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Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf

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Land-water connectivity in Mekong Delta, Vietnam: Important consideration in sustainable agriculture and water quantity-quality

To Our Readers

It is amazing that eight months have passed since I have been at the helm as the Head of the Soil and Water Management & Crop Nutrition. Time has passed very quickly, probably reflecting the intensity of the tasks in which I am involved and the pleasure of working with a dynamic team at the Section Headquarters in Vienna and the Soil Science Unit (SSU) at the Agency's Laboratories in Seibersdorf (hereafter referred to collectively as the Soils Team) and also with scientists and technical personnel from the Agency and Member States.

As indicated in the December issue, the challenges for the Soils Team are to apply existing nuclear techniques and develop new applications to address water and soil conservation issues at farm scale and watershed level, rather than simply on a field plot scale. We have successfully met these challenges with a range of co-ordinated research and technical cooperation contracts on soil erosion and conservation agriculture (see p. 16). In these studies, integrated soil-plant-nutrient- water issues that influence the extent of soil erosion, water conservation



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and loss of agricultural nutrients or pollutants are investigated so that management tools can be put in place to minimize soil erosion and to optimise resource (water and nutrients) use efficiency. During the past few months, new planning has also been initiated on research and technical activities on Water and Land Resources Management to ensure more crops per drop without compromising downstream water quantity and quality in agricultural catchments (see p. 10) and evaluation of crop germplasms for high nutrient use efficiency and tolerance to nutritional deficiencies (see p. 5).

These new initiatives together with inputs from Member States will contribute to the accomplishment of one of the Millennium Development Goals in Ensuring Environmental and Agricultural Sustainability. I am therefore enthusiastic about these new initiatives and would like to thank both IAEA and FAO colleagues, the Joint FAO/IAEA Division Director, Mr. James D. Dargie, the Soils Team and scientists and policy makers in our Member States, all of whom have contributed ideas and valuable suggestions for these new initiatives.

To contribute to both the on-going and new initiatives, the Soils team is pleased to welcome Mr. Lionel Mabit, who joined the SSU in March to fill the position left vacant by Ms. Rebecca Hood-Nowotny. Lionel will provide a significant input into our Soils projects on soil conservation and erosion (see p. 4). Ms. Lee Heng's 6-month extension until November 2005 also gives us a welcome reprieve – to ensure on-time delivery of the planned outputs in our sub-programme on water use efficiency and crop water productivity to Member States. Ms. Heng's hard working attitude and her expertise will be very valuable in the coming months. An advertisement has been

published to fill the position that will be left vacant by Ms. Heng's departure.

Felipe Zapata, a former staff member of the Section, is back with us for a 3-month assignment to assist me with a range of activities including the completion of an IAEA TECDOC on "Sustainable Crop Production Systems on Tropical Acid Soils through the Use of Nuclear and Related Techniques". This will help me to devote more time to the 'water in agriculture' initiative that I have mentioned above.

By the time the next January newsletter comes to print, our Division Director, Mr. James D. Dargie, will have retired from the Joint Division. We will miss a staunch supporter of the activities of our Soils Team and a strong advocate for the work of the Joint Division in the use of Nuclear Techniques in Food and Agriculture. Ms. Lee Heng our valued team member and Ms. Ruth Rossi, our loyal and long-serving secretary will also leave the Agency this year, Lee to further her career and Ruth to enjoy retirement. I wish them both well in their new endeavours.

To all our readers, I also would like to express my thanks for your support and wish you every success, good health and happiness. Please do send me any comments and suggestions on how to improve our newsletter presentations and the relevance of our research and technical co-operation programmes to Member States. Such suggestions are always welcome.

Long Nguyen

Staff

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New Staff member

Mr. Lionel Mabit recently joined the Soil Science Unit of the Agency's Laboratories Seibersdorf as a soil scientist directly linked to the FAO/IAEA project E.1.02 on "Development of soil management and conservation practices for sustainable crop production and environmental protection".



Mr. Mabit will be particularly involved in research and training on soil erosion, in support to the soils subpro-

gramme and the related activities. Mr. Mabit's background is in geology, hydrology and physical geography. He completed his Ph.D. at the Sorbonne University in Paris, France. The thesis was entitled "Assessment of soil erosion by the ^{137}Cs methods. Application to the Vierzy (France) and Lennoxville (Canada) watersheds". Before joining the IAEA, Mr. Mabit worked as soil scientist in soil erosion at Laval University, in Canada. His main areas of research expertise include soil and water quality assessment, geostatistical analysis and soil mapping, soil fertility, soil erosion and sediment budget at a range of scales (plot, field, watershed) using various tools such as fall-out radionuclides (e.g., ^{137}Cs , ^{134}Cs), rainfall simulator, models and GIS.

