmic reticulum of cells. CYPs metabolise thousands of endogenous and exogenous compounds. Most CYPs can metabolize multiple substrates, and many can catalyze multiple reactions. To clarify the substrate recognition mechanism by CYPs based on QSAR analyses, firstly one kind of pesticides was used and an interesting result was obtained. (Akamatsu)

f) Analysis of pesticide residues in environment around the suburban agricultural fields of Bangkok

Used pesticides were surveyed at the suburban agricultural fields of Bangkok, Thailand, to know whether pesticides are used safely and appropriately. In 2003 and 2004, river bottom and field soils around the area were sampled and pesticide residues in the samples were analyzed. A few pesticides were detected in several samples although the amount was small. In this year, we focused an insecticide, abamectin which is highly toxic but used at a large amount in Thailand. The residue analysis of abamectin in several Thailand soils was done. The degradation of abamectin was also investigated using Thailand soils. (Akamatsu, Tanaka)

g) Studies on soil management systems and socio-ecological resilience in Semi-arid Africa (Niger, Burkina Faso and Zambia):

Field studies were conducted in the Sahel region of West Africa to elucidate the characteristics of ecosystems, soils, local husbandry systems which lead approaches to ecologically sound land use systems, prevention of desertification and restoration of degraded lands. This year, system of risk management inheritaed in the local husbandry systems was analyzed through the researches on peoples' action to mitigate the danmages caused by drought during the "years of crisis" in the past 20 years. In Zambia, southern Africa, mechanisms of "resilliance" at household and landuse levels were studied. (Tanaka)

h) Studies on rural development, environmental conservation and disaster management at human scale (Viet Nam)

Field studies were conducted in some villages of Central Viet Nam, where natural disaster frequently hits. Agro-ecological characteristics and local husbandry systems were described in order to design research/development project for participatory rural development, environmental conservation and disaster management. This year, the resilience of the community was evaluated through the utilizeation of local food resources and the food sufficiency. (Tanaka)

i) Agrio-ecological characteristics in Bhutan

Field study was conducted on agricultural landscape, landuse and soil conservation in

Bhutan (Tanaka)

j) Genetic diversity and utilization of genetic resources of farm animals

We have identified several responsible genes for the beef marbling of Wagyu (Japanese beef cattle). A significant influence of the alleles on the beef marbling was clarified by using the field records collected from Ohita Prefecture and Nippon Ham meats company. A new multiple QTL (Quantitative Trait Loci) mapping method using multiple Wagyu half-sib families was applied to detect the presence of QTLs in Ohita Prefecture, and several QTLs and interactions among QTLs were detected. Moreover, the heritabilities of Superficial Digital Flexor Tendon in Thoroughbred racehorse was clarified about 0.2. (Miyake)

A-2. Publications and presentations

a) Publications

Books

Hirai, N.: Abscisic Acid, In: Natural Product Chemistry-Plants (Eds. Yamamura, S. and Hasegawa, K.), IPC, pp. 26-34, 2007 (in Japanese)

Miyake, T.: Estimation of random effects and BLUP method (Eds. Sasaki, Y.). Chapt. 7 and 11-8, Kyoto Univ. Sci. Public., Kyoto, 2007

Original papers

Kamo, T., Endo, M., Sato, M., Kasahara, R., Yamaya, H., Hiradate, S., Fujii, Y., Hirai, N., and Hirota. M.: Limited distribution of natural cyanamide in higher plants: occurrence in *Vicia villosa* subsp. varia, *V. cracca*, and *Robinia pseudo-acacia*. Phytochemistry, 69; 1166-1172, 2007

Hattori, Y., Horikawa, K., Makabe, H., Hirai, N., Hirota M., and Kamo, T.: A refined method for determining the absolute configuration of the 3-hydroxy-3-methylglutaryl group. Tetrahedron Asym. 18; 1183-1186, 2007

Shimomura, H., Etoh, H., Mizutani, M., Hirai, N. and Todoroki, Y.: Effect of the minor ABA metabolite 7'-hydroxy-ABA on Arabidopsis ABA 8'-hydroxylase CYP707A3. Bioorg. Med. Chem. Lett., 17; 4977-81, 2007

Fujikawa, M., Nakao, K., Shimizu, R., and Akamatsu, M.: QSAR study on permeability of hydrophobic compounds with artificial membranes. Bioorg. Med. Chem., 15; 3756-3767, 2007

Tomita, K., Oishi, S., Cluzeau, J., Ohno, H., Navenot, J.-M., Wang, Z., Peiper, S.C., Akamatsu, M., and Fujii, N.: SAR and QSAR studies on the N-terminally acylated pentapeptide agonists for GPR54. J. Med. Chem., 50; 3222-3228, 2007

Iizuka, A., Le Van An and U. Tanaka: Participatory rural development for susatinable livelihoods in cebtral Vietnam., SANSAI - An Environmental Journal for the Global Community -, No. 3, 77-102, 2008

Oki, H., R. Kusunose, H. Nakaoka, A. Nishiura, T. Miyake and T. Sasak: Estimation of heritability and genetic correlation for behavioural responsesby Gibbs sampling in the Thoroughbred racehorse. J. Anim. Breed. Genet., 124, 185-191, 2007

Nakaoka, H., A. Narita, T. Ibi, T. Miyake, Y. Sasae and Y. Sasaki: Effectiveness of adjusting for heterogeneity of variance in genetic evaluation ofJapanese Black cattle. J. Anim. Sci., 85, 2429-2436, 2007

Reviews

Hirai, N.: Thinking of the late Dr. Kazuhiko Ohkuma, Shokubutu no Seicho-Chousetsu, 42 (1), 107-108, 2007 (in Japanese)

Reports

Hirai, N: Development of drugs for protecting plants from environmental stresses in the semi-arid land. Report (2006) for Monbu-kagakusho Research Grant [Scientific Research (B)]

Tobita, S., Shinjo, H., Hayashi, K., Matsunaga, R., Miura, R., Tanaka, U., Abdoulaye, T. and Ito O. 2007 : Identification of plant genetic resources with high potential contribution to the soil fertility enhancement in the Sahel -with special interest in fallow vegetation-, Proceedings for Innovations as Key to the Green Revolution in Africa-Exploring the Scientific Facts, 17th-21st September, Arusha, Tanzania

Ikazaki, K., Shinjo, H., Tanaka, U. and Kosaki, T. 2007 : Development of a new sediment catcher to evaluate the effect of wind erosion on carbon dynamics in the Sahel, West Africa. Proceedings for International Symposium on Organic Matter Dynamics in Agro-Ecosystems, July 16-19, Poitiers, France

Hayashi, K., Abdoulaye, T., Matsunaga, R., Shinjo, H., Tanaka, U., Tobita, S. and Tabo, R. 2007 : Sustainable management of soil organic matter for agricultural land in the Sahel, West Africa. Proceedings for 5th of the European Society for Soil Conservation, June 25-30, Parelmo, Italy

Shinjo, H., Noro, Y., Miyazaki, H. and Tanaka, U. 2007: Spatial characteristics of soil properties in Miombo woodland in Eastern Province, Zambia – towards the rational experimental design for the ecological resilience study -. Vulnerability and Resilience of Social-Ecological Systems, FY2006 PR Project Report, 10-16, RIHN

Yamasaki, K., Nguyewn, T. C. and Tanaka, U. 2007: Evaluation of wild plants utilization in choice of food materials surveyed in Pa Rinh village, A Luoi district, Central Vietnam. GSGES Report 2006, 34-41, Kyoto University

Yamasaki, K., Nguyewn, T. C. and Tanaka, U. 2007: Characteristics and use of food resources surveyed in Pa Rinh village, A Luoi district, Central Vietnam. GSGES Report 2006, 42-50, Kyoto University

b) Conference and seminar papers presented

The 2008 Annual Meeting of the Japan Society for Bioscience, Biotechnology, and Agrochemistry (Nagoya): 2 reports

2008 Meeting of Chemistry and Biology (Kyoto): 1 report

The 42th Annual Meeting of Japanese Society for Chemical Regulation of Plants (Shizuoka): 2 reports

The 35th Symposium on Structure-Activity Relationships: 1 report

2007 meeting of Japanese Society of International Rural Development: 3 reports

2007 meeting of Japanese Society of Soil Science and Plant Nutrition: 2 reports

Japanese Society of Animal Breeding and Genetics: 1 reports

Japanese Society of Animal Science: 2 reports

A-3. Off-campus activities

Membership in academic societies

Hirai, N.: Japanese Society for Chemical Regulation of Plants (head of general secretary), Japan

Society for Bioscience, Biotechnology, and Agrochemistry (councilor of the Kansai Branch, and editor of the English journal)

Akamatsu, M.: Pesticide Science Society of Japan (Board member), Division of Structure-Activity Studies, the Pharmaceutical Society of Japan (Board member)

Tanaka U.: Japanese Society of International Rural Development (Editorial board member)

Miyake, T.: Japanese Society of Animal Science, Japanese Society of Animal Breeding and Genetics (Member of organizing committee of new animal breeding seminar), Society of Beef Cattle Science (Secretary)

Research grant

Hirai, N.: Monbukagakusyo Research Grant, Scientific Research (B): Development of drugs for protecting plants from environmental stresses in the semi-arid land (Hirai, Head)

Akamatsu, M.: Monbukagakusyo Research Grant, Research (B): Pesticide behavior and monitoring system in environment around the suburban agricultural fields in tropical areas (Akamatsu, Head)

A-4. International cooperations and overseas activities

International meetings (roles)

Hirai, N.: 19th International Congress on Plant Growth Substances Association (Puerto Vallarta, Mexico, 3 general papers)

Akamatsu, M.: 1st China-Japan Joint Workshop on Crop Health Chemistry, Shanghai, China (lecture)

Memberships in international academic societies

Hirai, N.: International Plant Growth Substances Association (member)

Akamatsu, M.: American Chemical Society

Tanaka, U: International Society of Soil Science

Miyake, T.: American Society of Animal Science

International joint researches, overseas research surveys

Akamatsu, M.: Pesticide residue analysis in environment around the suburban agricultural fields of Bangkok (Bangkok, Thailand)

Tanaka, U.: Development of soil fertility management in Semi-arid tropical Africa (Niger), Studies on rural development, Environmental conservation and disaster management at human scale in central Viet Nam (Viet Nam), GSGES Asia Platform Project (Viet Nam), Scoio-ecological resillriance (Zambia), Agro-ecological study in Bhutan (Bhutan)

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses Given

Undergraduate level: Scientific English (Agriculture) (Akamatsu, Tanaka), Japan-Korea HR (Akamatsu), Discovery and Development of New Drugs (Department of Pharmaceutical Sciences (share, Akamatsu), Information Processing Basics (Agriculture) (Miyake), Biometrics Practice (Miyake)

Graduate level: Comparative Study of Resources and Environment (Akamatsu, Miyake), Comparative Agricultural Science (Tanaka), Agriculture and Environment in Japan (Akamatsu, Tanaka, Miyake)

B-2. Off-campus teaching, etc

Part-time lecturer

Hirai, N.: Graduate School of Life and Environmental Sciences, Osaka Prefectrual University (Applied Life Sciences)

C. Other Remarks.

Hirai, N.: The Human Rights Committee of Kyoto University (member), Plant Research Foundation (director and councilor), Coordination of the beer project of Kyoto University and Waseda Univeristy, Coordination of researchg meetings between the University researchers and Company researchers.

Akamatsu, M.: Member of committee of the Faculty level: Committee of International academic exchange, Member of committee of Junior campus; The Ministry of Agriculture, Forestry, and Fisheries of Japan, tentative member of Councils of agricultural materials, pesticide division; National Institute of Technology and Evaluation, Japan, member of committee of quantitatitive structure-activity relationships; The Ministry of Economy, Trade and Industry, tentative member of Councils of chemicals.

Tanaka, U.: Member of committee of the Faculty level: Committee of International academic exchange; Committee of KUINEP; Global Environmental Forum (member of advisory committee)

Miyake, T.: Member of committee of the Faculty level: Committee of Technical Section of Information System in Graduate School of Agriculture; Technical Committee of Information Education in Kyoto University

Chair of Bio-environmental Science

2.5.2 Laboratory of Forest Ecology

Staff *Professor : Takeda, Hiroshi, Dr. Agri.*
Lecturer : Osawa, Naoya, Dr. Agri.
Instructor: Osono,Takashi, Dr. Agri.

Students and research fellows:

JSPS Research Fellow: (2) (DC: 2)	*Research Fellow : (1)*
Doctor's program : (5)	*Master's program : (5)*
Undergraduate : (2)	

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Decomposition process of leaf litter in forest ecosystems

Decomposition process of leaf litter has been studied at a cool temperate forest in Ashu and a pine plantation in Kamigamo, both at Experimental Forest, and Mt. Tanakami, Shiga, mainly

focused on the interaction among leaf litter, decomposer-microorganisms, and soil.

b) Fine root dynamics and the role of soil animals in a forest soil

Fine root dynamics at a forest ecosystem is studied at Kamigamo Experiment Station, Japan, and evergreen forest, Thailand. The manipulated experiments for the analysis of community structure and the function of soil animal are mainly perfomed at Kamigamo Experiment Station, and that for the fine root dynamics are mainly done at evergreen forest, Thailand.

c) Module Dynamics of Forest trees

Forest trees are characterized by their foraging behaviors for capturing the nutrients and light. Foraging behavior of trees has been studied through the population dynamics of modules, such as buds, current shoots, and leaves. The knowledge of module dynamics is important for the understandings of plant community.

d) Community structure of insect community and the role of herbivore in forest ecosystem

We are performing our research to clarify the impact of herbivorous insects on the community structure and its dynamic of the forests in Ashu and Tanakami experimental station, from a view point of the seasonal and spatial variation of plant quality and plant growth.

e) Impacts on ground arthropod community by artificial logging

Arthropod community at the Kamigamo Experiment station has been studied to clarify to clarify the impact of logging on forest ecosystem since July 1999.

A-2. Publications and presentations

a) Publication

Books

Osono, T., Takeda, H. (2006) The role of decomposition at forest ecosystem. In: Takeda T. Urabe J. eds. Enrironment and Ecosystem: Perspectives at Terrestrial Ecosystem. Kyouritsu Publishing LTD, Tokyo, pp96-119 (In Japanses).

Original papers

Hirose, D., Osono, T. (2006) Development and seasonal variations of *Lophodermium* populations on *Pinus thunbergii* needle litter. *Mycoscience* **47**: 242-247.

Hishi, T., Tateno, R., Takeda, H. (2006) Anatomical characteristics of individual roots within the fine root architecture of *Chamaecyparis obtusa* (Sieb. et Zucc.) in organic and mineral soil layers. *Ecological Research* **21**: 754-758

Mizumachi, E., Mori, A., Osawa, N., Akiyama, R., Tokuchi, N. (2006) Shoot development and extension of *Quercus serrata* saplings in responses to insect damages and nutrient conditions. *Annals of Botany* **98**: 219-226.

Mori, A.S., Mizumachi, E., Komiyama, A. (2007) Roles of disturbance and demographic non-equilibrium in species coexistence, inferred from 25-year dynamics of a late-successional old-growth subalpine forest. Forest *Ecology and Management* **241**: 74-83.

Mori, A., Osono, T., Iwasaki, S., Uchida, M., Kanda, H. (2006) Initial recruitment and establishment of vascular plants in relation to topographical variation in microsite conditions on a recently-deglaciated moraine in Ellesmere Island, high arctic Canada. *Polar Bioscience* **19**: 85-95.

Kameda, K., Koba, K., Hobara, S., Osono, T., Terai, M. (2006) Mechanism of long-term effects of cormorant-derived nitrogen in a lakeside forest. *Hydrobiologia* **567**: 69-86.

Osono, T. (2006) Role of phyllosphere fungi of forest trees in the development of decomposer fungal communities and decomposition processes of leaf litter. *Canadian Journal of Microbiology* **52**: 701-716.

Osono, T. (2007) Endophytic and epiphytic phyllosphere fungi of red-osier dogwood (*Cornus stolonifera*) in British Columbia. *Mycoscience* **48**: 47-52.

Osono, T., Hirose, D., Fujimaki, R. (2006) Fungal colonization as affected by litter depth and decomposition stage of needle litter. *Soil Biology & Biochemistry* **38**: 2743-2752.

Osono, T., Hobara, S., Koba, K., Kameda, K. (2006) Reduction of fungal growth and lignin decomposition in needle litter by avian excreta. *Soil Biology & Biochemistry* **38**: 1623-1630.

Osono, T., Hobara, S., Koba, K., Kameda, K., Takeda, H. (2006) Immobilization of avian excreta-derived nutrients and reduced lignin decomposition in needle and twig litter in a temperate coniferous forest. *Soil Biology & Biochemistry* **38**: 517-525.

Osono, T., Takeda, H. (2006) Fungal decomposition of Abies needle and Betula leaf litter. *Mycologia* **98**: 172-179.

Osono, T., Takeda, H. (2007) Microfungi associated with Abies needles and Betula leaf litter in a subalpine coniferous forest. *Canadian Journal of Microbiology* **53**: 1-7.

Sugiura, S., Yamazaki, K., Osono, T. (2006) Consequences of gall tissues as a food resource for a tortricid moth attacking cecidomyiid galls. *The Canadian Entomologist* **138**: 390-398.

Tuno, N., Takahashi, K.H., Yamashita, H., Osawa, N., Tanaka, C. (2006) Tolerance of *Drosophila* flies to ibotenic acid poisons in mushrooms. *Journal of Chemical Ecology* 33: 311-317.

b) Conference and seminar papers presented

The 117th annual meeting of Japan Forestry Society. (Tokyo Agricultual University, 2006, April). Number of presentations 3 (Osono et al.)

The 53th annual meeting of The Japan Ecological Society (Ehime University, 2007, March) Number of presentations 8 (Takeda et al.)

The 50th annual meeting of The Mycological Society of Japan. (The Chiba central Musium, 2006, June). Number of presentations 1 (Fukazawa)

The 57th annual meeting of Kansai Branch of Japanese Forestry Society (Wakayama convention Hall, 2006, October). Number of presentations 2 (Takeda et al.)

The 8th International Mycological Congress (Cairns Convention Centre, Cairns, Queensland, Australia, August 2006) Number of presentations 1 (Osono)

XXIX Symposium on Polar Biology (National Institute of Polar Research, Tokyo, November 2006) Number of presentations 1 (Osono)

6th International Symposium on Fungal Endophytes of Grasses (Chateau on the Park Hotel, Christchurch, New Zealand, March 2007) Number of presentations 1 (Osono)

A-3. Off-campus activities

Membership in academic societies (roles)

H. Takeda: The Society of Population Ecology (Editor), The Japanese society of Tropical Ecology (Commendatory member), The Japanese Society of Soil Animals (Councilor)

Research grants

Ministry of environment. Environmental studies on tropical carbon metabolism (Rep. co-researcher, H. Takeda).

Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture, Japan. Carbon input/output in tropics. (H. Takeda).

Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture, Japan. Studies on dispersal and colonization of pioneer fungus species in forest succession. (Rep. co-researcher, N. Osawa).

Grant-in-Aid for Scientific Research from the Ministry of Education, Science and Culture, Japan. Community studies on the interaction among insects and mushrooms. (Rep. co-researcher, N. Osawa).

Ministry of environment: Evaluation of biodiversity for rapid assessment (Rep. co-researcher, N. Osawa).

A-4. International cooperation and overseas activities

International joint researches, overseas research surveys

Takeda, H. : Decomposing process in tropical forests, JSPS ronpaku program, in Thailand.

B. Educational activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Practice of Forest Ecology (H. Takeda and N. Osawa), Seminar of Forest Ecology (H. Takeda and N. Osawa), Forest Ecology (H. Takeda), Community Ecology (N. Osawa), Practice of Forest Sciences II &III (N. Osawa and T. Osono). The Practice of Ecology (N. Osawa and T. Osono).

Graduate level: Practice of Forest Ecology (H. Takeda and N. Osawa), Seminar of Forest Ecology (H. Takeda and N. Osawa). Special Lecture of Coomunity Ecology (N. Osawa).

B-1. Off-campus teaching

Part-time Lecturer

H. Takeda: Undergraduate and Graduate Course, Kyoto Prefectural University (Lecture of Forest Ecology). Meijyo University (Forest Ecology).

2.5.3 Laboratory of Forest Hydrology

Staff *Professor* : *Tani, Makoto, Dr. Agric. Sci.*
Assistant Professor : *Kosugi, Yoshiko, Dr. Agric. Sci.*
Post Doctoral Fellow : *Itoh, Masayuki, Dr. Agric. Sci.*
Student and research fellows
Doctor's program : *(2)* *Master's program* : *(8)*
Undergraduate : *(4)*

A. Research activities (2007.4-2008.3)

a) Gas exchange between forest and the atmosphere

Our laboratory is conducting long-term observations on gas exchange processes between forest and the atmosphere using the eddy covariance method to evaluate the physical and physiological control by forest ecosystem. Our main fields are a Hinoki Cypress forest in Japan and a tropical rainforest in Malaysia. This year, our studies were conducted to assess the underestimation of nighttime CO_2 emission involved in an eddy covariance method by analyses of the storage and mass flow components in the CO_2 balance equation, to estimate detailed spatial distribution of ecosystem respiration from stem, branch and leaf, to apply a big-leaf model for the evaluation of evapotranspiration extensively to that of CO_2 exchange, and to detect suitable spectral vegetation indices for a large scale estimation of gas exchange processes.

b) Water quality and biogeochemistry

Detailed runoff processes and effects of their heterogeneities on biogeochemistry in forested catchments are studied to evaluate roles of forest in water and nutrient cycles. Biogeochemical processes on hillslope have been mainly studied to evaluate stream-water quality in small mountainous catchments, but our recent study also focuses on hydrological and biogeochemical processes in riparian and hyporheic zones within stream channel. This year, we evaluated effects of slope-topographic properties on runoff processes and elucidated a long-term hydrochemical characteristics in the weathered bedrock on hillslope. We also obtained findings on the dynamics of mercury in a forested catchment, and the nitrogen and phosphorus uptake in a stream channel.

c) Runoff control through forest management

Effects of geology, topography, soil and vegetation on rainfall-runoff responses are investigated from the forest management point of view. A dependency of storm runoff on water-storage characteristics within saturated and unsaturated zones in a soil layer was evaluated this year.

A-2. Publications and Presentations

a) Publications

Original papers

Kosugi, Y., Mitani, T., Itoh, M., Noguchi, S., Tani, M., Matsuo, N., Takanashi, S., Ohkubo, S., Abdul Rahim, N.: Spatial and temporal variation in soil respiration in a Southeast Asian tropical rainforest. Agricultural and Forest Meteorology 147, 35-47, 2007

Kosugi, Y., Takanashi, S., Ohkubo, S., Matsuo, N., Tani, M., Mitani, T., Tsutsumi, D, Abdul Rahim, N: CO_2 exchange of a tropical rainforest at Pasoh in Peninsular Malaysia. Agricultural

and Forest Meteorology 148, 439-452, 2008

Tani, M., Yamamoto, S., Leclerc, M.Y., Leuning, R.: Foreword for AsiaFlux Special Issue. Agricultural and Forest Meteorology 148, 697-699, 2008

Saigusa, N., Yamamoto, S., Hirata, R., Ohtani, Y, Ide, R., Asanuma, J., Gamo, M., Hirano, T., Kondo, H., Kosugi, Y., Li, S.G., Nakai, Y., Takagi, K., Tani. M., Wang, H.: Temporal and spatial variations in the seasonal patterns of CO2 flux in boreal, temperate, and tropical forests in East Asia. Agricultural and Forest Meteorology 148, 700-713, 2008

Hirata, R., Saigusa, N., Yamamoto, S., Ohtani, Y., Ide, R., Asanuma, J., Gamo, M., Hirano, T., Kondo, H., Kosugi, Y., Nakai, Y., Takagi, K., Tani, M., Wang, H.: Spatial distribution of carbon balance in forest ecosystems across East Asia. Agricultural and Forest Meteorology 148, 761-775, 2008

Nakaji, T, Ide R, Takagi K, Kosugi Y, Ohkubo S, Nishida K, Saigusa N, Oguma H : Utility of spectral vegetation indices for estimation of light conversion efficiency in coniferous forests in Japan Agricultural and Forest Meteorology 148, 776-787, 2008

Ohkubo, S., Kosugi, Y.: Amplitude and seasonality of storage fluxes for CO_2, heat and water vapor in a temperate Japanese cypress forest. Tellus B 60, 11-20, 2008

Itoh, M., N. Ohte, K. Koba, A. Sugimoto and M. Tani: Analysis of methane production pathways in a riparian wetland of a temperate forest catchment, using $\delta^{13}C$ of porewater CH_4 and CO_2. Journal of Geophysical Research; doi:10.1029/2007JG000647, 2008

Shimamura, T., K. Osaka, M. Itoh, N. Ohte and Y. Takemon: Spatial distribution of nitrate in a Mizoro-ga-ike, a pond with floating mat bog. Advances in Geosciences 6; 129-137, 2007

b) Conference and seminar papers presented

The 118th Annual Meeting of Japanese Forestry Society: 7 topics.

The Annual Meeting of Japan Society of Hydrology and Water Resources: 2 topics.

The 55th Annual Meeting of Japanese Ecological Society: 9 topic.

The 71th Annual Meeting of Japan Society of Limnology: 3 topic,

The 72th Annual Meeting of Japan Society of Limnology: 1 topic,

AsiaFlux Workshop 2007: 1 topic,

XXIV IUGG General Assembly: 2 topics

The annual Meeting of the Society of Agricultural Meteorology of Japan: 1 topic

Joint Meeting on Environmental Engineering in Agriculture: 1 topic,

The 53th Symposium on Wind Science: 1 topic

A-3. Off-campus activities

Membership in academic societies (roles)

Tani: Steering Committee member of AsiaFlux Network, and Vice president, Japan Scoiety of Hydrology & Water Resources.

Kosugi: Japan Society of Revegetation Technology (Secretary of Editorial Review Board), and AsiaFlux Network (Member of News Letter Editorial Board).

Research grant

Grants-in-Aid for Scientific Research (A): Prediction of flood and drought runoff from ungauged basins based on the development of bedrock-soil-vegetation-atmosphere continuum model (Tani, Head and Kosugi, member)

Global COE: In Search of Sustainable Humanosphere in Asia and Africa (Tani and Kosugi,

members)

Nippon Life Insurance Foundation: Quantitative evaluation of effects of long-term forest disturbances on water cycle degration

A-4. International cooperation and overseas activities

International joint researches, overseas research surveys

Tani, Kosugi and Itoh: Investigation on carbon balance in tropical rainforest (Malaysia).

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Basic Science for Forest and Biomaterials 3 (Tani), Forest and Biomaterials Sceince 3 (Tani), Forest Hydrology (Tani), Interaction of Forest and Environment (Kosugi, Tani), Laboratory Course in Forest and Biomaterials Science 3 (Tani, Kosugi), Laboratory Course in Physics of Forest and Biomaterials (Kosugi), Laboratory Course in Forest Hydrology and Erosion Control (Tani, Kosugi), Practice in University Forest 2 (Tani, Kosugi).

Graduate level: Special Lecture on Forest Hydrology (Tani), Seminar of Forest Hydrology (Tani), Special Laboratory Work in Forest Hydrology (Tani).

B-2. Off-campus teaching, etc.

Part-time lecturer

Tani: Faculty of Agriculture of Kyoto Prefectural University, Forest Training Institute, Forestry Agency

C. Other remarks.

Tani: Convener of the 53th Symposium on Wind Science

2.5.4 Laboratory of Forest Biochemistry

Staff *Professor* *: Azuma, Jun-ichi, D. Agric. Sci.*
Maitre de Conferences : Sakamoto, Masahiro, D. Agric. Sci.
Students and research fellows
Doctor's program : (2) *Master's program : (10)*
Undergraduates : (3) *JSPS Research Fellow : (1)*
Foreign undergraduate : (1)

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Biosynthsis and improvement of plant biomass constituents

Characterization of biosynthetic mechanism of biomass constituents is a key step for their better use. In this theme, biochemical and molecular biological approach is carried out for characterization of photosynthetic products and secondary metabolites in woody and monocotyledonous plants. In addition, enzymatic approach is carried out to give information about biosynthesis of cell-wall polysaccharides/glycoconjugates and elongation growth of monocot. For improvement of biomass production, a system of chloroplast DNA from bamboo and cotton, the very important non-woody biomass-plants, is also investigated. Especially whole genome system of chloroplast DNA of sea-island cotton which produces the longest fiber among cotton plants was characterized and its partial base sequences were found to be usable for identification of species name of cotton plants.

b) Structure and function relationships of biomass constituents and their biodegradation mechanism

Carbohydrates, which comprise more than 70% weight of cell-walls of higher plants, not only play various physiological functions but also are important for recycling of C on the earth. In this theme, characterization of interactions between cellulose and hemicellulose in the helical fibrous network of plant cell-wall was carried out to find out ways to produce biodegradable artificial woody materials and improve the physical properties of lignocelluloses. In addition, because of importance of cellulolytic enzymes in the ecosystem, biodegradation mechanisms of cellulose by termite-protozoa and termite-fungi symbiotic systems are also investigated.

c) Recycling of biomass and conversion of lignocellulosic materials to biofuel

Biomass plays a key role in recycling of organic matters on earth. Therefore, the behaviors of environmental aspects of biomass in ecosystem are very important problems. The object of this study is to develop new technologies which make recycling of biomass possible, utilization of lignocellulosic materials for production of bio-fuel, leading to attaining zero-emission.

In addition, microwave energy is used to develop comprehensive method for utilization of diverse woody, agricultural and food-waste biomass materials. Hydrothermal effects of microwave on diverse biomass materials are mainly studied under high temperature and high pressure as well as low temperature and low pressure.

A-2. Publications and presentations

a) Publications

Books and reviews

Sakamoto, M.: What is bamboo ? ~ Which gene characterize bamboo ? ~ (No.1), Take (Bamboo) vol.98, Japan Bamboo Society, 2007

Sakamoto, M.: What is bamboo ? ~ Which gene characterize bamboo ? ~ (No.2), Take (Bamboo) vol.99, Japan Bamboo Society, 2007

Sakamoto, M.: What is bamboo ? ~ Which gene characterize bamboo ? ~ (No.3), Take (Bamboo) vol.101, Japan Bamboo Society, 2007

Azuma, J.: Techniques for conversion of wood to ethanol, *Agric. and Techn.*, 73(12), 93-98、2007

Azuma, J.: Degradation of wood by dry-wood termites and development of anti-termite reagents by using inhibitors for carbohydrate degrading enzymes, 71th Symposium of Sustainable Humanosphere, DOL/LSF Cooperative Research Symposium, Research Institute for Sustainable Humanosphere, Kyoto University, Feb.25, 2008

Original papers

Delage, L., Giegé, P., Sakamoto, M. and Maréchal-Drouard, L.: Four paralogues of RPL12 are differentially associated to ribosome in plant mitochondria. *Biochimie* , **89** (2007) 658-668

Osono, T., Takeda, H. and Azuma, J. : Carbon isotope dynamics during leaf litter decomposition with reference to lignin fractions. *Ecol.Res.,* **23**, 51-55, 2008

R. I. Hag Ibrahim, Azuma, J. and Sakamoto, M. : LA-PCR-RFLP analysis of the whole chloroplast DNA from three cultivated species if cotton (*Gossypium* L.) *Euphytica* , **156** (2007) 47-56

Yudianti, R., Indrarti, L., Azuma, J. and Sakamoto, M., Tsunoda, K. and Tsuyoshi, Y. : Digestibility of cellulosic hydrocolloid by termite *Coptotermes formosanus* Shiraki (Isoptera: Rhinotermitidae): Proceedings of The Fifth Conference of the Pacific-Rim Termite Group, Bali, Indonesia, 113-117, 2008

Yudianti, R., Indrarti, L. and Azuma, J.: Structure and physical properties of natural gellous materials, *J. Appl. Sci.*, **7**(4), 580-584, 2007

Yudianti, R., Indrarti, L., Karina, M., Sakamoto, M. and Azuma, J.: Chemical compositions of hydrocolloids produced from nutlets of Salvias, *J. Trop. Wood Sci. Technol.*, **5**(1), 12-16, 2007

b) Conference and seminar papers presented

International Conference and Seminars:

Sakamoto, M: International Congress on Plant Mitochondrial Biology, ICPMB2007, Nara, June 25-29, 2007 (1 paper in English) (Sakamoto, M. et al.)

Azuma, J.: The Fifth Conference of the Pacific-Rim Termite Group, Bali, Indonesia, 113-117, 2008 (1 paper in English) (Azuma, J. et al.)

Domestic Annual Meeting:

25th Annual Meeting of the Japanese Society for Plant Cell and Molecular Biology (3 papers in Japanese): (Sakamoto, M. et al.)

57th Annual Meeting of the Molecular Biology Society of Japan (1 papers in Japanese): (Sakamoto, M. et al.)

57th Annual Meeting of the Japan Wood Research Society (6 papers in Japanese): (Azuma, J. et al.; Sakamoto, M. et al.)

Annual Meeting of the The Japan Society for Bioscience, Biotechnology, and Agrochemistry (4

papers in Japanese): (Azuma, J. et al., Sakamoto, M. et al.)

3rd Meeting of the Utilization of Microorganisms (Wakayama Techno): (Azuma, J.)

Symposium for Utilization of Waste Materials in Heisei 19 (Research Foundation for Waste Materials): (Azuma, J.)

The First Symposium of Japan Society of Electromagnetic Wave Energy Applications (1 paper in English): (Azuma, J. et al.)

A-3. Off-campus activities

Membership in academic societies (roles)

Azuma, J.: The Japan Society for Bioscience, Biotechnology, and Agrochemistry (Councilor of the Kansai Branch)

The Japan Society for Carbohydrate Research (Councilor)

Japan Radioisotope Association (Councilor of Life Science Division)

Azuma, J.: Councilor of NPO 'Society of Maintenance of Earth Environment by Recycling'.

Research grants:

Monbusho Research Grant:

Cooperative Basic Research (B) Utilization of Gellous Biomass Containing Cellulose (Main, Azuma, J., cooperative, Sakamoto, M.)

NEDO Research Grant: High Efficient Conversion Technology of Biomass Energy (Cooperative, Sakamoto, M.)

Cooperative Research Grant between University and Others:

Recycling use of waste biomass, Wakayama, 2007 (Main, Azuma, J.).

Innovation Project for Functional Polysaccharides of Marin Products, 2007 (cooperative, Azuma, J.).

A-4. International cooperations and overseas activities

International meetings (roles)

Sakamoto, M.: International Congress on Plant Mitochondrial Biology ICPMB2007, Organizing Committee.

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Laboratory course in the basic forest and biomaterials chemistry, (Azuma, J., Sakamoto, M.), Laboratory course in the biomaterials chemistry I (Azuma, J., Sakamoto, M.), Laboratory course in the biomaterials science II (Sakamoto, M.), Basic Science for Forestry II (Azuma, J., Sakamoto, M.), Forest biochemistry I (Azuma, J., Sakamoto, M.), Forest biochemistry II (Sakamoto, M., Azuma, J.), Seminar in forest and biomaterials science (Azuma, J., Sakamoto, M.), Forest analytical science (Azuma, J.), Basic Science for Agriculture (Azuma, J.)

Graduate level: Laboratory Course in Forest Biochemistry (Azuma, J., Sakamoto, M.), Seminars in Forest Biochemistry (Azuma, J., Sakamoto, M.), Special lecture on Forest Biochemistry (Azuma, J.)

B-2. Off-campus teaching, etc.

Part-time lecturer

Sakamoto, M.: Faculty of Human Life and Science of Doshisha Woemen's Coulege of Liberal Arts.
Azuma, Z.: Graduate School of Agriculture, Ryukyu University

C. Other remarks

Micellaneous

University level

Azuma, J.: Member of Committee of University Students, Kyoto University, Member of Committee of Safe Committee for Radioisotopes and Radiation, Kyoto University Radioisotopes and Radiation

Azuma, J.: Member of Committee of Chemistry for University Students, Kyoto University, Member of Committee for Education System of Chemistry of Kyoto University

Azuma, J.: Member of Consolidating Committee for Atomic Force of Kyoto University

Faculty level

Azuma J.: Member of Safeguard Committee of Faculty of Agriculture for Radioisotopes and Radiation

Sakamoto, M.: Member of Transaction of Inorganic Waist Liquor.

Chair of Agro-ecosystem Science

2.5.5 Laboratory of Tropical Agriculture

Staff *Professor* *: Nawata, Eiji, D. Agric. Sci.*
Associate Professor: Higuchi, Hirokazu, D. Agric. Sci.

Students and research fellows

Doctor's program : (4) *Master's program : (6)*
Undergraduates : (4) *Research fellow : (4)*

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Bio-resources, farming and cropping systems and sustainability in Mainland Southeast Asia

In northeast Thailand and middle south Laos, field surveys on traditional plant utilization of Phuthai, an ethnic minority in these areas, and other ethnicities, were practiced and clarified differences in the species used and construction of homegardens among ethnicities and regions.

b) Evaluation of agricultural resources and sustainability in upland crop areas, developed on a large scale, in the tropics

In Central Thailand, studies on the diversity of farming and cropping systems were carried out, and GIS maps of cropping systems in this area were constructed. Interview surveys to local farmers clarified the recent dynamics of farming systems in this area. In slope lands in north

Thailand, sampling of river water was continued and seasonal and annual changes in phosphorus contents were analyzed.

c) Distribution and dissemination of tropical crops

A field survey in the Batanes Islands, the Philippines, and isozyme analyses on the distribution and utilization of indigenous *Capsicum frutescens* varieties, revealed that genotypes showing special zymogram patterns observed only in Indonesia and Japan were also distributed in Batanes and Taiwan.

d) Evaluation of crop tolerance to environmental stresses

A series of experiments on effects of partial heat stress in maize in a controlled environment clarified that heat stress in one leaf accelerated the system to mitigate the stress in the other leaves. It is revealed that heat stress to flowers and fruits affected chilli pepper fruit and seed development independently from the effect of heat stress to the whole plant.

e) Agro-ecological physiology of tropical fruit trees

On durian, a large tropical fruit tree, its magnitude has become to a trouble thing during in orchard management. A cut-back pruning of main trunk and thinning of lateral branches were tried on durian trees grown in eastern part of Thailand, to estimate the improvement of light condition, matter production efficiency, canopy position to sunlight exposure.

To the solution of fruit disorder of mangosteen, which is a serious problem annoying producers, soil water content, transpiration rates, inorganic plant nutrient contents, development of root system were monitored. The results indicated the fruit disorder related to shortage of Ca, soil pH, moisture, development of root system, water stress.