Forthcoming Events

Research Coordination Meetings (RCMs) of FAO/IAEA Coordinated Research Projects (CRPs)

Third RCM of CRP on “Integrated Soil-Water and Nutrient Management for Sustainable Rice-Wheat Cropping Systems in Asia” 11–15 July 2005, Dhaka, Bangladesh (D1.50.07)

Technical Officer: Long Nguyen

Six contract holders from Bangladesh, China (2), India (2), Nepal and Pakistan, two technical contractors from Australia and the Philippines (IRRI) and two Agreement holders from Australia (CSIRO) and India (CIMMYT), will participate in this RCM. The meeting will be held from 11 to 15 July in Dhaka, Bangladesh. Md. Akhter Khan from the Bangladesh Rice Research Institute will act as local organizer with the assistance of Murshedul Alam from the same institution. The results obtained since the 2nd RCM will be presented and evaluated according to the objectives of the CRP. The meeting will therefore play an important role in formulating contract renewals and project implementation in the 2005-2006 cycle to ensure successful accomplishment of all the objectives and outcomes set out in this CRP.

FAO/IAEA Technical Meeting “Combating Soil Degradation to Enhance Food Security in Africa: The Role of Nuclear Techniques in Developing Improved Soil, Water and Nutrient Management Practices”, ICRAF Headquarters, 16–20 October 2005, Nairobi, Kenya

Technical Officer: Claude Bernard

The intensification of agriculture in small land holdings in Africa has often resulted in widespread soil degradation so that the food gap (requirements minus production) keeps widening although large areas of forests, wetlands, river valley bottoms and grassland savannah have been put under crops production.

The objectives of the meeting are 1) to review recent advances in the use of nuclear and related techniques for developing integrated soil, water and nutrient management practices to combat land degradation and desertification, 2) to enhance knowledge and awareness on the potential of nuclear and related techniques to help develop integrated strategies to combat land degradation at national and regional scales and 3) to provide a forum for participants to exchange ideas and experiences and establish linkages for future collaboration.

The specific topics to be addressed will include nutrient mining and replacement, carbon sequestration, soil acidity, soil salinization, water management and soil erosion.

More detailed information on the meeting can be found on the IAEA’s websites at:

<http://www.iaea.org/programmes/nafa/d1/index.html>

<http://www-pub.iaea.org/MTCD/Meetings/Meetings2005.asp>

Second RCM of CRP on “Selection for Greater Agronomic Water-Use Efficiency in Wheat and Rice Using Carbon Isotope Discrimination”, 21–25 November 2005, Meknes, Morocco (D1.20.08)

Technical Officer: Rachid Serraj

The second RCM on the “Selection for Greater Agronomic Water-Use Efficiency in Wheat and Rice Using Carbon Isotope Discrimination” will be organized by INRA-Meknes in Morocco from 21 to 25 November 2005.

After a successful first RCM (27 September-1 October 2004, Vienna International Centre, Vienna), which revised the initial research work plans and activities of the CRP, the main objectives of the second RCM will be to assess the research outputs and activities, and evaluate the progress made in the identification and crossing of wheat and rice cultivars with contrasting carbon isotope discrimination values and their characterization under various environmental conditions for yield components and agronomic water use efficiency.

Consultants’ Meeting

Consultants’ Meeting on Crop Nutritional Stress, 25–27 July 2005, Vienna International Centre, Vienna, Austria

Scientific Secretary: Rachid Serraj

A consultants’ meeting (CM) on the “Selection and Development of Germplasm Tolerant to Nutritional Stress in Tropical Crops” will be held at the Vienna International Centre, Austria, 25-27 July 2005, with the main objectives to: (i) review the state-of-the-art in the physiology and breeding of crop nutritional stress, (ii) identify key research areas related to the use of isotope and nuclear techniques, and (iii) develop the proposal of a coordinated research project (CRP) on the selection and development of germplasm tolerant to nutritional stress in tropical crops.

This CRP will be directly related to the objectives of Project E.1.05 as it involves the use of nuclear techniques for the development and evaluation of crop genotypes with superior nutritional value and adapted to harsh environments. It will complement several past projects on isotope-aided plant nutrition studies (CRPs on Rock Phosphate, Acid Soils and Root Characters).

Five external experts will participate in the CM in addition to the staff of SWMCN Section and SSU at Seibersdorf. Rachid Serraj will act as the Scientific Secretary of the CM.