Post-harvest physiology study of passionfruit was continued. Some of this fruit contain high acidity, which disturbs an increase of the consumption. A dropped fruit from 90 cm height showed high acid content even after ripened. While, a dropped and cracked fruit did not show high acidity with normal process of after-ripening.

Evolutionary old annona species have primitive system of floral biology. Insect pollinators were investigated using annona species grown in southern Japanese mainland and the Okinawa islands. Thermal requirement of *Carpophilus marginellus*, one of those insect pollinators, was decided.

A-2. Publications and presentations

a) Publications

Original papers

Funakawa S., T. Minami, Y. Hayashi, S. Naruebal, C. Noichana, T. Panitkasate, R. Katawatin, T. Kosaki and E. Nawata: Process of runoff generation in different cultivated slopes in Northern and Northeast Thailand. Japan. J. Trop. Agric., 51 : 12-21, 2007.

Pagamas P. and E. Nawata: Effect of high temperature during the seed development on quality and chemical compositions in chili pepper seed. Japan. J. Trop. Agric., 51 : 22-29, 2007.

Kotera A. and E. Nawata: Role of plant height in the submergence tolerance of rice: A simulation analysis using an empirical model. Agric. Water Manage., 89 : 49-58, 2007.

Yamamoto S., M. Misumi and E. Nawata: Effects of various photoperiods on flowering in *Capsicum frutescens* and *C. annuum*. Envir. Cont. Biol., 45 : 133-142, 2007.

Ynanai, J., S. Nakata, S. Funakawa, E. Nawata, R. Katawatin, T. Tulaphitak and T. Kosaki:

Evaluation of nutrient availability of sandy soil in Northeast Thailand with reference to growth, yield and nutrient uptake by maize. Japan. J. Trop. Agric., 51 : 169-176, 2007.

Yamamoto S., M. Misumi and E. Nawata: Effects of photoperiod on vegetative growth, flowering and fruiting of *Capsicum frutescens* L. and *C. annuum* L. in Japan. Envir. Cont. Biol., 46 : 39-47, 2008.

Kozai, N., I. Kataoka, T. Kondo, S. Amemiya, H. Higuchi, T. Ogata and Y. Yonemoto: Effect of Night Temperature Regime on Fruit Quality of 'Summer Queen' Passion Fruit (*Passiflora edulis* × *P. edulis* f. flavicarpa) Harvested in Winter. Jpn. J. Trop. Agr. 51:70-72.

Yonemoto, Y., T. Ogata, N. Kozai, O. Chusri and H. Higuchi: Potential of 'Khom' for use as an interstock for compact tree size in mango. Jpn. J. Trop. Agr. 51:66-69.

Yamamoto, K., Higuchi, H.: Agricultural land use of seasonal swamps in a Tanzania Highland: A case study of the Mbozi Plateau. Jpn. J. Trop. Agr. 51:129-137.

Maeda, T., Y. Yonemoto, H. Higuchi, H. Okuda, S. Hagiwara, M. Taniguchi: Dormancy period in Japanese pepper (*Zanthoxylum piperitum* (L.) DC. f. inerme Makino) Tree. Hort. Res. Japan 6:565-569.

Tsukada, M., D. Tanaka and H. Higuchi: Thermal requirement for development of *Carpophilus marginellus* (Coleoptera: Nitidulidae), a potential pollinator of cherimoya and atemoya trees (Magnoliales: Annonaceae). Applied Entomology and Zoology 43: 281-285.

b) Conference and seminar papers presented

101th Meeting, Japan. Soc. Trop. Agric. (4)

102th Meeting, Japan. Soc. Trop. Agric. (8)

The Meeting of J. Soc. Hort. Sci. in 2007 Autumn. (4)

A-3. Off-campus activities

Membership in academic societies

Nawata, E.: Japanese Society for Tropical Agriculture (Board member, Editorial board member, Secretary for public relations).

Research grants

JSPS Research Grant: Research (A); Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (leader Nawata), Research (A); Proposal of optimized land use based on C dynamics model in humid tropics (leader Kosaki, Laboratory of Soil Science, collaborator Nawata), Research (B); Proposal of optimized land use in irrigated area by large-scale salt dynamics model using geographical information – Case study in irrigated farming area in Syr Dar'ya river in southern Kazakhstan – (leader Funakawa, Laboratory of Soil Science, collaborator Nawata), Research (B); Land Use Dynamics of Mainland Southeast Asia: Combining Field Works with RS (leader Kono, Center for Southeast Asian Studies, collaborator Nawata), and Research (S); Integrated Research on African Way of Rural Development Based on Area Studies (leader Kakeya, Graduate School of Asian and African Area Studies, collaborator Higuchi)

A-4. International cooperation and overseas activities

International meetings (roles)

Nawata, E.: International Society of Food, Agriculture and Environment (Editorial board

member)

International joint researches, overseas research surveys

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, Kasetsart University)

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, Khon Kaen University)

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, Chiang Mai University)

Nawata, E.: Evaluation and restoration of environmental degradation caused by agricultural intensification in mainland Southeast Asia (Thailand, ICRAF),

Nawata, E.: Utilization of bio-resources in homegardens in Phuthai people in Laos (Laos, National Agriculture and Forestry Research Institute)

Higuchi, H.: The international project of low tree height cultivation techniques (Thailand, Chantaburi Horticultural Research Center)

Higuchi, H.: The international project of low tree height cultivation techniques (Vietnam, South East Fruit Research Center)

Higuchi, H.: The integrated research on African way of rural development based on area studies; - Towards the endogenous development through the thoroughly understanding of the reality of the areas and the appreciating a new value of the indigenousness - (Tanzania, Sokoine University)

B. Education Activities (2007.4-2008.3)

B-1. On-campus teaching

a) courses given

Undergraduate level: Outline of Bioresource Science IV (Nawata), Social and Environmental Changes under Sustainable Development in Monsoon Asia (Nawata), Introduction to Tropical Agriculture (Nawata), Environmental Stresses for plants (Nawata), Laboratory Course in Bioresource Science I・II (Higuchi, Nawata), Seminar in Tropical Agriculture (Nawata, Higuchi)

Graduate level: Climatic ecology in the tropics (Nawata), Agroecology of Tropical Crops (Nawata), Seminar in Tropical Agronomy (Nawata, Higuchi), Special Laboratory Work in Tropical Agronomy (Nawata, Higuchi)

B-3. Overseas teaching

Students and research fellows from abroad

Foreign student 1 (Thailand)

2.5.6 Laboratory of Soil Science

Staff *Professor* *: Kosaki, Takashi, Dr. Agric. Sci.*
Associate Professor: Funakawa, Shinya, Dr. Agric. Sci.
Assistant Professor : Shinjo, Hitoshi, Dr. Agric. Sci.
Assistant Professor : Watanabe, Tetsuhiro, Dr. Agric. Sci. (since 16th July)

Students and research fellows

Doctor's program : (9) *Master's program : (8)*
Undergraduate : (2) *Research student : (2)*

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Soil characterization, development of the soil management and environment conservation in the tropics and arid regions:

The laboratory of soil science widely concerns soil management strategies for sustainable use and conservation of environment in the tropics and the arid regions. In Central Asia (Kazakhstan, and northwestern China), researches on soil degradation due to continuous cereal cropping in the steppe region were conducted. In Southeast Asia (Thailand and Indonesia), soil processes under traditional shifting cultivation systems were investigated with special reference to soil organic matter dynamics and the agro-ecological degradation due to excessive land use under increasing population pressure was also analyzed to establish a sustainable land use system there. In Sub-Sahara Africa (Burkina Faso, Tanzania, Zambia and Niger), human-environment relationship was investigated through the research on the response of soils to the soil management practices under conventional farming systems by small-scale farmers.

b) Dynamic pedology on the soil acidification processes:

The acid-buffering and/or storing capacity of the amorphous sesquioxides in the course of pedogenetic acidification of soils derived from several parent materials were studied in the cool and warm temperate forests in Japan and in the tropical forests in Southeast Asia. Conditions for formation and weathering of expandable 2:1 type soil clay minerals in leaching environments were investigated and simultaneous dynamics of organic matter and soil acidity in different soil ecosystems were analyzed.

c) Studies on dynamics of organic matter and soil microbes under different soil ecosystems:

The dynamics of organic matter and soil microbes in ecosystems are key processes in terms of different environmental problems such as global warming and nutrient leaching. The soil organic matter-decomposing characteristics and microbial activities were analyzed for soil collected from different environments (Thailand, Indonesia, Kazakhstan, etc).

A-2. Publications and presentations

a) Publications

Books

Funakawa S, Yanai J, Takata Y, Karbozova-Saljnikov E, Akshalov K and Kosaki T: Dynamics of water and soil organic matter under grain farming in Northern Kazakhstan – Toward sustainable land use both from the agronomic and environmental viewpoints. Climate

Change and Terrestrial Carbon Sequestration in Central Asia (ed. Lal R et al.). p.279–331, Taylor & Francis, London, 2007

Shinjo H, Kosaki, T: Global environmental problems related to land, Soil erosion, Salinization. Handbook of land environment engineering (ed. Kamon M et al.), Asakura Shoten, Tokyo, 2007

Original papers

Funakawa S, Suzuki R, Kanaya S, Karbozova-Saljnikov E and Kosaki T: Distribution patterns of soluble salts and gypsum in soils under large-scale irrigation agriculture in Central Asia. Soil Sci. Plant Nutr., 53, 150–161, 2007

Funakawa S and Kosaki T: Potential risk of soil salinization in different regions of Central Asia with special reference to salt reserve in deep layers of soils. Soil Sci. Plant Nutr., 53, 634–649, 2007

Funakawa S, Tachikawa S, Kadono A, Pulunggono HB and Kosaki T: Factors controlling soil organic matter decomposition in small home gardens in different regions of Indonesia. Tropics, 17, 59–72, 2008

Funakawa S, Hirooka K and Yonebayashi K: Temporary storage of soil organic matter and acid neutralizing capacity during the process of pedogenetic acidification of forest soils in Kinki District, Japan. Soil Sci. Plant Nutr., 54, 434–448, 2008

Watanabe T, Funakawa S and Kosaki T: Profile description, properties, and classification of seven typical upland soils formed under different climatic conditions in Japan, Thailand, and Indonesia. Pedologist, 51, 24–34, 2007

Kadono A, Funakawa S and Kosaki T: Factors controlling mineralization of soil organic matter in Eurasian steppe area. Soil Biol. Biochem., 40, 947–955, 2008

Takata Y, Funakawa S, Akshalov K, Ishida N and Kosaki T: Influence of land use on the dynamics of soil organic carbon in northern Kazakhstan. Soil Sci. Plant Nutr., 53, 162–172, 2007

Takata Y, Funakawa S, Akshalov K, Ishida N and Kosaki T: Spatial prediction of soil organic matter in northern Kazakhstan based on topographic and vegetation information. Soil Sci. Plant Nutr., 53, 289–299, 2007

Takata Y, Funakawa S, Yanai J, Mishima A, Akshalov K, Ishida N and Kosaki T: Influence of crop rotation system on the spatial and temporal variation of soil organic carbon budget in northern Kazakhstan. Soil Sci. Plant Nutr., 54, 159–171, 2008

Sawada K, Funakawa S and Kosaki T: Soil microorganisms have a threshold concentration of glucose to increase the ratio of respiration to assimilation. Soil Sci. Plant Nutr., 54, 216–223, 2008

Yanai J, Nakata S, Funakawa S, Nawata E, Katawatin R, Tulaphitak T and Kosaki T: Evaluation of nutrient availability of sandy soil in Northeast Thailand with reference to growth, yield and nutrient uptake by maize, Jpn. J. Trop. Agr., 51, 169–176, 2007

Sugimori Y, Funakawa S, Pachikin KM, Ishida N and Kosaki T: Soil salinity dynamics in irrigated fields and its effects on paddy-based rotation systems in southern Kazakhstan. Land Degradation and Development, Published online: Dec 31 2007.

Fujii K, Funakawa S, Hayakawa C and Kosaki T: Contribution of different proton sources to pedogenetic soil acidification in forested ecosystems in Japan. Geoderma, 144, 478–490, 2008

Yanai J, Matsubara T, Li C, Moritsuka N, Shinjo H, Kosaki T: Establishment of rational soil

sampling scheme for the paddy field –Relationship between sampling frequency and data reliability-. Jpn. J. Soil Sci. Plant Nutr., 79, 61-67, 2008

b) Conference and seminar papers presented

Annual meeting of Japanese Society of Pedology (Tokyo, 2007.4): 1 paper

International Symposium on Organic Matter Dynamics in Agro-Ecosystems (Poitiers, France, July 16-19): 1 paper

Annual meeting of Japanese Society of Soil Science and Plant Nutrition (Tokyo, 2007.8.22-24): 12 papers

The 8th Conference of the East and Southeast Asian Federation of Soil Science (Tsukuba, October 22–23): 5 papers

The 102nd conference of Japanese Society of Tropical Agriculture (Miyazaki, 2007.10.13-14): 1 paper

The 55th conference of Japanses Society of Ecology (Fukuoka, 2008.3.14-17): 1 paper

The 103rd conference of Japanese Society of Tropical Agriculture (Machida, 2008.3.29-30): 3 papers

A-3. Off-campus activities

Memberships in academic societies (roles)

Kosaki, T.: Japanese Society of Soil Science and Plant Nutrition (division chief), Japanese Society of Pedology (council member)

Research grants

Monbusho Research Grant: Grant-in-Aid for Scientific Research (A), Proposal of optimized land use based on C dynamics model in humid tropics (Kosaki, chief; Funakawa, member); Grant-in-Aid for Scientific Research (B), Dynamics of soil organic matter in cold regios of Eurasia (Kosaki, chief; Funakawa and Shinjo, members); Grant-in-Aid for Scientific Research (Houga-kenkyu), Developing virtual museum "Wonder in Soils" (Kosaki, chief); Grant-in-Aid for Scientific Research (B), Changes of agro-ecological environments in Central Eurasia during the last millennium (Funakawa, chief; Kosaki and Shinjo, members); Grant-in-Aid for Scientific Research (A), Integral database for regional studies based on realization of virtual global space (Funakawa, member); Grant-in-Aid for Scientific Research (A), Evaluation of environmental degradation along with intensification of agriculture in continental Southeast Asia (Funakawa, member); Grant-in-Aid for Scientific Research (B), Evaluation for alteration of hydrological environments and human activity in recent years in Cenral Asia (Funakawa, member).

Entrust Research Fund by Japanese International Research Center for Agricultural Sciences: Characterization of the natural resources in the sandy soils in the semiarid tropics of Africa (Shinjo)

Sumitomo Foundation: Study on carbon cycle in tropical ecosystems and its changes by human activities. (Funakawa, chief)

Start-up fund for young researchers, Kyoto University: Roles of soil minerals in biogeochemical process in forest ecosystems. (Watanabe)

A-4. International cooperation and overseas activities

International joint researches, overseas research surveys

Kosaki, T.: Assessment and prediction of soil degradation processes using the archive of soil monoliths. (Russia)

Funakawa, S.: Study on agricultural ecosystems in tropical Asia. (Thailand, Indosesia); Study on agricultural ecosystems in East Africa. (Tanzania); Recent agro-environmental alteration in Central Asia.

Shinjo, H.: Study on desertification in West Africa. (Niger); Study on social-ecological resilience in semi-arid Tropics (Zambia)

Watanabe, T.: Study on organic matter dynamics under cool climatic condition. (Finland)

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Outline of Biological and Environmental Science, Science of Biosphere-Life, Environmental Sciences A, Resource, Environment and Technology and World Food Production, Environmental Information Processing, Soil Science- Part I (Kosaki); Basic Laboratory Cousrse in Biological and Environmental Science II, Soil Science- Part II (Funakawa); Practice in University Forest III, Livestock Production Techniques and Practice, Introduction to Plant Investigations, Laboratory Course in Biological and Environmental Science IV, Seminar in Soil Science, (Kosaki, Funakawa, Yanai, Shinjo).

Graduate level: Research in Soil Science, Seminar in Soil Science (Kosaki, Funakawa, Yanai); Biogeochemistry (Funakawa)

B-2. Off-campus teaching

Kosaki, T.: Special lecture (Soil Analysis and Improvement, Agricultural and Rural Development with Environmental Conservation, Forage Production and Utilization Technologies, Envrionment oriented rural development in Peru) in Japan International Cooperation Agency

Shinjo, H.: Special lecture (Seminar on natural environment at Bampaku Park)

B-3. Overseas teaching

Students and research fellows from abroad

Doctor course student: 1 (New Zealand)

2.5.7 Laboratory of Environmental Mycoscience

Staff *Professor* : *Futai, Kazuyoshi, D.Agric.Sci*
Associate Professor: Tanaka, Chihiro, D.Agric.Sci
Assistant Professor : Takeuchi, Yuko, D.Agric.Sci
Guest Proffesor : *Zaki Anwar Siddiqui, Ph. D. (1 Oct. 2007 – 30 Sept. 2008)*

Students and research fellows
Doctor's program : *(6)*
Master's program : *(11)* *Undergraduate : (2)*
COE Research Fellow: (Rina Sriwati; 1 April 2007 – 31 March 2008)

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Ecological Studies on the Microorganisms-mediated interactions

1. Host-parasite interactions involved in the Pine Wilt Disease have been studied from some viewpoints. Among them are gene expressions for host resistance in relation with possible factors that elicit host responses. Biological control method with entomopathogenic nematodes has been examined with some hopeful results. Field survey to find latent carrier trees was also conducted to confirm their importance in disease spreading.
2. Biological control trials for another forest epidemic, the Japanese Oak Wilt, have also been ongoing. Candidate endophytic fungi which can be antagonistic to pathogenic fungus were found and their characteristics have been studied. Various yeast species found in relation to this epidemic disease were examined carefully and intensively to determine the biological relationship between the vector beetle and its cohabiting microorganisms. Studies on host responses after infection with pathogenic fungus, focusing on the changes in the secondary products, are being pursued. Spatiotemporal distribution of mycorrhizal mushrooms in oak forests has also been studied in relation to host death due to the Oak Wilt.
3. Field studies on mycorrhizal symbiosis was well progressed in this year, especially in the relationship with soil eutrophication and bacterial environments. These studies produced some remarkable results.

b) Biochemical and ecological genetics on fungi

1. The two classes of fungicides, Dicarboximides and Phenylpyrroles are effective and used for control of gray mold (*Botrytis cinerea*) deseases of several plants. The modes of the actions of these fungicides were unclear. However, our studies using the mutants of *Cochliobolus heterostrophus* revealed that these fungicides improperly activate the filamentous-fungus specific high-osmolarity stress signaling pathway. This signaling pathway has a great attension as a target of the fungicides. The pathway is involved not only in the adaptions for high osmotic environment but also in the adaptions for the host plant. The pathway seems to have a critical role in the lifecycles of plant pathogenic filamentous fungi. To elucidate the roles of this pathway in *Botrytis cinerea*, we have cloned the 6 genes (*BcOs1*, *BcSsk1*, *BcSsk2*, *BcPbs2*, *BcHog1* and *BcSkn7*). The phenotypic charcterisations of the disruptants are still in progress.
2. In the rice blast fungus, *Magnaporthe grisea*, one of P-type ATPase gene (*MgAPT2*) is

required for biotrophic interaction with a host. Targeted gene replacement of it showed that the loss of *Mgapt2* does not significantly affect hyphal growth or sporulation. However, the disruptant reduces both foliar and root infection by the fungi, and rapidly induces incompatible host defense responses. We studied the roles of Apt2 homologues in the necrotrophic plant pathogens, *B. cinerea* and *C. heterostrophus*, and in the biotrophic symbiont, *Epichloë typhina.* The *Apt2*-gene disruptants of *B. cinerea* and *C. heterostrophus* showed reduced colonial growth, whereas the rates of appresorial and germtube- formations were same as their wild types. The disrutants developed many lesions on their host as wild types did. However, sizes of lesions in the disruptants were smaller than those of lesions in the wild-type: the initial lesion sizes were same, however, the sizes of the 6 days old lesions were significantly smaller than those of the wild-types. Our results implied that in *B. cinerea* and *C. heterostrophus, Apt2* homologues are also involved in their pathogenicity but not in their virulence. The phenotypic charcterisations of the *Epichloë typhina* disruptants are on going.

A-2. Publications and Presentations

~~a)~~a) Publications

Books

Tanaka, C. and T. Okuno: Protection of plants from diseases. Advances in plant protection (ed., M. Sakuma) , p195–241. In "Agriculture in the 21st century in view of bioresources. vol. 3", Kyoto University Press, Kyoto, 2008

Original papers

Ishihara, A., Y. Hashimoto, C. Tanaka, G.J. Dubouzet, Y. Nakao, F. Matsuda, T. Nishioka, H. Miyagawa and K. Wakasa: The tryptophan pathway is involved in the defense responses of rice against pathogenic infection via serotonin production. Plant J. 54; 481–495, 2008

Kataoka, R., T. Taniguch, H. Ooshima and K. Futai: Comparison of the bacterial communities established on the mycorrhizae formed on *Pinus thunbergii* root tips by eight species of fungi. Plant and Soil 304; 267–275, 2008

Sriwati, R., N. Kanzaki, L.K. Phan and K. Futai: *Bursaphelenchus eproctatus* n. sp. (Nematoda: Parasitaphelenchidae) isolated from dead Japanese black pine, *Pinus thunbergii* Parl. Nematology 10; 1–7, 2008

Izumitsu, K., A. Yoshimi and C. Tanaka: Two-Component response regulators Ssk1p and Skn7p additively regulate high-osmolarity adaptation and fungicide sensitivity in *Cochliobolus heterostrophus*. Eukaryot Cell 6; 171–181, 2007

Sriwati, R., S. Takemoto and K. Futai: Cohabitation of the pine wood nematode, *Bursaphelenchus xylophilus*, and fungal species in pine trees inoculated with *B. xylophilus*. Nematology 9; 77–86, 2007

Takemoto, S. and K. Futai: Polymorphism of Japanese isolates of the pinewood nematode, *Bursaphelenchus xylophilus* (Aphelenchida: Aphelenchoididae), at heat-shock protein 70A locus and the field detection of polymorphic populations. Appl. Entomol. Zool. 42; 247–253, 2007

Takeuchi, Y. and K. Futai: Avirulent isolate of the pinewood nematode *Bursaphelenchus xylophilus*, survives 7 months in asymptomatic host seedlings. For. Path. 37; 289–291, 2007

Taniguchi, T., S. Tamai, N. Yamanaka and K. Futai: Inhibition of the regeneration of Japanese black pine (*Pinus thunbergii*) by black locust (*Robinia pseudoacacia*) in coastal sand dunes. J. For. Res. 12; 350–357, 2007

Truong, B.N., K. Okazaki, T. Fukiharu, Y. Takeuchi, K. Futai, X.T. Le and A. Suzuki: Characterization of the nematocidal toxocyst in *Pleurotus* subgen. *Coremiopleurotus*. Mycoscience 48: 222–230, 2007

Yamasaki, M., A. Iwatake and K. Futai: A low *Platypus quercivorus* hole density does not necessarily indicate a small flying population. J. For. Res. 12; 384–387, 2007

b) Conference and seminar papers presented

The 118th Annual Meeting of the Japanese Forestry Society: 7 papers

The 15th Annual Meeting of the Japanese Nematological Society: 2 papers

The 23rd Annual Meeting of Japanese Society of Microbial Ecology: 1 paper

The 11th Annual Meeting of the Japanese Soc. of Mushroom Sci. and Biotechnol.: 1 paper

The Annual Meeting of Japan Soc. for Biosci, Biotechnol., and Agrochem. 2008: 3 papers

The 51st Annual Meeting of the Mycological Society of Japan: 2 papers

The 33rd Annual Meeting of the Pesticide Science Society of Japan: 3 papers

The Annual Meeting of the Phytopathological Society of Japan, 2007: 3 papers

The 12th Annual Meeting of the Tree Health Research Society: 2 paper

A-3. Off-campus activities

Memberships in Academic Societies

Futai, K.: Japanese Society of Nematology (Fellow, Chief in organizers for the 15th annual meeting), Tree Health Research Society (member of editorial board).

Tanaka, C.: The Mycological Society of Japan (trustee, member of editorial board, member of database committee), Japanese Society of Pesticide Science (member of editorial board).

Takeuchi, Y.: Japanese Society of Nematology (member of organizers for the 15th annual meeting)

Research grants

Futai, K.: Grant-in-Aid for Scientific Research (A) from the Ministry of Education, Science and Culture, Japan, (Molecular biological study on the pathogenic mechanisms of drastic tree wilting diseases)

Tanaka, C.: Grant-in-Aid for Scientific Research (B2) from the Ministry of Education, Science and Culture, Japan, (Studies on exotic ectomycorrhizal fungi invaded into New Zealand native forest)

Takeuchi, Y.: Grant-in-Aid for Young Scientists (start-up) from the Ministry of Education, Science and Culture, Japan, (Cloning of acetylcholine esterase genes of the pine wood nematode)

A-4. International cooperation and overseas activities

International meetings (roles)

Tanaka, C.: China-Japan Pan Asia Pacific Mycology Forum（organizing committee）

International joint researches, overseas research surveys

Tanaka, C.: A study on fungal flora in a tropical and monsoon South-East Asia (Malaysia).

Tanaka, C.: Studies on exotic ectomycorrhizal fungi invaded into New Zealand native forest (New Zealand).

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Course given

Undergraduate level: Microbes in Ecosystem (Futai), Seminar in Environmental Microbiology (Futai, Tanaka), Laboratory course in Biological and Environmental Science III, IV (Futai, Tanaka), Outline of Bioresource Science IV (Futai, Tanaka), Microbiology (Futai, Tanaka), Pesticide Science (Tanaka).

Graduate level: Seminar in Environmental Mycoscience (Futai, Tanaka), Research in Environmental Mycoscience (Futai, Tanaka), Special Lecture on Microbial Management (Tanaka).

B-2. Off-campus teaching,etc.

Part-time lecturer

Futai, K.: Kyoto Institute of Technology (Environmental Biology), Minami Kyushu University (Conservation Biology), Doshisha University (behavioural ecology, Life Science)

2.5.8 Laboratory of Ecological Information

Staff

Professor	:	*Takafuji, Akio, Ph. D.*
Associate Professor:		*Osakabe, Masahiro, Dr. Agric. Sci.*
Assistant Professor :		*Yano, Shuichi, Dr. Agric. Sci.*
Postdoctoral fellows:		*Fukaya, Midori, Ph.D.*
		Uesugi, Ryuji, Ph. D.

Students and research fellows

Doctor's Program	*: (3)*	*Research Fellow*	*: (1)*
Master's Program	*: (5)*	*Foreign Visiting Fellow*	*: (1)*
Undergraduate	*: (3)*		

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

The central research topic in this laboratory is the ecological, molecular and biochemical analysis of the interactions among plants, herbivors and predators, along with basic ecological and genetical studies of individual components comprising of these systems.

a) Inter- and intra-specific variations in the ecological performance of spider mites

Phytophagous mites of the family Tetranychidae occur in a variety of environments, while their adaptive traits such as diapause, dispersal and host plant range vary within species and between them. We have studied experimentally and theoretically, the genetic basis of this variation, and the ecological factors responsible for and the significance of the variation.

b) Management of spider mites in orchards

We have compared the abundance of spider mite populations in pear and persimmon orchards that have different cultural and control programs, and determined the artificial factors

responsible for outbreaks of the mites. Based on this survey, we proposed strategies for controlling the mites, including the use of natural enemies, such as phytoseiid mites, and the development of new cultural management techniques.

c) Ethological interactive studies of spider mites and their predators

In general, herbivors and their predators are connected with diffuse food webs. Moreover, members within a trophic level also interact through inter-specific competition and/or intra-guild predation. We have investigated direct and indirect consequences of these interactions on the population dynamics of herbivors.

d) Evolutionary ecology of plant-herbivore interactions

Diverse interactions between plants and herbivors are maintained by the balance between herbivore defense of plants and counter adaptation by herbivors. From this viewpoint, we have examined the reason why host ranges of phytophagous insects and mites are generally restricted to the small fraction of the plants available to them. We also investigated proximate factors responsible for the interactions such as secondary metabolites of host plants.

e) Meta-population structure and maintenance of genetic variation in spider mites

Neutral mutations are frequently lost or fixed by genetic drift within a finite population. Nevertheless, genetic variations in pesticide susceptibilities are maintained in a selection free, wild population of spider mites. Such variations may be maintained by the meta-population structure of spider mites. We have analyzed the structure using molecular markers such as DNA polymorphism, and discussed the maintenance mechanism of the genetic variations.

A-2. Publications and Presentations

a) Publications

Books

Takafuji, A. (2008) Ecology and control strategy of spider mites. In: Agriculture in the 21st Century, Vol. 3 (M. Sakuma ed.), Kyoto Univ. Press, pp. 43-81.

Original papers

Hinomoto, N., S. Nishimura, and A. Takafuji (2007) DNA sequence variation in the *Tetranychus kanzawai* complex in northern Hokkaido, Japan. J. Acarol. Soc. Jpn 16: 97-107.

Hinomoto, N., D. P. Tran, A. T. Pham, T. B. N. Le, R. Tajima, K. Ohashi, Mh. Osakabe, and A. Takafuji (2007) Identification of spider mites (Acari: Tetranychidae) by DNA sequences: a case study in northern Vietnam. Internat. J. Acarol. 33: 53-60.

Kamezaki, H., K. Ohashi, K. Ishihara, Y. Sasaki, A. Takafuji (2007) Lethal effects of two types of oxygen absorbers on the eggs of three house dust mites, *Dermatophagoides farinae*, *D. pteronyssinus*, and *Tyrophagus putrescentiae*. J. Acarol. Soc. Jpn. 16: 145-151.

Nishimura, S., N. Hinomoto, and A. Takafuji (2007) The population genetic structure of *Tetranychus kanzawai* Kishida (Acari: Tetranychidae) in northern Hokkaido, Japan, as estimated using microsatellite polymorphism. J. Acarol. Soc. Jpn. 16: 11-20.

Nishimura, S., N. Hinomoto, and A. Takafuji (2007) The genetic variations among populations of *Tetranychus kanzawai* complex (Acari: Tetranychidae) indicated by using mitochondrial, ribosomal, and microsatellite DNA markers. J. Acarol. Soc. Jpn. 16: 109-119.

Osakabe, Mh., H. Isobe, A. Kasai, R. Masuda, S. Kubota and M. Umeda (2008) Aerodynamic advantages of upside down take-off for aerial dispersal in *Tetranychus* spider mites. Exp. Appl. Acarol. 44: 165-183.

Tajima, R., K. Ohashi, A. Takafuji (2007) Specific adaptation of sympatric populations of the Kanzawa spider mite, *Tetranychus kanzawai* (Acari: Tetranychidae) to three host plants. J. Acarol. Soc. Jpn. 16: 21-27.

Tajima, R., K. Ohashi, M. Osakabe and A. Takafuji (2007) Host plants utilized during the immature development of *Tetranychus kanzawai* (Acari: Tetranychidae) determine the preference of the adult females for the plants. J. Acarol. Soc. Jpn. 16: 121-127.

Takafuji, A., R. Tajima, and H. Amano (2007) The overwintering ecology and diapause capacity of *Tetranychus kanzawai* Kishida (Acari: Tetranychidae) in west-central Taiwan. J. Acarol. Soc. Jpn. 16: 29-34.

Uesugi, R., and Mh. Osakabe (2007) Isolation and characterization of microsatellite loci in the two-spotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae). Mol. Ecol. Notes 7: 290-292.

Yano, S. (2008) Collective and solitary behaviors of the two-spotted spider mite (Acari: Tetranychidae) are induced by trail following. Ann. Entomol. Soc. Am. 101: 247-252.

Reviews

Magalhães, S., M. R. Forbes, A. Skoracka, M. Osakabe, C. Chevillon, and K. D. McCoy (2007) Host race formation in the Acari. Exp. Appl. Acarol. 42: 225-238.

Osakabe, Mh., K. Morimoto, K. Hongo, K. Funayama, S. Osumi (2007) Amensalism via webs in spider mites. Plant Protection 61: 268-272.

Takafuji, A. (2007) Spider mites in Southeast Asia. Plant Protection 61: 635-641.

b) Conference and seminar papers presented

52nd Annual Meeting of Japanese Society of Applied Entomology and Zoology: 10 papers

16th Annual Meeting of the Acarological Society of Japan: 9 papers

Symposium of Entomological Science COE "Innovative Food and Environmental Studies Pioneered by Entomomimetic Sciences": 3 papers

A-3. Off-campus activities

Membership in academic societies (roles)

Takafuji, A.: Japanese Society of Applied Entomology and Zoology, The Acarological Society of Japan (Councilor), The Society of Population Ecology, The Kansai Plant Protection Society (President)

Osakabe, M.: Japanese Society of Applied Entomology and Zoology, The Genetics Society of Japan, Pesticide Science Society of Japan, The Society of Population Ecology, The Acarological Society of Japan (Councilor), The Kansai Plant Protection Society

Yano, S.: Japanese Society of Applied Entomology and Zoology, The Society of Population Ecology, The Acarological Society of Japan, The Ecological Society of Japan

Research grants

JSPS Research Grant: Basic Research (B) Management of spider mites in orchards by using native phytoseiid predators (Takafuji, Partial).

JSPS Research Grant: Basic Research (C) Molecular basis of counter-adaptation by agricultural pests against chemical defense of host plants (Osakabe, Head).

JSPS Research Grant: Encouragement of Young Scientists (B): Investigation on an evolutionary mechanism of pesticide-resistance instigated by apparent cross resistances (Uesugi, Head).

The 21st Century COE Program: Innovative food and environmental studies pioneered by entomomimetic sciences (Takafuji and Osakabe; Partial)

Research Project funded by the Japan Ministry of Agriculture, Forestry and Fisheries: Development of new biorational techniques for sustainable agriculture (Osakabe and Yano; Partial)

A-4. International cooperation and overseas activities

International meetings (roles)

Osakabe, Mh. The Entomological Society of America

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Ecology (Takafuji), Ecological Management (Osakabe), Seminar in Ecological Management (Takafuji and Osakabe), Basic Bioresource Science II (Takafuji), Outline of Bioresourse Science IV (Osakabe), Fundamentals of the Experiments of Bioresource Science (Yano), Laboratory Course in Bioresource Science I・II (Osakabe and Yano)

Graduate level: Ecological Information (Takafuji), Seminar in Ecological Information and Management (Takafuji and Osakabe), Research in Ecological Information and Management (Takafuji, Osakabe and Yano)

B-2. Off-campus teaching

Part-time lecturer

Osakabe, M.: Ishikawa Prefectural University (Applied Entomology)

B-3. Overseas teaching

Takafuji, A.: Department of Agriculture, Bangkok, Thailand (Spider mites in Asia)

Research fellow from abroad

Ronpaku research fellow: 1 (Thailand)

Chair of Environmental Development Engineering

2.5.9 Laboratory of Agricultural Facilities Engineering

Staff *Associate Professor: Kobayashi Akira, Dr. Eng. Sci.*
Assistant Professor : Kiyama Shouichi, Dr. Agric. Sci.
Assistant Professor : Yamamoto Kiyohito, Dr. Agric. Sci.

Students and research Fellows
Doctor's Program : (4) *Undergraduate : (4)*
Master's Program : (3)

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Non-destructive method for long used hydraulic facilities for irrigation

To make the strategy for the maintenance of long used hydraulic facilities for irrigation activity, non-destructive methods such as impact acoustic method, electrical resistivity survey and electro-magnetic method to investigate the state of the structure or subsoil has been developed.

b) Maintenance and renewal or rehabilitation of the long used facilities

Nowadays, it is important decision making how to choose among rehabilitation work, repair, or renewal of facilities by the new project, based on the grasp of various functional loss of the deteriorated facilities. Also the need of the farmers to various facilities has been changed from the past. From this point what is the best strategy for the economical use of the finance is investigated.

c) Validation of the coupled mechanical, hydraulic and thermal analysis

By applying the simulation method for the coupled mechanical, hydraulic and thermal phenomena, the numerical method is tried to be validated.

d) Experimental research on failure mechanism of irrigation tank caused by overtopping and risk analysis of the irrigation tank damages

Many traditional irrigation tanks easily fail due to the overtopping of the pond water by a heavy rain. But the mechanism of the failure is not clarified because of the lack of the exact observation. So the experimental test of overtopping has been carried out. Also based on the data of many failed irrigation tanks in AWAJI Island caused by the heavy rain of a typhoon, a risk analysis was carried out.

e) Mechanics of solute transport through ground having sea water intrusion

To understand the environmental problem near coast area, the solute transport through the area having sea water intrusion is investigated by the 2-D tank and numerical approach.

f) Eco-efficiency assessment of eutrophication for the watershed environmental management

Quantifying watershed based integrated environment and economic accounting and eutrophication potential, we investigate how to manage the sustainable water environmental development in the future inter-sectoral and inter-regional activities.

g) Mechanical property change in rocks and concrete due to degradation

For long use of irrigation structure, mechanical characteristics of degraded rock and concrete are investigated. Mechanical characteristics of degraded mortal are grasped using compression strength test. Analysis model of damage mechanism is examined.