The proposed CRP will build upon the current knowledge and research achievements in the field of crop improvement of nutritional stress tolerance, with the objective to develop isotope-based methodologies that can streamline selection of crop germplasm for high nutrient use efficiency and tolerance to nutritional deficiencies through:

- screening large collections of cereal and legume genotypes, their wild relatives and mutant lines for adaptation to low nutrient conditions (and/or Al toxicity);
- development and use of isotopic tracer techniques to evaluate crop germplasm and to understand the physiological basis for plant adaptation to nutritional stress (deficiency);
- development of methodologies for quantifying root exudates and assessment of their roles in solubilizing unavailable soil nutrients (P, Fe, etc.) in low-nutrient environments;
- investigate and harness plant interactions with VA mycorrhizae fungi and soil microbial activity that enhance nutrient supply to crop-plants in nutrient-poor soils;
- on-farm research to evaluate interactive effects of plant roots, soil nutrients and their relationship to soil micro-organisms in a series of soil-plant systems.

FAO/IAEA International Workshop

The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture will host a Workshop on the Use of Nuclear Techniques in Addressing Soil-Water-Nutrient Issues for Sustainable Agricultural Production at the **18th World Congress of Soil Science to be held in Philadelphia, Pennsylvania, USA from 9 to 15 July 2006**. This Workshop, which will be held on the 9th July 2006, will provide an excellent opportunity for participants to exchange information on nuclear techniques in agriculture and to attend the 18th World Congress of Soil Science which covers a range of research and technical issues highly relevant to the participants.

The Secretariat of the International Atomic Energy Agency has limited funds at its disposal and these funds will be used to help meet the costs of attendance at the Workshop by selected specialists mainly from developing countries with low economic resources. The grant application and a copy of a paper that the applicant wishes to submit for presentation at the IAEA Workshop must be sent to the Secretariat of the Agency (the International Atomic Energy Agency, Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria, Telefax no. +43-1-26007) by 1 October 2005. Application forms and information on the workshop as presented below were sent to Member States in April 2004. Further inquiries relating to the application or scientific aspects of the Workshop can be addressed to the Agency's Workshop Scientific Secretary, Mr. Minh-Long Nguyen at: M.Nguyen@iaea.org.

It is important to observe the deadline of 1 October 2005. This deadline will allow sufficient time for participants to:

- (i) be notified if their application for grant allocation is successful.
- (ii) submit a visa application to the nearest diplomatic or consular representative of the United States of America at the earliest possible date.

Attention is specifically drawn to the fact that the applicants need to contact the Organizing Committee of the **18th World Congress of Soil Science** independently if they wish to register to attend the entire Conference (9–15 July 2006) and book hotel accommodation for the 18th World Congress of Soil Science at the following web-sites: <http://www.18wcss@soils.org>
<http://www.18wcss.org>

INFORMATION

Address:

IAEA Workshop at The 18th World Congress of Soil Science, (9–15 July 2006), Philadelphia, Pennsylvania, USA

Title of Workshop:

Use of Nuclear Techniques in Addressing Soil-Water-Nutrient Issues for Sustainable Agricultural Production

Dates:

Deadline for paper submission to IAEA for funding consideration: 1 October 2005

Notification of paper acceptance: 1 December 2005

Date of IAEA Workshop: 9 July 2006

Workshop Venue:

The Workshop will be held at the same venue (The Pennsylvania Convention Center, Philadelphia, Pennsylvania, USA) with the 18th World Congress of Soil Science.

Inquiries:

Requests for further information concerning scientific aspects of the Workshop can be addressed to the Agency's Scientific Secretary for the Workshop, Mr. Minh-Long Nguyen, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, IAEA, P.O. Box 100, Wagramer Strasse 5, A-1400, Vienna, Austria.

Registration to attend the 18th World Congress of Soil Science plus accommodation booking should be directed to the 18th World Congress of Soil Science Website (www.18wcss.org).

The Congress Organizers can also be contacted at:

Fax: (608) 273-2021

Phone: (608) 273-8095

Postal address:

18 WCSS Registration

Soil Science Society of America

677 S. Segoe Road

Madison, WI 53711

USA

Background information on the topic:

Nuclear techniques play a significant role in the search for more productive, sustainable and profitable farming systems. In particular, isotopic and other nuclear-based techniques are an invaluable tool in tracking the flows of nutrients and water in soil-plant and soil-plant-animal agro-ecosystems. Additionally, isotopes can be used to quantify the movement of soil in the landscape and to measure the effect of different cultural practices on the gain or drain of carbon in agro-ecosystems. Thus nuclear techniques provide unique information that can assist in defining best management practices. Isotopic techniques are continually undergoing refinement as well as finding new applications in crop improvement and natural resource management programmes. The IAEA Workshop aims to provide a forum where scientific and technical advances in FAO/IAEA Member States using **nuclear and related techniques** to develop optimum soil-water-plant-nutrient management practices for sustaining crop productivity and environmental sustainability.