A-2. Publications and presentations

a) Publications

Original Papers

Kobayashi, A., R. Niwa, T. Yanagimoto, K. Yamamoto and S. Aoyama: Influence of water distribution in the embankment of irrigation tank by elastic wave exploration, Transactions of the Japanese Society of Irrigation, Drainage and Rural Engineering, No. 249, pp.1-8, 2007 (in Japanese)

Yamoto, K., A. Kobayashi, S. Aoyama: Change in behavior of uniaxial compression due to degradation of salt water and freezing and thawing for rock, Journal of the society of materials science Japan, Vol. 56, No.9, pp. 809-812, 2007(in Japanese)

Kobayashi, A., Y. Yamamoto, S. Aoyama and K. Inoue: Risk estimation for failure of irrigation tank embankment using database, JCOSSAR 2007, pp.327-332, 2007(in Japanese)

Kobayashi, A., Y. Yamamoto, T. Oka and S. Aoyama: Examination of life cycle cost for embankment of irrigation tank with regard to heavy down fall, Journal of Geotechnical Engineering, Japan Society of Civil Engineering, C, Vol. 63, No.4, pp.954-962, 2007 (in Japanese)

Fujisawa, K., A. Kobayashi, S. Momoki and S. Aoyama.: Mechanism elucidation of embankment failure due to overflow and assessment of slope protection, Transactions of the Japanese Society of Irrigation, Drainage and Rural Engineering, No. 252, pp.593-599, 2007

Kobayashi, A., Y. Toyoda, K. Yamamoto and S. Aoyama, Effect of eater content of concrete on resonant frequency of elastic wave, Transactions of the Japanese Society of Irrigation, Drainage and Rural Engineering, No. 252, pp.71-78, 2007 (in Japanese)

Kobayashi, A., Y. Yamamoto., S. Aoyama, T. Oka and K. Inoue: Statistical assessment of breach of irrigation tank embankment due to downpour, Applications of Statistics and Probability in Civil Engineering, Taylor & Francis Group, pp.185-187, 2007

Fujisawa, K., A. Kobayashi, K. Yamamoto and S. Aoyama.: Failure mechanism of an embankment due to overflow, The seventeenth International Offshore and Polar Engineering Conference, pp.1696-1701, 2007

Kobayashi, A., T. Yanagimoto, K. Yamamoto, H. Tsunematsu and S. Aoyama: Nondestructive investigation of embankment of irrigation tank, International Conference on Advanced Technology in Experimental Mechanics 2007,OS3-4-3 (CD-ROM), 2007

Makokha, M., A. Kobayashi and S. Aoyama: Effect of velocity distribution on contaminant transport in coastal aquifers, Third Asian-Pacific Congress on Computational Mechanics in conjunction with Eleventh International Conference on the Enhancement and Promotion of Computational Methods in Engineering and Science, MS29-5-3 (CD-ROM), 2007

Kiyama, S.: Influence of agriculture and inter-regional trading on watershed water quality and production management, Proceedings of the 2nd IASTED International Conference, Water Resources Management, ed. by J. Wilson, Honolulu, USA, 109-117, 2007

Kiyama, S.: Assessment of sustainable industrial structure in watershed water quality management: Effects of agricultural input structure and inter-regional trading. Selected Papers Environmental Systems of Research, JSCE, 35(1); 219-226, 2007 (in Japanese)

Makokha, M., A. Kobayashi and S. Aoyama: Effect of tidal fluctuation on velocity distribution in coastal aquifers, Journal of Rainwater Catchment Systems , Vol. 13, No.2, pp.1-6,2008

Inoue, K., A. Kobayashi, N. Matsunaga and T. Tanaka: Application of particle tracking method to dispersivity identification and its experimental verification, Journal of Rainwater Catchment Systems , Vol. 13, No.2, pp.7-16, 2008

Kobayashi, A., R. Takahashi, S. Aoyama and D. Watabe: Examination method of present situation of riprup by image analysis, Transactions of the Japanese Society of Irrigation, Drainage and Rural Engineering, No. 253, pp.35-44, 2008 (in Japanese)

Reports

Kobayashi A.: Numerical simulation of Aspo diorite core samples, DECOVALEX-THMC Task B Phase 2 Report, SKI Report 2008:08, pp.45-55, 2007

b) Conference and seminar papers presented

H-19 National conference of JSIDRE: 4 papers

H-19 Kyoto regional conference of JSIDRE: 5 papers

42th National conference of JGS: 2 papers

H-19 National conference of JSCES: 1 paper

National Symposium of Environmental System, JSCE: 1 paper

2nd IASTED Water Resources Management: 1 paper

International Conference of Applications of Statistics and Probability in Civil Engineering, Kashiwa: 1 paper

International Conference on Advanced Technology in Experimental Mechanics, Fukuoka: 1 paper

The seventeenth International Offshore and Polar Engineering Conference: 1 paper

Third Asian-Pacific Congress on Computational Mechanics in conjunction with Eleventh International Conference on the Enhancement and Promotion of Computational Methods in Engineering and Science: 1 paper

A-3. Off-campus activities

Membership in academic society

Kobayashi, A.: Japanese Society of Irrigation, Drainage and Reclamation Eng. (member of committee of dam, Officer of Kyoto branch), Japanese Geotechnical Society (Domestic member of ATC8, councilor of kansai branch), Japan Soc. Civil Eng., Japanese Association of Groundwater Hydrology, J. Soc. Computational Eng., Int. Soc. of Rock Mechanics, Japan Rainwater Catchments System Association (councilor).

Kiyama, S.: Japanese Society of Irrigation, Drainage and Reclamation Eng. (member of committee of education organization of agricultural engineers, Kinki branch, JSIDRE.), Japanese Geotechnical Society, Japan Soc. of Civil Eng.

Yamamoto, K.: Japanese Society of Irrigation, Drainage and Reclamation Eng., Japanese Geotechnical Soc., Japan Soc. of Civil Eng., Japanese Soc. of Experimental Mechanics.

Research grants

Monbusyo Grants-in-Aid : Basic research (B) Development of maintenance technique of agricultural hydraulic structures by considering its life cycle cost. (Kobayashi, head

researcher)

Monbusyo Grants-in-Aid : Embryonic research Development of remote support system for daily check of agricultural hydraulic structure (Kobayashi, head researcher)

Monbusyo Grants-in-Aid : Basic research (C) Method of maintenance and control of agricultural resources based on the sound water cycle and fair regional benefit distribution . (Kiyama, head researcher)

A-4. International cooperation and oversea activities

International meeting (role)

Kobayashi, A.: International Conference of Applications of Statistics and Probability in Civil Engineering, Japan, (presentation), International Conference on Advanced Technology in Experimental Mechanics, Japan (presentation), DECOVLEX Task force meeting, Czech (presentation), DECOVLEX Task Workshop, Sweden (presentation)

Kiyama, S.: 2nd IASTED Water resources management, USA (presentation)

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level:, Structural Analysis (Kobayashi), Seminar in Rural Facility Engineering (Kobayashi), Applied Mechanics (Kobayashi), Soil Mechanics and Concrete Engineering (Kobayashi), Laboratory Course in Soil Mechanics, Concrete Engineering and Environmental Geotechnique (Kobayashi, Kiyama and Yamamoto), Exercise in Information Processing, Basics (Kobayashi), Introduction to Agricultural and Environmental Engineering I (Kobayashi shear), Seminar in Agricultural and Environmental Engineering (Kobayashi shear).

Graduate level: Planning and Design of Rural Facilities (Kobayashi), Numerical Science of Structural Design (Kobayashi), Laboratory Course in Agricultural Facilities Engineering (Kobayashi), Advanced Course of Data Processing for Design I (Kobayashi), Advanced Course of Data Processing for Design II (Kobayashi)

B-2. Off-campus teaching, etc.

Part-time lecturer

Kobayashi, A.: Tokyo Institute of technology (Underground environment)

B-3. Overseas teaching

Students from abroad

Foreign student (PhD Course): 1 (Bangladesh)

C. Other Remarks

Kobayashi, A.: Member of council for engineering problems in design and construction of dams for irrigation use, Member of the committee for seismic technology of irrigation structures, Member of the committee of performance design of irrigation structures, JIID., Member of committee of dams for irrigation use, Member of committee on long use of dams for irrigation use, JSIDRE, Member of the committee on the research activity of geological

disposal, Member of the committee on the advanced development of chemical effect on disposal system, Japan Nuclear Cycle Development Institute

Kiyama, S.: Party organizer KATSURA river network (voluntary organization), Committee member of lake planning of HIYOSHI dam water resource region, Ministry of land, infrastructure and transport, Committee member of environmental planning of HIYOSHI dam water resource region, Secretariat of AMAWAKA lake art project, Committee member of "Edu-tope" Project of Kyoto city Shirakawa high school of total support.

2.5.10 Laboratory of Water Resources Engineering

Staff *Professor* : *Kawachi, Toshihiko, Dr. Agric. Sci.*
Associate Professor: *Unami, Koichi, Dr. Agric. Sci.*
Lecturer : *Maeda, Shigeya, Dr. Agric. Sci.*
Assistant Professor : *Takeuchi, Junichiro*

Students and research fellows
Doctor's program : *(2)*
Master's program : *(10)*
Undergraduate : *(3)*

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Hydraulic and environmental modeling

Analytical approaches to assessment and prediction of water environment interacting with human activities are explored standing on environmental hydraulics. Major research effort is focused on developing robust, versatile and efficient numerical models for simulating flows and transport phenomena in a wide variety of bodies of water (water conveyance system (open channels or pipelines), rivers, lakes, wetlands, etc.), with the ultimate aim of offering hydraulic and environmental engineers an integrated family of powerful computation tools that encompasses all possible water environmental problems encountered.

b) Optimum management and control of water resources systems

Optimum strategies for management and control of water resources systems are fundamentally investigated to give better answers for tasks of water resources development, management and conservation. Both static and dynamic models are applied for supporting decision makers in agricultural water management, water quality control, and aquatic ecosystem restoration problems. Operation strategy for an irrigation system consisting of storage and conveyance facilities is researched and is experimentally proved to be effective. Stochastic methods are applied to comprehending aquatic ecosystems in rural areas to be strategically conserved. Problems of optimum fertilizer application strategy in open fields using genetic algorithm, etc. are being tackled.

A-2. Publications and presentations

a) Publications

Original papers

Alam, A.H.M.B., J. Takeuchi, and T. Kawachi: Identification and Uncertainty Assessment of Model Parameters of Distributed Runoff Model Using Bayesian Inference. Journal of Rainwater Catchment Systems 13(1); 1-10, 2007

Izumi, T., J. Takeuchi, T. Kawachi, K. Unami, and S. Maeda: An Inverse Method to Estimate Soil Hydraulic Properties in Saturated-unsaturated Groundwater Flow Model. Journal of Rainwater Catchment Systems 13(2); 23-28, 2007

Maeda, S. and T. Kawachi: Fuzzy optimization model for allocating allowable discharged T-N load to point and nonpoint sources. Proceedings of 32nd IAHR Congress, PAPER-310.pdf in CD, 2007

Takeuchi, J., T. Izumi, T. Kawachi, K. Unami, and S. Maeda: Model-based Optimal Design of Land Use Arrangement for Environmentally Sound Watershed Management. Journal of Rainwater Catchment Systems 13(2); 29-33, 2007

Yangyuoru, M., K. Unami, and T. Kawachi: A Prototype Tank Irrigation Scheme with Rainwater Harvesting. Proceedings of International Conference on Rainwater Management for Disaster Mitigation and Sustainable Development; 81-88, 2007

Zhang, Q., S. Maeda and T. Kawachi: Fuzzy optimization model for allocating irrigation water to paddy fields. Trans. of JSIDRE 249; 55-62, 2007

Zhang, Q., S. Maeda and T. Kawachi: Stochastic multiobjective optimization model for allocating irrigation water to paddy fields. Paddy Water Environ. 5(2); 93-99, 2007

b) Conference and seminar papers presented

2007's Annual Conf. of Jap. Soci. Irri. Drain. Recl. Eng.: 4 articles

64th Kyoto-Branch Conf. of Irri. Drain. Recl. Eng.: 4 articles

15th Congress of Jap. Rain. Catch. Sys. Associ.: 6 articles

2007 JSIDRE Workshop of Applied Hydraulics: 2 articles

A-3. Off-campus activities

Membership in academic societies

Kawachi, T.: Rainwater Catchment Systems Association (Executive), Japanese Society of Irrigation, Drainage and Reclamation Engineering (President, Chairperson of Journal Editorial Board)

Unami, K.: Rainwater Catchment Systems Association (Councilor)

Research grants

Monbukagakusho Grant-in-aid: Basic Research (A) Hydro-environmental modeling and optimal management of water-network system in rural area (Kawachi, Unami, Maeda, Takeuchi)

Monbukagakusho Grant-in-aid: Exploratory Research Development and verification of runoff models for sudden floods (Unami)

Monbukagakusho Grant-in-aid: Young Scientists (B) Developing decision support system for river water quality management using integrated GIS-optimization model (Maeda)

Monbukagakusho Grant-in-aid: Young Scientists (B) Development of simulation optimization model for environmentally sound fertilizer application to upland crop field on sloping land (Takeuchi)

A-4. International cooperation and overseas activities

International meetings (roles)

Kawachi, T.: Member of the Steering Committee of 2006 PAWEES International Symposium

Membership in international academic societies

Kawachi, T.: International Water Resources Association/IWRA (Member of Peer-reviewers Committee)

The 32nd IAHR Congress: 1 article

International joint researches, overseas research surveys

Unami, K.: Development and Verification of Runoff Models for Sudden Floods (Ghana)

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Introduction to Agricultural and Environmental Engineering <Part I> (Kawachi), Applied Mathematics (Maeda), Hydraulics (Unami), Water Resources Utilization (Kawachi), Water-Use Systems Engineering (Kawachi), Seminar in Computational Hydraulics (Kawachi, Unami, Maeda), Laboratory Course in Hydraulics (Unami, Maeda), Seminar in Agricultural and Environmental Engineering (Kawachi)

Graduate level: Hydraulic and Environmental Modeling (Unami), Seminar-I in Water Resources Engineering (Kawachi, Unami), Seminar-II in Water Resources Engineering (Kawachi, Unami), Laboratory Course in Water Resources Engineering (Kawachi, Unami)

B-2. Off-campus teaching, etc.

Part-time lecturer

Takeuchi J.: 2007 Workshop of Land and Water Resources (National Institute for Rural Engineering) (Speaker)

B-3. Overseas teaching

Students and research fellows from abroad

Students: Master course/1 (Brazil)

C. Other remarks

Kawachi, T.: Member of the Japan National Council on Food, Agriculture and Rural Policies, Chair of the Consultation Committee for Restoration of Irrigation Tanks in Shiga, Chair of the Council for Environmentally Sound Rural Developments in Fukui, Member of the Council for Local Community Use of Irrigation Water in Yasu River Area, Chair of the Council for Environmentally Sound Kuzuryu-Project Implementation, Member of the Council for Building Flood-Proof Towns in Southern Biwa-Lake Areas

Chair of Land and Water Resources Management

2.5.11 Laboratory of Irrigation, Drainage and Hydrological Environment Engineering

Staff *Professor : Kawashima, Shigeto, Dr. Agric. Sci. (2007.7.1～)*
Lecturer : Nakamura, Kimihito, Dr. Agric. Sci.

Students and research fellows

Doctor's program : (2) *Master's program : (8)*
Undergraduate : (5) *Research fellow : (1)*

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Early detection and prediction of climate warming based on the long-term monitoring of alpine ecosystems on the Tibetan Plateau

The global warming observation system was constructed in the center part and the northern part of the Tibet plateau for the early detection of effects of global warming on ecosystem using the extremely high plateau and we started the long-term monitoring. The continuous meteorological observation at multi points in special high region with holding wide range in observation altitudes like this research is the first attempt in the Tibet plateau which is called the third pole of the earth. The meteorological data obtained by our observation network offers information on the reality how the status of global warming and the influence appear.

b) Hydrological evaluation enhancement of multipurpose functions of agricultural lands and forest area

Evaluation of flood control of a basin (Oshinohara, Shiga). Evaluation of hydrological and meteorological characteristics in forested catchments (Oshinohara, Shiga and Kamigamo, Kyoto). Evaluation of purification function of air pollution by a forest basin and measurement of pH and EC of rainfall and stem flow (Oshinohara, Shiga).

c) Hydro-geological environment management in agricultural area.

Water management of paddy fields as wetland in order to reduce nitrogen load to Lake Biwa (Omihachiman, Shiga). Optimal water management for the environmental agriculture (c.f. the physical and chemical consideration of cyclic irrigation system in paddy field district and groundwater level control for the reduction of nitrogen load) (Konohama, Shiga and Takashima, Shiga). Water management in paddy fields harmonized with ecological system (Yasu, Shiga). Agricultural land accumulation is necessary for sustainable agriculture. Merits of plot-to-plot irrigation system are investigated from standpoints of farming, water use amount and water quality (Takashima, Shiga).

d) Modeling of mass transport of various substances in soil

Effect of infiltration rate on nitrogen transformation characteristics, Model of nitrogen transport in paddy soil. Model of heavy metals transport in vadose zone. Measurement of continuous air content in soil using acoustic wave.

e) Development of the methodology for forecasting the hybridization mating rate of wind pollination crops

In order to promote the development and the popularization of GMO products, the establishment of a scientific technique to evaluate the influence of GMO on conventional crops is indispensable. The forecasting model of the pollen dispersal and the hybridization mating for wind pollination crops such as corn and rice plants is constructed based on the atmospheric diffusion equation and the ecological information of crops. The result of this research quantifies the cultivation conditions of GMO and conventional crops, and contributes to the establishment of the policy criterion to coexist of both.

f) Development of an automatic measurement method for airborne pollen

The environmental impact and safety of genetically modified organisms have become to a social problem. Especially in the wind pollination crops, the pollen diffuses distantly, and there is a possibility to generate the hybridization mating in wide area. It is important to develop the technique for measuring the amount of airborne pollen correctly and speedily in order to assess the environmental effect problems of pollen that causes the hybridization mating. However, conventional measurement method for airborne pollen in the past require much labour and long amount of time. Then, we develop the technique for automatically measuring the amount of airborne pollen. This method is able not only to decrease the amount of labor but also to catch a detailed change in the concentration of airborne pollen.

A-2. Publications and presentations

a) Publications

Original papers

Kawashima, S., B. Clot, T. Fujita, Y. Takahashi and K. Nakamura: An algorithm and a device for counting airborne pollen automatically using laser optics, Atmospheric Environment, 41, 7987–7993.

Yonemura S. and S. Kawashima: Concentrations of carbon gases and oxygen and their emission ratios in the burning of rice seed sheaths in a wind tunnel, Atmospheric Environment, 41, 1407–1416.

Yonemura, S., S. Kawashima, H. Matsueda, Y. Sawa, S. Inoue and H. Tanimoto: Characteristics of temporal variations in ozone concentrations derived from principal component analysis, Theoretical and Applied Climatology, 92, 1434-4483.

Kawashima, S., K. Matsuo, H. Shibaike, Y. Takahashi, S. Inoue, S. Yonemura and M. Du: Effects of biological and meteorological conditions on inter-annual variation in hybrid percentage of maize, Journal of the Palynological Society of Japan, 53, 9-17. (in Japanese)

Nakamura, K. and N. Toride: Numerical modeling of nitrogen transport with first-order transformation processes in soils, Journal of the Japanese Society of Soil Physics 105; 83-97, 2007 (in Japanese)

Hama, T., K. Nakamura, and T. Mitsuno: Mass balances of nitrogen and phosphorus in the paddy field district implementing cyclic irrigation, Transactions of the Japanese Society of Irrigation, Drainage and Rural Engineering 250; 91-97, 2007 (in Japanese with English abstract)

Hama, T., K. Nakamura, S. Watanabe, T. Mitsuno, and R. Kaneki: Reduction of murky water load by cyclic irrigation in a riparian paddy field district, Journal of the Japanese Society of

Irrigation, Drainage and Rural Engineering 75(9); 39-43, 2007 (in Japanese)

Sakata, S., K. Nakamura, and T. Watanabe, and T. Mitsuno: Long-term change of water demand change of paddy irrigation scheme with pipeline system, Journal of the Japanese Society of Irrigation, Drainage and Rural Engineering 75(12); 7-10, 2007 (in Japanese)

Nakamura, K., K. Funamoto, and T. Mitsuno: The fate of nitrogen in paddy applied with methane fermentation manure liquid, Environmental Conservation Engineering 36(9); 23-30, 2007 (in Japanese)

Patents

Patent pending/applied for Patent no. 2007-312961, 'Water-saving system for preventing water leakage from a paddy field', patentee: Nakamura, K., Y. Nakajima, T. Koyama, M. Furukawa, Y. Tamamura, M. Shimizu, Y. Tanaka, S. Koike, N. Nakamura, registration date: Dec. 4, 2007

Reports

Seto, S., S. Sakata, T. Mitsuno, and K. Nakamura: Evaluation of flood control function of a forest basin using averaging time index in the case of Oshinohara basin in Shiga Prefecture; 73-78, Annual report of "Research for water conservation function of a forest", 98p., 2007 (in Japanese)

Morioka, M., R. Sawa, N. Takigami, K. Nakamura, and T. Mitsuno: Monitoring of pH and EC of rainfall, stem flow, and stream in Oshinohara forest basin; 79-89, Annual report of "Research for water conservation function of a forest", 98p., 2007 (in Japanese)

Kawashima, S., K. Nakamura, and S. Sakata: Annual report of "Research for revise of design criteria for irrigation and drainage water and land reclamation in Nanki district"; 29p., 2007 (in Japanese)

Kawashima, S., K. Nakamura, and S. Sakata: Annual report of "Research for revise of design criteria for irrigation and drainage water and land reclamation in Hino river district"; 14p., 2007 (in Japanese)

Horino, H., T. Nakagiri, K. Nakamura, and A. Fukami: Annual report of "Research for revise of design criteria for irrigation and drainage water and land reclamation in the east of Biwa Lake"; 19p., 2007 (in Japanese)

Matsuno, Y. and K. Nakamura : Publication of the Textbook for Agricultural Engineers in Paddy Farming Regions, PAWEES 2007 6th International Conference on Educational Accreditation System and APEC Engineers Project for Agricultural Engineering in Paddy Farming Regions, 2007

Nakamura, K., K. Funamoto, and T. Mitsuno : Nitrogen Management in a Paddy Plot Applied with Methane Fermentation Manure Liquid, Proceeding of PAWEES 2007 6th International Conference on Sustainable Rural Development and Management; 202-221, 2007

Hama, T., K. Nakamura, T. Mitsuno, and S. Kawashima : Relationship between Effluent loadings of Suspended Solids and Nutrients and the Weather Condition in Cyclic Irrigation System, Proceeding of PAWEES 2007 6th International Conference on Sustainable Rural Development and Management; 177-185, 2007

Nakamura, K., Y. Matsuno, and T. Masumoto: PAWEES 2007 6th International Conferences on Sustainable Rural Development and Management and on Educational Accreditation System and APEC Engineers Project for Agricultural Engineering in Paddy Farming

Regions, Journal of the Japanese Society of Irrigation, Drainage and Rural Engineering 76(1); 65-68, 2008 (in Japanese)

b) Conference and seminar papers presented

Annual Meeting of the Japanese Society of Irrigation, Drainage and Rural Engineering in 2007: 11 papers

The 64th Annual Meeting of the Japanese Society of Irrigation, Drainage and Rural Engineering Kyoto Branch: 4 papers

The 49th Annual Meeting of Japanese Society of Soil Physics: 1 paper

Fall Meeting of Japanese Association of Groundwater Hydrology in 2007: 1 paper

Annual Meeting of the Society for Risk Analysis Japan in 2007: 1 paper

Annual Meeting of The National University Corporation Arid Land Research Center, Tottori University in 2007: 1 paper

PAWEES 2007 6th International Conference on Sustainable Rural Development and Management: 2 papers

PAWEES 2007 6th International Conference on Educational Accreditation System and APEC Engineers Project for Agricultural Engineering in Paddy Farming Regions: 1 paper

A-3. Off-campus activities

Membership in academic societies

Kawashima, S.: Japanese Society of Irrigation, Drainage and Rural Engineering, Japanese Society of Allergology, Palynological Society of Japan, Meteorological Society of Japan, The Society of Agricultural Meteorology of Japan

Nakamura, K.: Japanese Society of Soil Physics (Councilor and Member of Editorial Board), Japanese Society of Irrigation, Drainage and Rural Engineering (Member of research council, Member of the subcommittee of strategically research, Member of subcommittee of annual meeting organization, Member of the committee of international technical training of agricultural engineers in irrigation and drainage)

Research grants

Kawashima, S. and K. Nakamura: Research on functions of forest for water environmental conservation (Shiga Prefecture), Research for revise of design criteria for irrigation and drainage water and land reclamation in Nanki district, Research for revise of design criteria for irrigation and drainage water and land reclamation in Hino river district (The Ministry of Agriculture, Forestry and Fisheries Entrust Research)

Nakamura, K. : Monbukagakusho Grant-in-aid Basic Research (B) Proposal of various techniques for environmental paddy water management based on agricultural soil functions (Head: Nakamura, K.), Research and development project of new technology in collaboration with public and private sectors on drainage water management for reduction of management costs and environmental loadings in paddy field areas (Co-researcher)(The Ministry of Agriculture, Forestry and Fisheries Entrust Research), Collaborative research for establishment of evaluation method of a groundwater contamination risk using numerical simulation of heavy metal transport in vadose zone (Kokusai Kogyo Co., Ltd.)

A-4. International cooperations and overseas activities

International meetings (roles)

Kawashima, S.: Third International Conference on Coexistence between Genetically Modified (GM) and non-GM based Agricultural Supply Chains, Seville, Spain. (Invited presenter)

Nakamura, K.: International Society of Paddy and Water Environment Engineering, PAWEES 2007 6th International Conference on Sustainable Rural Development and Management, Seoul (participation)

Nakamura, K.: International Society of Paddy and Water Environment Engineering, PAWEES 2007 6th International Conference on Educational Accreditation System and APEC Engineers Project for Agricultural Engineering in Paddy Farming Regions, Seoul (participation)

International joint researches, overseas research surveys

Kawashima, S.: A joint research on development of automatic measurement technique of airborne biological particles, with Meteo Swiss and Neuchatel University (Switzerland).

Kawashima, S.: Early detection and prediction of climate warming based on the long-term monitoring of alpine ecosystems on the Tibetan Plateau, with Chinese Academy of Science (The People's Republic of China).

Kawashima, S.: Investigation on the coexistence system of genetically modified organisms in EU and the technological development situation, with IPTS (Institute for Prospective Technological Studies) of the European Union.

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Agricultural Hydrology (Kawashima), Irrigation and Drainage (Kawashima), Practice in Irrigation and Drainage Planning (Nakamura), Soil Physics (Nakamura), Laboratory Course in Soil Physics and Hydrological Environment Engineering (Nakamura), Exercises in Information Processing Basic (Nakamura), Seminar in Agricultural and Environmental Engineering (Kawashima and Nakamura)

Graduate level: Seminar in Irrigation, Drainage and Hydrological Environment Engineering I (Nakamura and Kawashima), Seminar in Irrigation, Drainage and Hydrological Environment Engineering II (Kawashima and Nakamura), Laboratory Course in Irrigation, Drainage and Hydrological Environment Engineering (Kawashima and Nakamura), Applied Hydrology (Nakamura)

B-2. Off-campus teaching, etc.

Part-time lecturer

Nakamura, K.: Lecture of “Modeling of nitrogen transport in paddy soil applied with methane fermentation manure liquid” in Soil Physics Division of JSIDRE at Kyushu University (Lecturer, Hakata)

C. Other remarks

Kawashima, S.: Committee member of the research committee concerning pollen dispersal (Ministry of the Environment)

Nakamura, K.: Member of the committee of water environmental conservation (Water quality) (Shiga Prefecture), Member of the council meeting of water environmental conservation in Nishinoko and Ibanaiko basin (Shiga Prefecture)

2.5.12 Laboratory of Rural Planning

Staff *Professor* *: Hoshino, Satoshi, Dr. Agric. Sci.*
Assistant Professor : Kuki, Yasuaki, Dr. Agric. Sci.

Students and research fellows

Doctor's program : (1) *Research student : (1)*
Master's program : (4)
Undergraduate : (8)

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Restructuring of the systems of local resource management by introducing knowledge management

Local resources such as farmland, a mountain, reservoirs, etc. are maintained by the knowledge and skills that has been accumulated in the farmers over many generations. However, the tacit knowledge related to the resource management is not properly succeeded by the next generation but dispersed. There is concern that the resource management will be difficult in many places. The strategy for succeeding to the necessary knowledge for the local resource management is researched introducing the knowledge management as counter measures in this study.

b) Analyse of social capital (SC) for the strategy of revitalisation of rural areas

Cooperation of the local residents is the key issue to accomplish the revitalisation of rural areas. We supporse that social capital is one of the most important factors to build up the system of cooperation. This study aims to analyse the correlation between the revitalisation of rural areas and social capital from the point of view of the policy of the decoupling for the mountainous area. Considering the strategy that strengthens the SC is also the part of this study aim as well

c) Consideration of measures to prevent agricultural damage by wildlife in mountainous areas

The agricultural damage caused by wildlife, especially wild boar, and the measures to prevent the damage by farmers are investigated in Wakayama Prefecture. This study focus on the relation between the farmers' attitude and the farmers' profile, as well as the non-farmers' attitude toward the agricultural damage caused by wildlife. The goal of this study is consideration of the problems in order to set the measures to prevent the agricultural damage caused by wildlife under the residents' participation using workshop methods, and the measure suitable for the study area will be conducted and the effectiveness of the measures will be evaluated.

A-2. Publications and presentations

a) Publications

Books

Hoshino, S.: Perspective of the Rural Potential, Potential of rural areas(edited by Takahashi et al.), 225-236, Shouwado, Kyoto, 2007(in Japanese)

Hoshino, S.: Planning by rural residents' wisdom, Potential of rural areas(edited by Takahashi et al.), 248-258, Shouwado, Kyoto, 2007(in Japanese)

Hoshino, S.: "Rural Development in China", the "Suido no chi wo kataru" series, 13, 96-121, 184-200, Japanese Institute of Irrigation and Drainage, Tokyo, 2007(in Japanese)

Original papers

Yamashita R. and S. Hoshino: The availability of the multi-agent simulation as a planning tool for regional paddy field farming conservation. Journal of Agricultural Management in Kanto and Tokai District 98; 13-27, 2008 (in Japanese)

Hoshino S. and Wuritu: Features and problems of the New Village Construction Program in China. -Giving attention to the Village Council as a Farmers' Receiving Organization- Journal of Rural Planning Association 26(4); 427-433, 2008 (in Japanese)

Wuritu and S. Hoshino: The problems of the New Town Construction policy in the western part of China. -A case study of Otog Province in Inner Mongolia Self-Governing Ward- Journal of Rural Planning Association 26(Special); 377-382, 2007 (in Japanese)

Fujiyoshi H., T. Ushino, Y. Kuki and S. Hoshino: Grasping problems and analyzing trends of customers with customer satisfaction investigation in farmers markets. Journal of Rural Planning Association 26(Special); 329-334, 2007 (in Japanese)

Kinoshita D., Y. Kuki, E. Takeyama and S. Hoshino: Present conditions of measures to prevent agricultural damage caused by wildlife and residents' attitudes in Wakayama Prefecture. Journal of Rural Planning Association 26(Special); 323-328, 2007 (in Japanese)

Nakatsuka M. and S. Hoshino: Problems and perspective of autonomous organization in elementary school division. -Case study of Kusayama District, Sasayama City, Hyogo Pref.- Journal of Rural Planning Association 26(Special); 299-304, 2007 (in Japanese)

Itakura A., S. Hoshino and M. Nakatsuka: New partnerships among parents by children and community development. Journal of Rural Planning Association 26(Special); 293-298, 2007 (in Japanese)

Yamaguchi S., M. Nakatsuka and S. Hoshino: Study on region characteristic and settlement in rural area. -A case of Sasayama City, Hyogo Prefecture- Journal of Rural Planning Association 26(Special); 287-292, 2007 (in Japanese)

Mizutani Y., S. Hoshino and R. Yamashita: A study on the conflicts between participant subjects and its solution mechanism in the consensus building about the preservation activity for irrigation pond applying Drama Theory. -Focusing on the activities consociation of Terada Pond in Kakogawa City, Hyogo Prefecture- Journal of Rural Planning Association 26(Special); 269-274, 2007 (in Japanese)

Hoshino S. and R. Yamashita: The effectiveness of the model for regional agricultural planning by the multi-agent simulation. Agricultural and Rural Development Information Center 87; 36-41, 2007 (in Japanese)

Yamashita R. and S. Hoshino: The evaluation of "the comprehensive method for the land consolidation" based on the prior estimation of its effectiveness. -Case study of Misato

Town, Akita Prefecture- Transactions of the JSIDRE 75(4); 27-37, 2007 (in Japanese)

Yamashita R. and S. Hoshino: The examination about the influence of the accuracy of agricultural management information for future prediction of states of regional paddy agriculture. -The applicable condition of a multi-agent model "ASMAP"- Journal of the Association for Regional Agricultural and Forestry Economics 43(1); 161-166, 2007 (in Japanese)

Wuritu and S. Hoshino: The innovation and problems of a local administration organization in China. Journal of the Association for Regional Agricultural and Forestry Economics 43(1); 206-211, 2007 (in Japanese)

Reports

Hoshino, S.: Research report on rural development in China. JIID, 181-202, 2008 (in Japanese)

Hoshino, S.: Commissioned-business report on revision of planning criteria. JSIDRE, 112-114, 2008 (in Japanese)

Hoshino, S.: Commissioned-business report on reorganization of rural communities, in Kutsuki Harihata District in Siga Prefecture, 103-104, 2008 (in Japanese)

Kuki, Y.: Research project of the measures to prevent agricultural damage caused by wildlife in Wakayama Prefecture. Wakayama Prefecture, 1-41, 51-114, 135-160, 2008 (in Japanese)

b) Conference and seminar papers presented

2007 spring conference of the Association of Rural Planning: 5 papers

2007 autumn conference of the Association of Rural Planning: 7 papers

2007 annual meeting of the Japanese Society of Irrigation, Drainage and Reclamation Engineering: 1 paper

The 64th annual meeting of Kyoto branch of the Japanese Society of Irrigation, Drainage and Reclamation Engineering: 2 papers

A-3. Off-campus activities

Membership in academic societies

Hoshino, S.: Association of Rural Planning (board of directors, head of the international exchange committee), Japanese Society of Irrigation, Drainage and Reclamation Engineering (head of the committee for revision of planning criteria)

Research grant

Kuki, Y.: Study on the choice of measures to prevent agricultural damage by wildlife considering agricultural characteristics and social structures in Wakayama Prefecture (Wakayama Prefecture)

A-4. International cooperations and overseas activities

International joint researches, overseas research surveys

Hoshino, S.: Empirical research of the New Village Construction Policy (China), Comparative study of Rural Development Engineering (China)

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Rural planning (Hoshino), Land consolidation engineering (Hoshino), Surveying (Hoshino), Rural planning and practice (Hoshino and Kuki), Practice in

surveying (Hoshino and Kuki)

Graduate level: Rural environmental planning (Hoshino), Special seminar in rural planning I (Hoshino), Special seminar in rural planning II (Hoshino), Laboratory course in rural planning (Hoshino)

C. Other Remarks.

Hoshino, S.: Member of the independent committee for "Policy Measures to Conserve and Improve Land, Water and Environment" (Rural Development Bureau, Ministry of Agriculture, Forestry and Fisheries of Japan), Member of the committee of new policy evaluation method for rural areas development (RDB, MAFF), Member of the committee of landscape planning system for rural areas (RDB, MAFF), etc.

Kuki, Y.: Member of the JSIDRE committee of consideration of Japanese rural beauty, Member of the committee of comprehensive rural improvement plan in North Harima region (Kinki Regional Agricultural Administration Office)

Chair of Bioproduction Engineering

2.5.13 Laboratory of Agricultural Systems Engineering

Staff *Associate Professor: Nakashima, Hiroshi, D. Agric. Sci.*
Assistant Professor : Miyasaka, Juro, M. Agric. Sci.
Assistant Professor : Ohdoi Katsuaki, D. Agric. Sci.

Students and research fellows
Master's program : (5)
Undergraduate : (5)

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Terramechanics

The Discrete Element Method is applied to elucidate the interaction between machine parts and soil. We are now simulating the soil behavior caused by a tire. Some effective methods are under study, such as combining DEM and FEM, or parallel processing of DEM. Experimental researches on tire mobility by using an indoor soil bin and bionics study to reduce the draft of cutting blade are also conducted. Moreover, numerical analysis of turning behavior of articulate-frame steering vehicle has been studied.

b) Development of electric agricultural vehicle using microwave power transmission

A no-emission vehicle is under development in order to contribute the environmental conservation. A test electric vehicle, which has no battery but only electric motors which are driven by electricity transmitted in form of microwave, is designed, made and tested. In order to improve the transmission efficiency a parabola antenna, direction control of antennae and a radio

data transmission method are tried.

c) Systems engineering study on farm management, mechanization and rural development

The optimum cultivation system is studied to maximize the income of competitive vegetable farmer by means of a simulated annealing method.

d) Biomass energy

It is clear that the fossil energy resources will be exhausted and the energy production by way of recycling agricultural wastes will be one of the necessary technologies in future. We are now investigating the efficient production of methane gas.

e) Root growth simulation

An approach of model construction by applying dynamic contact interaction has also been studied.

A-2. Publications and presentations

a) Publications

Original papers

Nakagawa, S., Y. Yamanaka, K. Ohdoi, J. Miyasaka, H. Nakashima: Development of an electric vehicle by microwave power transmission—Detection of vehicle's position using image processing for control of direction of antenna—, Report of 7th SPS Technical Group, 27–34, 2008

Tangwongkit, B., R. Tongwongkit, V. M. Salokhe, H. P. W. Jayasuriya, H. Nakashima: Field evaluation of a variable rate herbicide applicator. Agricultural Information Research 17 (1); 1–5, 2008

Tada, S., K. Ohdoi and H. NAKASHIMA: Dynamic Optimization of Farm-Work Schedules by Genetic Algorithm. Proceedings of the International Agricultural Engineering Conference 2007, Bangkok; 2007 (CD-ROM)

Yamashita, W., K. Ohdoi and H. Nakashima: Research of Model and Expression Indicating Decomposition of Substrate and Gas Generation in Methane Fermenter Fed Wheat Bran. Proceedings of the International Agricultural Engineering Conference 2007, Bangkok; 2007 (CD-ROM)

Khot, L. R., V. M. Salokhe, H. P. W. Jayasuriya, H. Nakashima: Experimental validation of distinct element simulation for dynamic wheel-soil interaction. Journal of Terramechanics, 44(6); 429–437, 2007

Soni, P., V. M. Salokhe, H. Nakashima: Modification of a mouldboard plough surface using arrays of polyethylene protuberances. Journal of Terramechanics, 44(6); 411–422, 2007

Oida, A., H. Nakashima, J. Miyasaka, K. Ohdoi, H. Matsumoto, N. Shinohara: Development of a new type electric off-road vehicle by means of microwave power transmission in the air. Journal of Terramechanics 44(5); 329-338, 2007

Karoonboonyanan, R., V. M. Salokhe, T. Niyamapa, H. Nakashima: Vibration effects on the performance of a single-shank subsoiler. Agricultural Engineering International, The CIGR E-journal; Manuscript PM 07 018, Vol. IX, September, 2007

Lungkapin, J., V. M. Salokhe, R. Kalsirisilp, H. Nakashima: Development of a stem cutting unit for cassava planter. Agricultural Engineering International, The CIGR E-journal, Manuscript PM 07 008, Vol. IX, July, 2007

Nakashima, H., Y. Takatsu: Some improvements on soil-tire interaction analysis by FE-DEM.

Proceedings of the Joint North America, Asia-Pacific ISTVS Conference and Annual Meeting of Japanese Society for Terramechanics, Fairbanks, ISTVS-2007-22-0416, 1–11, 2007

Nakashima, H., T. Konishi, Y. Toki: Numerical analysis for cone penetration of mesoscopic soil Model. Proceedings of the Joint North America, Asia-Pacific ISTVS Conference and Annual Meeting of Japanese Society for Terramechanics, Fairbanks, ISTVS-2007-31-0319, 1–9, 2007

Nakashima, H., Y. Toki, T. Konishi: Some experimental observations on cone penetration of mesoscopic soil model. Proceedings of the Joint North America, Asia-Pacific ISTVS Conference and Annual Meeting of Japanese Society for Terramechanics, Fairbanks, ISTVS-2007- 31-0420, 1–11, 2007

H. Nakashima, H., Y. Shioji, T. Kobayashi, S. Aoki: Numerical analysis of sand flow under low gravity condition. Proceedings of the Joint North America, Asia-Pacific ISTVS Conference and Annual Meeting of Japanese Society for Terramechanics, Fairbanks, ISTVS-2007-62- 0147, 1–10, 2007

Ramirez, A. A., A. Oida, H. Nakashima, J. Miyasaka, K. Ohdoi: Mechanization index and machinery energy ratio assessment by means of an artificial neural network: a Mexican case study. Agricultural Engineering International, The CIGR E-journal; Manuscript PM 07 002, Vol. IX, May, 2007

Nakashima, H., H. Fujii, A. Oida, M. Momozu, Y. Kawase, H. Kanamori, S. Aoki, T. Yokoyama: Parametric analysis of lugged wheel performance for a lunar microrover by means of DEM. Journal of Terramechanics 44(2); 153-162, 2007

Reports

Ogino, Y., J. Miyasaka, A. Oida, H. Nakashima: Optimization of growing plan of mizuna for stabilization of production (in Japanese). Kansai Branch Report of JSAM 103; 38-39, 2008

Nakashima, H., H. Shinone: Effect of tread pattern of tires on tractive performance (in Japanese). Kansai Branch Report of JSAM 102; 2, 2007

Nakashima, H., Y. Toki: On cone penetration resistance and particle shape in mesoscopic soil model (in Japanese). Kansai Branch Report of JSAM 102; 3, 2007

Nakashima, H., Y. Shioji: DEM analysis of sand flow under low gravity conditions (in Japanese). Kansai Branch Report of JSAM 102; 9, 2007

Nakashima, H., Y. Takatsu: Fast analysis of soil-tire interactions (in Japanese). Kansai Branch Report of JSAM 102; 10, 2007

Saito, H., J. Miyasaka, H. Nakashima, M. Shinohara, T. Mitani: Effect of 2.45 GHz microwave on the initial growth of plant—Possibility of active germination, elongation and increase of Chlorophyll—(in Japanese). Kansai Branch Report of JSAM 102; 30, 2007

Iwai, Y., J. Miyasaka, H. Nakashima: 3D simulation of root by cellular automaton—Introduction of water diffusion model and evaluation using fractal—(in Japanese). Kansai Branch Report of JSAM 102; 45, 2007

b) Conference and seminar papers presented

Joint North America, Asia-Pacific International Conference of ISTVS and Annual Meeting of Japanese Society for Terramechanics, Fairbanks, USA: 4 papers

Joint Meeting on Environmental Engineering in Agriculture 2007: 6 papers

118th Meeting of Kansai Branch of JSAM: 4 papers

119th Meeting of Kansai Branch of JSAM: 4 papers

International Agricultural Engineering Conference, Bangkok, Thailand: 2 papers

7th Meeting of SPS Technical Group: 1 paper

Annual Meeting of JSAM: 3 papers

A-3. Off-campus activities

Membership in academic societies

Nakashima, H.: JSAM (Councilor, Member of Planning Committee), Kansai Branch of JSAM (Secretary), Japanese Society for Terramechanics (Member of Lunar Mechanics Committee)

Miyasaka, J.: Kansai Branch of JSAM (Member of Planning Committee)

Research grants

Monbusho Research Grant: Exploratory Research: Expression of root elongation and enlargement based on a dynamic contact interaction with surrounding soil environments (Project Leader: Nakashima)

A-4. International cooperation and overseas activities

International meetings (roles), etc.

Nakashima, H.: Joint North America, Asia-Pacific International Conference of ISTVS and Annual Meeting of Japanese Society for Terramechanics, Fairbanks, USA. (Session Chairman, Presentation)

Membership in international academic societies

Nakashima, H.: ISTVS (Secretariat of Japan)

International Journals

Nakashima, H.: Journal of Terramechanics (Associate Editor), Agricultural Engineering Journal of AAAE (Editorial Board Member)

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Applied Mechanics (Nakashima, shared), Strength of Materials (Nakashima), Energy and Prime Movers in Agriculture (Nakashima), Laboratory Course in Agricultural Machinery I (Nakashima, Miyasaka, Ohdoi, shared), Laboratory Course in Agricultural Machinery II (Nakashima, Miyasaka, Ohdoi, shared), Practice in Data Processing (Nakashima and Miyasaka, shared), Seminar in Agricultural Machinery (Nakashima, Miyasaka, Ohdoi, shared), Seminar in Agricultural and Environmental Engineering (Nakashima, Miyasaka, Ohdoi, shared), Practice in Data Processing II (Nakashima, and Ohdoi, shared)

Graduate level: Terramechanics (Nakashima), Special Seminar in Agricultural Systems Engineering I and II (Nakashima), Laboratory Course in Agricultural Systems Engineering (Nakashima)

B-3. Overseas teaching

Students and research fellows from abroad

Visiting Professor: 1 (AIT, Thailand)

C. Other remarks

Awards

Nakashima, H.: Best Poster Award (3rd Prize) at Joint North America, Asia-Pacific International Conference of ISTVS and Annual Meeting of Japanese Society for Terramechanics

2.5.14 Laboratory of Field Robotics

Staff *Professor* : *Umeda, Mikio, Dr. Agric. Sci.*
Associate Professor: *Iida, Michihisa, Dr. Agric. Sci.*
Assistant Professor : *Suguri, Masahiko, Dr. Agric. Sci.*
Assistant Professor : *Masuda, Ryouhei, M. Agric. Sci.*

Students and research fellows

Teaching assistant	*: (2)*	*Overseas special research fellow*	*: (1)* (～2007.6)
Doctor's program	*: (1)*	*Master's program*	*: (7)*
Undergraduate	*: (9)*		
Research fellow	*: (1)*		

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

It is afraid that a un-balance of the material cycle due to increase in the food import deteriorates environment in Japan.

This laboratory researches mainly on precision agriculture and field robot based on the thought with "Food should be produce within the country to preserve an environment of the country" and "Agriculture has always adopted the most advanced technology of the age."

a) Precision agriculture based on the field map and variable rate fertilizer application.

The Precision agriculture is the information-orientated agriculture that the field is separated virtually into small fields, and fertilizer is implicated based on the soil condition, plant growth and grain yield on those small fields, and copes with stabilization of the yield and the quality of the products and protection of the environment.

In order to decide the amount of fertilizer, the nutriment in the soil and the amount of growth must be measured. This laboratory in cooperation with Laboratories of Plant Production Systems and Soil Science starts research on precision agriculture in 1997. In 2007, the field tests were conducted in Yagi and Takatsuki.

b) Estimation of nitrogen contents of rice plant using remote sensing.

The ideal amount of topdressing fertilizer is the amount possess subtracts from the necessity. Plant growth sensor is required to estimate the nitrogen possessed by the plant. In 2007, both basal- and top-dressing were applied at the prescribed variable rate in a paddy field (0.5ha) of the

Takatsuki Experimental Farm, Osaka, Japan. After that, the airborne images were taken using hyper-spectral and multi-spectral meter in order to estimate the plant growth.

c) Estimation of nitrogen contents and proper time of harvesting for tea plant using remote sensing.

Tea cultivation requires enormous amounts of nitrogen fertilizer. Therefore, it is important to analyze the relationship between the amount of applied nitrogen and the quality of tea The quality of the tea and the optimum time of plunking were estimated using the portable plant growth measuring device and hyper-spectral camera.

d) Grain yield mapping by using a head-feeding combine with a grain yield monitor.

A head-feeding combine equipped with a grain yield monitor has been developed by collaboration with Mitsubishi Agricultural Machinery Co., Ltd. We measured grain yields in several paddy fields in Shiga, Kyoto, and Osaka Prefectures, and then grain yield maps, which showed the spatial valiability of grain yield in the field, were made by processing the measured data.

e) Measurement of power distribution of a head-feeding combine to harvest rice.

It is important to optimize the distribution of an engine power to harvest rice efficiently. Therefore, in order to measure the power required at each section of the combine during harvesting rice, we conducted a field test. In this test, we measured the relationship the power required powers at travelling, cutting , threshing, separating, and unloading sections versus the grain flow to the combine as an input.

f) Development of liquid fertilizer applicator for methane fermentation digested sludge.

In order to apply methane fermentation digested sludge as liquid fertilizer, liquid fertilizer applicators have been developing. A slurry injector is used for basal dressing. This machine is installed a GPS and electric-hydraulic valve control system in order to adjust the amount of fertilizer according to speed and position. It was used to apply the digested sludge in two paddy fields. In addition, a new liquid applicator is developed for top-dressing. This machine can adjust the amount of fertilizer by control of the rotational speed of three pumps. It was used to apply the concentrated digested sludge in a paddy field.

g) Development of a LCD controller for field operation support.

In past researches, a note PC was used to control a machine and display data in variable application of fertilizing and seeding. However, it is important to improve easy operation, mobility, and power supply. Therefore, a LCD controller equipped with a readable/recordable device was developed to support field operation.

h) Research about mechanical properties and geometric characteristics of parenchyma.

It seems that geometric characteristics of plant cell parenchyma, e.g. shape of the parenchyma cells and distribution of the cells, influence upon mechanical properties of parenchyma. We have given consideration to the geometric characteristics of calotte parenchyma by using images taken with the confocal laser microscope. 2-dimensional Fourier analysis and Gabor filter were used for image analysis.

i) Threshing of colza with head-feeding type combine harvester

In order to reduce the emission of CO_2 , biodiesel fuel of colza oil is expected as one of alternatives of fossil fuel. Because colza can be cultivated as altercrop of rice. Colza is harvested by conventional combine harvester, but if it could be harvested by head-feeding type combine, it has advantage in energy efficiency and machine cost. Therefore threshing ability and power

requirement was tested.

j) observation of wet rice grain on grainpan

Wet grains stick on grainpan and interfare conveying or cleaning in a combine harvesters. It is necessary to prevent from sticking like them. The movement of wet rice grain on grainpan and effect of water-repellant coating were observed.

A-2 Publications and presentations

a) Publications

Books

Umeda, M., T. Inamura (Yamasue, Y., Ed), 2008 (March): Agiricultural Science in 21st Century, Chapt 8 Remote Sencing and Agiricultural Prodction, p221-248, Kyoto Univerity Publishing, 2008 (March)

Original papers

Yao, Y., Iida, M., Nonami, K., Kimura, A., Nishikori, M., 2007 : Model of grain return flow for separating section of head-feeding combine, JSAM, 69(1), 37-41.

Ryu, C., Suguri, M., Iida, M., Umeda, M., 2007 : Validation of rice taste elements influenced by amounts of nitrogen fertilizer and estimation using remote sensing, JSAM, 69(1), 52-58.

Ryu, C., Ueda, T., Suguri, M., Iida, M., Umeda, M., 2007 : Application of methane digested slidge for paddy, Journal of Resource Recycling Section of JSIDRE, 2, 59-69.

Ikenaga, S., Goto, K., Suguri, M., Umeda, M., Inamura, T., 2007: Geostatistical Analysis of Spatial Variability of Paddy Rice Nitrogen in Paddy-Upland Rotational Fields for Extension of Precision Agriculture, Journal of JSAM 69(2), 69-78.

Nishikawa, T., F. Ching, H. Inoue, M. Umeda, 2007: Effect of continues application of methane fermented digestied sludge to growth, yield and, total nitrogen, total carbon and mineralized nitrogen generation, Kinki crop and breeding study, 52, 53-58.

Kang, D. H., Min, Y. B., Iida, M., Umeda, M.,2007: A basic study of hexapod walking robot (in Korean with English abstract), Journal of Biosystems Engineering,32(5),1-9.

Sakai, S., Iida, M., Osuka, K., Umeda, M.,2007: Design and control of a heavy material handling manipulator for agricultural robots (in English), Autonomous robots,*accepted*.

Sakai, S., Osuka, K., Maekawa, T., Umeda, M., 2007: Robust Control Systems of a Heavy Material Handling Agricultural Robot: A Case Study for Initial Cost Problem, IEEE TRANSACTION ON COTROL SYSTEMS TECHNOLOGY, 15 (6), 1038-1048, November.

Reports

Iida, M., Takata, H., Fukuta, M., Umeda, M., 2007：Development of a small mobile robot for "Field Robot Event" －Travelling units of robot－、Reports of Kansai Branch of JSAM, 102, 42.

Iida, M., Fukuta, M., Takata, H., Umeda, M., 2007：Development of a small mobile robot for "Field Robot Event" －Sensors of robot－、Reports of Kansai Branch of JSAM, 102, 43.

Takeshita, M., Iida, M., 2007 : Moisture measurement of a single grain of brown rice using NIR, Proceedings of Joint Meeting 2007 of Environmental Engineering in Agriculture (CD-ROM), 00230.pdf.

Masuda, R., Soneda, T., Umeda, M., 2007 : Target approaching of autonomous mobile robot based on concise local map, Reports of Kansai Branch of JSAM, 102, pp53.

Suguri, M.,Kurimoto,T., Ryu C., ASAI, A., Umeda, M., 2007: Estimasion of quality and optimam time for plucking with reflectance of Tea Canopy,Report of Kansai Branch of

JSAM,102,pp18

Iida, M., Higurashi, T., Nonami, K., Nakagawa, Y., 2007; Application technology of organic liquid fertilizer, Proceedings of Joint Meeting 2007 of Environmental Engineering in Agriculture (CD-ROM), 00231.pdf.

Iida, M., Inamura, T., 2008 : Variable rate applicator for wheat seeing and fertilizeing to make wheat establishment uniform, Research reports of Precision Upland Farming, Project supported by MAFF, 38-39.

Iida, M., Higurashi, T., Nonami, K., 2007; Development of a liquid fertilizer applicator technology for top-dressing, Proceedings of Annual meeting 67 of Japanese Society of Agricultural Machinery.

Masuda, R. Field surveillance by multi-robot system using topological map, Proceedings of the international workshop on agricultural and bio-systems engineering, Ho Chi Minh, Vietnam, Dec. 2007, pp291-296.

Ryu, C.S., Suguri, M., Kurimoto, T., Umeda, M.,: Application of precision agriculture to green tea management, In Proc. 2nd ACPA, Ansung, Korea,/ in CD-Rom, 2-4 Aug, 2007, ACPA: Asian Conference on Precision Agriculture.

Ryu, C.S., Suguri, M., Ueda, T., Iida, M., Umeda, M., 2007: Application of precision agriculture to recycling of biomass, In Proc. 2nd ACPA, Ansung, Korea,/ in CD-Rom, 2-4 Aug.

Kurimoto, T., Ryu, C.S., Suguri, M., Umeda M., 2007: Estimation of optimal plucking time of green-tea using canopy reflectance,In Proc. 2nd ANDE, Busan, Korea,/ Paper No. 2007-417, 17~19 Oct. 2007, ANDE : International conference on Advanced Nondestructive Evaluation.

Suguri, M., Ryu, C.S., Umeda, M., 2007: Estimation of quality and quantity of Green-tea by hyperspectral image, In Proc. 2nd ANDE, Busan, Korea, Paper No. 2007-413, 17~19 Oct.

Ryu, C.S., Suguri, M., Umeda, M., 2007: Estimation of nitrogen content of rice using hyperspectral remote sensing, In Proc. 2nd ANDE, Busan, Korea, Paper No. 2007-412, 17~19 Oct.

Ueda, T., Ryu, C.S., Suguri, M., Umeda, M., 2007: Investigation of rice taste elements at wide area, using remote sensing and GIS technology, In Proc. 2nd ANDE, Busan, Korea, Paper No.2007-414, 17~19 Oct.

Kang, D. H., Min, Y. B., Iida, M., Umeda, M., 2007: A basic study of hexapod walking robot, Proceedings of the KSAM 2007 Summer Conference, 12(2), 373-376.

Iida, M., Fukuta, M., Tamaki, H. 2007: Proceedings of the 5th Field Robot Event in Netherlands, June 14-16, 2007, 52-62.

International

The Field Event 2007, Netherlands, Wageningen : Poster (1)

International workshop on agricultural and bio-systems engineering, Ho Chi Minh, Vietnam: 1 presentation

The 2nd Asian Conference on precision agriculture, Korea, Pyeongtaek : (2)

The 2nd International Conference on Advanced Nondestructive Evaluation, Korea, Busan : (4)

Domestic

Joint Meeting of Environmental Engineering in Agriculture: 2 presentations

118th Regular Meeting of Kansai Branch of JSAM: 1 presentation

119th Regular Meeting of Kansai Branch of JSAM: 5 presentations

Annual Meeting 67 of Japanese Society of Agricultural Machinery: 1 presentation
Agricultural Informatics and System Section of Scienece Council of Japan : 1 presentation

A-3. Off-campus activities

Membership in academic societies (roles)

Umeda, M.: JSAM (Japanese Society of Agricultural Machinery, Director, Chairman of Program Committeer), JSAI (Japanese Society of Agricultural Informatics, Director)

Iida, M.: JSAM (Councilor), Robotic Society of Japan, Japanese Society of Agricultural Informatics

Suguri, M.: JSAM

Masuda, R.: JSAM

Research grant

Research Grant of Japanese Science Promotion Society (JSPS): Scientific Research (B)(2) "Development of crop management in consideration of soil, crop growth and grain yield variation." (Participant: M. Iida)

Accepted Research from Ministry of Agriculture, Forestry and Fisheries: "Development of technical bio-resource recycling solutions of methane fermentation digested sludge by application as liquid fertilizer" (Representative: Umeda. M.)

Accepted Research from Ministry of Agriculture, Forestry and Fisheries(BRAIN): "Evaluation of portable crop growth information measurement device" (Representative: Umeda. M.)

Industry-University Co-operation Project: "Quality analyzer of a single kernel of brown rice" Satake Co., Ltd. (Representative: Umeda. M., Participant: M. Iida)

Industry-University Co-operation Project: "Cornering control for articulated steered vehicle" Shin Caterpillar Mitsubishi Co., Ltd. (Representative: Umeda. M., Participant: M. Iida)

Co-operation Research Project: "Investigation of rice taste in Yagi (Subsidy Project for Creation of Biomass Circle)", (Representative: Umeda. M.)

Co-operation Research Project: "Measurement of spatial variability of sludge in case that methane fermentation digested sludge is applied with irrigated water (Subsidy Project for Creation of Biomass Circle)", (Representative: Umeda. M. Participant: M. Iida, M. Suguri)

Co-operation Research Project: "Development of uniform application system of basal dressing using methane fermentation digested sludge (Committal Research Project)", (Representative: Umeda. M. Participant: M. Iida)

A-4. International cooperation and overseas activities

Membership in international academic societies

Umeda, M.: International Commission of Agricultural Engineering (CIGR) (Chairperson of Section IV), Asian Conference on Precision Agriculture (ACPA) (Director), Asian Association for Agricultural Engineering (AAAE, Country representative of Japan), American Society of Agricultural and Biological engineering (ASABE)

Iida, M.: American Society of Agricultural and Biological engineering (ASABE)

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level: Field Robotics (Umeda), Introduction to Foreign Literature in Agricultural Machinery (Umeda), Design of Machine Elements (Umeda), Practice in Computer Aided Design (Umeda and Masuda), Vibration (Iida), Automatic Control (Iida), Applied Mathematics (Iida and others), Laboratory Course in Agricultural Machinery I (Iida, Suguri, Masuda and others), Laboratory Course in Agricultural Machinery II (Iida, Suguri, Masuda and others), Practice in Data Processing II (Iida, Masuda and others), Seminar in Agricultural Machinery (Umeda, Iida, Suguri, Masuda and others), Science of Life Sphere (Umeda and others), Selected Technologies of Food and Agriculture (Umeda and others), Seminar in Agricultural and Environmental Engineering (Umeda, Iida, Suguri, Masuda and others), Experiments in Physics (Masuda and others), Life/Food/Environment and Physics (Umeda)

Graduate level: Advanced Seminar in Field Robotics I (Umeda and Iida), Advanced Seminar in Field Robotics II (Umeda, Iida, Suguri and Masuda), Laboratory Course of Field Robotics (Umeda, Iida, Suguri and Masuda), Field Robotics (Advanced cource) (Umeda)

B-2. Off-campus teaching and others

Part-time lecturer

Umeda, M.: Kobe University (Technology, Society and Ethics)

B-3. Overseas teaching

Lectures and seminars

Umeda, M.: Lecture "Introduction to Precision Agriculture" in JICA Course of low input production system.

Students and research fellow from abroad

Doctor's program 1 (Korea)

C. Other Remarks

Umeda, M.: (On-campus) Depertment of Agricultural and Environmental Engineering (Chairperson), School Affairs Committee(Member), Assessment Committee (Member), Experimental Farm Council (Member of council), Information System Management committee (Member), Information Security Committee (Member), Research Promotion Committee (Member), Basic Education Committee/Physical Subject Section (Member)
(Off-campus) Science council of Japan (Extended Member), Japan Organics Recycling Association; Special Committee for Recycling System of Bio-waste-materials of Technical Committee of (Chairperson), Japanese Asociation of Rural Reciycing Resouce Solution; Biomass Utilization Information Committee (Member), Methne Formation Test Plant System for Rural Area Committee (Member), Agriculture Promption Association; Large Scale Farm Management Committee (Member), Biogas Utilization Council; Biomass Promotion committee (Member)

Iida, M.: (On-campus) Member of Space Collaboration System Committee, Member of Working Group for PFI Construction, Member of Annual Report 2006 Committee

Suguri M: (On-campus) Member of KAIS Steering Committee

Masuda R: (On-campus) Observer of Experimental Drain from the Facility of Bio-production Engineering

2.5.15 Laboratory of Agricultural Process Engineering

Staff *Professor* *: Kondo, Naoshi, Dr. Agric. Sci.*

Assistant Professor : Nishizu, Takahisa, Dr. Agric. Sci.

Students and research fellows

Foreign research associate: (1) *Special research student: (2)*

Master's program *: (7)* *Undergraduate* *: (5)*

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Clarification of formative mechanism of uneven grain moisture in silo and the monitoring

Unevenness of grain moisture forms during storage, even if the silo were charged with uniform moisture grain. In order to elucidate the formative mechanism of the uneven grain moisture layer, the moisture transfer and dew condensation in grain silo caused by temperature difference and the measurement of moisture distribution in grain layers using time-domain reflectometry (TDR) and TDT are being studied.

b) Visualization and image measurement of a small amount of remaining rice bran by heating method

If a simple method to detect a small amount of residual rice bran or complete removal of bran layer is developed, it is ideal for the inspection of no rinse rice and the control of the rice mill machine. We discovered that remaining rice bran changes color and become visible easily by only heating polished rice. Polished rice is heated to about 200℃ by infrared rays, the rice bran that changes color easily than endosperm is scorched and visualized and the method of analyzing the images is being developed.The method is simple, and it is possible to view the remaining rice bran with a microscope image definitely and to know whether rice bran was completely removed or not regardless of whiteness level or variety. It can be applied to ideal control, monitoring of rice polishing process and inspection of no-rinse rice, therefore we are studying with the company.

c) Automatization for Breeding and Controlling the Cattle

In order to recognize the individual cattle and breed it, we are developing the technologies through which the individual cattle is identified with its vocalization. The voice spectra of the cattle are estimated with the maximum entropy method to characterize the vocalization in the frequency domain. The parameters involved in the estimated power spectra are utilized to identified the individual cattle through the discriminant analysis. In the present step of this research, the judgment of the cattle's physiological conditions is the target.

The black-and-white pattern on the milking cow (Holstein) is analyzed to recognize the individual animal. And the image of the face of cow is analyzed to identify the individual. The image of the iris pattern is analyzed for individual recognition of the cattle.

d) Nondestructive Quality Evaluation of Food Stuff by Ultrasound

The effects of the chemical constituents and the non-homogeneous structure of the agricultural products to their physical properties are investigated systematically in order to apply these physical properties to obtaining the internal information of the agricultural products and the foods nondestructively. Currently, the liquified foods and starch gel are used as the samples to evaluate the state of the water contained in the food and to measure the concentration of emulsion with the non-linear acoustic parameter B/A which is one of the acoustic characteristics of the material. And the influence of intercellular space or air bubbles in the agricultural products and food materials on their acoustic properties is being studied.

e) Measuring of Volume/density of Agricultural Products and Foodstuffs by Acoustic Resonance

We developed a volume/density measuring system using a Helmholtz resonator. This system enables us to measure volume/density of not only solid food or liquid food but also solid-liquid mixture food. Further experiments will be made for applications to determine void fraction of the porous food in the future. Now we are developing a new type resonator for on-line measuring of volume, a monitoring system of cream whipping process and a fuel meter of orbit transfer vehicle in space by utilizing Helmholtz phenomena.

f) Porousness Estimation for Foodstuffs by Acoustic Resonance

Porousness is one of physical properties related to texture of foodstuff. We started to develop application of Helmholtz resonance phenomena to porousness estimation for foodstuffs. Now we investigate relations between Helmholtz resonant frequency and airflow resistance of grain layer used as a porous sample.

A-2. Publications and presentations

a) Publications

Books

Naoshi Kondo and Kazunori Ninomiya: DATA ASSIMILATION SYSTEMS, in Systems Analysis and Modeling in Food and Agriculture, [Eds. David H. Fleisher,K. C. Ting,Luis F. Rodriguez], in Encyclopedia of Life Support Systems (EOLSS), Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford ,UK, [http://www.eolss.net], 2007

Original papers

Ohnishi, K., T. Nishizu, H.T. Kim: A consideration on afterripening management of kiwifruits based on relation between fruit density and sugar content. Kansai Branch Report of JSAM 102; 54, 2007

Narita, N., T. Nishizu, S. Kitahata: Study on effect of moisture content on texture evaluation for ice-cream cone–. Kansai Branch Report of JSAM 102; 55, 2007

Okabe,Y. and K. Kato: Study on cell electrical model parameters for vegetable tissue dipped in saline solution. Kansai Branch Report of JSAM 102; 56, 2007

Takeuchi K., K. Kato, M. Kawano, N. Uemuki: Measurement of small amounts of rice bran using heating & image processing method – a comparison with MG reagent staining method. Kansai Branch Report of JSAM 102; 57, 2007

Kim, H.T., H.J. Ko, K.Y. Kim, T. Nishizu, H.L. Choi: Determination of egg freshness and internal quality measurement using image analysis. Journal of Biosystems Engineeing 32(3); 166-172, 2007.

Shigemune Taniwaki, Naoshi Kondo: Acquisition of High Resolution Image by Virtual

Stabilization of Observation Satellite,, Journal of JSME (C), Vol.73, No.736, 3279-3286 , 2007

b) Conference and seminar papers presented

Th 67th Annual Meeting of Japan Society of Agriculture Machinary: 4 papers

The 119th Annual Meeting of Kansai Branch of JSAM: 7 papers

2007 CIGR Section VI International Symposium on Food and Agricultural Products: Processing and Innovations: 1 paper

2007 ASABE An International Conference on BIOLOGICAL SENSORICS- Critical Technologies for Future Biosystems-: 2 papers

2007 ASABE Annual meeting: 2 papers

2008 ISHS Application of Precision Agriculture for Fruits and Vegetables: 1 paper

A-3. Off-campus activities

Membership in academic societies (roles)

Kondo, N.: Japanese Society of Agricultural Machinery (Director, Councilor, Editor in Chief, English journal editing committee); Kansai Branch of Japanese Society of Agricultural Machinery (Member of Board); Japapense Society of Mechancal Engineers (Robotics Mechatronics branch committee member); Japanese Society of Agricultural Biological and Environmental Engineers and Scientists (Science and High Technology in Agriculture Division, Director)

Nishizu, T.: Japanese Society of Agricultural Machinery (Member of community-based education and research committee)

Research grants

Kondo, N.: Grant-in-Aid for Scientific Research (B), "Mobile grading robot for citrus production and control of observation satellite" (Head), Grant-in-Aid for Scientific Reserch (Houga): "Fundamental study on wearable assist device under high noisy environmental condition" (Head), Mitsutoyo Association for Science and Technology, " Control of tomato fruit cluster harvesting robot" (Head), Suzuki Association for Science and Technology, "Precision relative navigation system for safety inter-vehicular distance"

Nishizu, T.: Grant-in-Aid for Scientific Research (B), "Study on distribution management of kiwifruits based on sugar content information obtained by thier densities at harvesttime" (Head), Ground-based Research Announcement for Space Utilization promoted by the Japan Space Forum, "Development of a system for measuring the remaining amount of liquid in a propellant refillable reservoir on orbit" (Head)

A-4. International Cooperation and overseas activities

International meetings (roles)

Kondo, N.: ASABE International Annual Meeting, Minneapolis, USA, (invited Speaker)

Nishizu, T.: International Conference on Advanced Nondestructive Evaluation, Cheju, Korea (Invited Speaker)

Scholar from abroad

Foreign research associate: 2

B. Educational Activities (2007.4-2008.3)

B-1. On-campus teaching

a) Courses given

Undergraduate level:Measurement Science (Kondo), Laboratory Course In Agricultural Machinery I and II (Kondo and Nishizu, shared), Practice in Data Processing II (Nishizu, shared), Seminar in Agricultural Machinery (Kondo, and Nishizu, shared), Seminar in Agriculture and Environmental Engineering(Kondo and Nishizu, shared)

Graduate level: Physical Properties of Agricultural Products (Kondo), Special Seminar in Farm Processing Technology I and II (Kondo), Laboratory Course in Farm Processing Technology (Kondo and Nishizu, shared)

B-2. Off-Campus teaching

Guest Professor:

Kondo, N.: Zhejiang University, China (Robotics for bioproduction systems)

Part-time lecturer:

Kondo, N.: Faculty of Engineering, Mie University (Mechatronics)

Nishizu, T.: Faculty of Applied Biological Sciences, Gifu University (Physical properties of Agricultural Products)

B-3. Overseas teaching

Students and research fellow from abroad

Graduate Student: (China 1)

Special Research Student: (Iran 1, Italy 1)

Chair of Nuclear Science and Engineering (Research Reactor Institute)

2.5.16 Laboratory of Radiation Safety Control

Staff *Professor* *: Fukui, Masami, Dr. Eng., Dr. Agric. Sci.*

Assistant Professor : Yamasaki, Keizo, M. Eng.,

Assistant Professor : Yashima, Hiroshi, Dr. Eng.,

Students

*Doctor's program : (**2**)*

A. Research Activities (2007.4-2008.3)

A-1. Main subjects

a) Estimating the concentration of HTO in waters in the environment

A great amount of tritium is likely to be released from the operation of the nuclear reprocessing plant in Rokkasho, Aomori Prefecture. The discharge of tritium in the environment is concerned for the radiation exposure on the public near the facilities. For the above, the environmental impact assessment is required to make sure the safety by measuring the

concentration of tritium in the environment. As a first step of an analogical research, the concentrations in moisture in air and fresh waters around the Kyoto University Research Reactor site which releases a small quantity of tritium, has been measured and compared with those in water samples that are not contaminated artificially. This was accomplished by the development of the radiometry for water samples with extreamly low level radioactivity.

b) Distribution and behavior of radon and its progeny in the environment and dose assessment

Radon and its progeny are an important part of natural environmental radiation exposure. Since inhalation is a major pathway, the measurement of airborne radioactivity in geologic materials is relevant to assess the environmental radiation hazards. However, little information has been available for the radon contents in soil gas and groundwater in a wide area of Japan. We carried out therefore a survey of ^{222}Rn-concentrations in the western Japan and summarized data.

Natural radiation exposure is one of the constraints for radiation exposure to general publics and workers. Not only the behavior and the property of the radon and its progeny in the indoor and outdoor environment, but also the standardization of the aerosol attached radon progeny size distribution measurements in a building made of thick concrete using some low pressure cascade impactors and the generation process of radioactive aerosols by attachment between the radon progeny and standard aerosols, are now proceeding on to assess the natural radiation dose.

c) Residual activity estimation in the nuclear and accelerator facilities

The nuclide-production cross-sections are required to estimate the radioactivities in the nuclear and accelerator facilities. In this study, the nuclide-production cross-sections induced by charged particle and neutron have been measured and residual activities have been evaluated from measured results.

d) Remediation of the water environment contaminated with refractory organic matter (ROM), endocrine disruptors, and arsenic

Application of soil percolation and phytoremediation techniques were studied to renovate the water environment contaminated with ROM and endocrine disruptors. The distribution of OM in the soil-water environment as well as the effect of plants on the behavior of OM were studied by monitoring dissolved OM by colour, dissolved organic carbon concentration and COD measurements, and sequential fractionation techniques. Analyses of endocrine disruptors using gas-chromotograph- mass specgrometry are now under way. Performance of a manganese sand processed from manganese and bismuth metals, and biological treatment unit using iron and manganese oxidizing bacteria were tested to develop inexpensive measures of arsenic removal from groundwater. Synchrotron radiation XAFS analyses were conducted to clarify the arsenic removal mechanism.

A-2. Publications and presentations

a) Publications

Original papers

Fukui M., Evaluation of radon in soil gas and natural radioactivity in surface soil of Kinki district, Japan, J. Nucl. Sci. Technol., **44**, 1106-1116, 2007

Shimo M., Yamasaki K., Tsujimoto T., Okamoto K., Yoshimoto T. Kojima H., Mizuma M., The influence of the Concentration of Atmospheric Radon Decay Products on the Environmental Radiation Dose Rate, Jpn. J. Health Phys., **42**(2), 156-165, 2007.

Sakurai S., Fujikawa Y., Fukui M., Hamasaki T., Sugahara M., Vegetation on the Soil Infiltration System Treating Livestock Wastewater –Diagnosing Soil Status with respect to Available Phosphorus and Salts Accumulation-Environmental Conservation Engineering, **36**(8) ; 571-579、2007. (in Japanese)

Fujikawa Y., Fumiko O., Sakurai S., Fukui M., Inamura T., Umeda M., Hara Y., Hamasaki T., Sugahara M., Nakagawa Y., Protection of Environment through Application of Methanogenic Digestate to Agricultural Field, Environmental Conservation Engineering, **36**(9) ; 31-37、2007. (in Japanese)

Reports

Sakurai S., Fujikawa Y., Fukui M., Umeda M., Kakumoto M., Sugahara M., Hamasaki T., Shinjo T., Investigation on estrogen concentration affecting plant growth-On the application of organic waste to agricultural lands..Proceedings of 11th International Congress of Toxicology, Montreal, Canada, 2007.PT9.243

Fujikawa Y., Oritate F., Hara Y. , Sakurai S., Fukui1 M., Umeda M., Hamasaki T., Sugahara M., Estrogens in the livestock manure and food safety－ Results of the preliminary inivestigation. Proceedings of 11th International Congress of Toxicology, Montreal, Canada, 2007. PT9.230

Fujikawa Y., Hara Y., Oritate F., Sakurai S., Oh E., Fukutani S., Fukui M., Inamura T., Umeda M., Hamasaki T., Sugahara M., Preliminary Investigation on the Estrogens and Cadmium in the Livestock Manure and Food Safety, Environmental and Sanitary Engineering Research, 21(3),83-86,2007. (in Japanese)

Sakurai S., Fujikawa Y., Fukui M., Umeda M., Kakumoto M., Hamasaki T., Sugahara M., Shinjo T., Estrogen from livestock manure – The behavior in the rhizosphere and effect on the plant growth, Environmental and Sanitary Engineering Research, 21(3)、87-90, 2007. (in Japanese)

Fujikawa Y., Minami A., Yashima H., Ihara K., Yoshikawa E., Sugahara M., Hamasaki T., Fukui M., Honma T., Mechanisms and the Rate of Arsenite Removal in the Reactor Colonized by Iron Bacteria, Proceeding of the 44th Forum of Environmental Engineering, Japan Society of Civil Engineers, 227-229, 2007.

Fukui M.: Studies on the safety of environmental radioactivity around nuclear facilities. J. Nucl. Sci. Technol. **43**, 10-11, 2006.

Fukui M. : fourty years with radioactivities (paper selection), Ractor Research Institute Kyoto University, 2008.

Yamasaki K., Urabe I., Yashima H., Ohta M., Oki Y., Fukui M., Fundamental Study on Radiation Protection of Fixed-Field Alternating-Gradient Accelerator, Reports on the 42ht scientific meeting, Kyoto University Research Reactor Institute, 203-210, 2008. (in Japanese)

b) Conference and seminar papers presented

41th annual meeting of Japan Health Physics Society: 1 presentation

77th meeting of Japan Atmospheric Electricity: 1 presentation

The 24th symposium on Aerosol Science & Technology: 2 presentations

2007 meeting of the Atomic Energy Society of Japan: 1 presentation

62th annual meeting of Japan Society of Civil Engineers: 2 presentations

7th annual meeting of Environmental Technology: 1 presentation

42th annual meeting of Japan Society on Water Environments: 2 presentations

44th symposium for isotope and radiation: 4 presentations

A-3. Off-campus activities

Research grants

Grant-In-Aid for Scientific Research (C) Application of livestock excrements to agricultural plot – Behavior of refractory organic matter and estrogens in the environment (Fukui, Partial charge)

A-4. International cooperation and overseas activities

Editorial board of the International journal etc.

Fukui, M.: J. Contam. Hydrol. (Elsevier, Associate Editor)

B. Educational Activities (2007.4-2008.3)

B-1. On-Campus teaching

a) Course given

Undergraduate level: Behavior of Contaminant in the Environment (Fukui)

Graduate level: Environmental Radiation Protection (Fukui), Seminar in Environmental Radiation Control I, II (Fukui), Applied Environmental Radiation Technology (Fukui), Experimental Radiation Control in the Environment (Fukui)

C. Other remarks

Safety Management

Fukui, M.: Director of Radiation Control, Member of Nuclear Safety Committee, Member of Health Physics Committee, Member of Radiation Committee for Medical Usage

Off-campus activities

Fukui, M.: Japan Atomic Energy Agency (Scientific member for (1) Safety Research Committee, and (2) Waste Management Committee), Osaka Prefecture (Environmental Radiation Assessment Committee)