Scope and issues to be addressed at the Workshop:

(i) The use of isotopic tracers and soil moisture neutron probes to quantify stocks and flows of carbon, nutrients, water and soil in cropping systems.

(ii) The use of isotopic markers or tracers in germplasm selection or breeding programmes for enhanced tolerance to abiotic stresses.

(iii) Soil carbon sequestration and conservation agriculture in mitigating soil erosion, fertility degradation and desertification.

(iv) Agricultural water management and productivity (crop water productivity and agricultural water resource assessment/measurement).

(v) Integrated soil-nutrient management in agro-ecosystems (e.g., use of crop residues and fertilizer utilization efficiency and losses to environment).

Non-FAO/IAEA Meetings**2005**

- June 13–17, 2005. Nitrogen Fertilizer Production Technology Workshop (on behalf of IFA), Maastricht, Netherlands. Contact: IFDC Director, Training and Workshop Coordination Department. Email to: hrd@ifdc.org or hrdu@ifdc.org; <http://www.ifdc.org>
- June 20–25, 2005. International Symposium on "Sustainability of Paddy Farming Systems", Manila, Philippines. Contact: Jose Rondal at joserondal@yahoo.com
- July 17–22, 2005. XII International Congress on Molecular Plant-Microbe Interactions, Cancun, México. Contact the Congress Chair: Federico Sanchez at federico@ibt.unam.mx; <http://www.ibt.unam.mx/cancun2005>
- July 18–23, 2005. XVII International Botanical Congress, Austria Centre Vienna, Austria (Europe), Nomenclature Section: UNI-CAMPUS Hörsaakzetrynm 12-16 July. <http://www.ibc2005.ac.at>
- July 30–August 4, 2005. Soil and Water Conservation Annual and International Conference. Rochester, New York, USA. Contact: Nancy Herselius, Phone: + 1-515-2892331. nancy.herselius@swcs.org; <http://www.swcs.org>
- September 10–18, 2005. 19th International Congress on Irrigation and Drainage (ICID), Beijing, China. Contact the Chinese National Committee on Irrigation and Drainage, Phone: +86-10-68415522/68416506. cnid@iwhr.com; http://www.icid.org/index_e.html.

- September 14–19, 2005. 14th International Plant Nutrition Colloquium (IPNC). Beijing, China. Fax: +86 10 62891016. <http://www.ipnc2005@cau.edu.cn>; <http://www.ipnc15.com>
 - September 17–20, 2005. 8th International Conference on Dry Lands Development, Beijing, China. <http://www.8iccd.org>
 - September 26–30, 2005. InterDrought-II. The 2nd International Conference on Integrated Approaches to Sustain and Improve Plant Production under Drought Stress, Rome, Italy. <http://www.plantstress.com/id2>
 - September 26–30, 2005. Phosphate Fertilizer Production Technology Workshop (on behalf of IFA). Brussels, Belgium. Contact: IFDC Director, Training and Workshop Coordination Department. Email to: hrd@ifdc.org or hrdu@ifdc.org; <http://www.ifdc.org>
 - October 3–7, 2005. III World Congress on Conservation Agriculture, Nairobi, Kenya. The congress theme is “Linking production, livelihoods and conservation”. More information can be obtained at <http://www.act.org.zw/Congress/congress.htm>
- 2006**
- January 22–27, 2006. The 14th World Fertilizer Congress of the International Scientific Centre for Fertilizers (CIEC) on “Fertilizers and Fertilization - Stewardship for Food Security, Food Quality, Environment and Nature Conservation, Chiang Mai, Thailand. For further information, see <http://www.pb.fal.de/en/> and registration at <http://www.ldd.go.th/wfc14> or www.pb.fal.de/ciec.htm
 - March, 2006. 4th World Water Forum: Local Actions for a Global Challenge, Mexico City, Mexico. See http://www.cna.gob.mx/publica/doctos/eventos/Cuarto_Foro_Mundial/Paginas/Inicio_ingles.htm
 - May 14–19, 2006. The 14th conference of the International Soil Conservation Organisation (ISCO), Marrakesh, Morocco. The Soil and Water Management and Crop Nutrition Section is actively involved in this meeting, by organizing a session on “The Use of Fallout Radio-nuclides for Erosion/Sedimentation Studies”. For information on the ISCO meeting; Email: isco2006@wanadoo.net.ma; Web site: www.maneskovtravel.com/isco2006
 - July 9–15, 2006. 18th World Congress of Soil Science. Frontiers of Soil Science: Technology and the Information Age, Philadelphia, Pennsylvania, USA. Contact: The Organizing Executive Committee at 18wcss@soils.org; www.18wcss.org See First Announcement at http://www7.nationalacademies.org/usnc-ss/WCSS_First_Announcement.html

Technical Cooperation Projects

Operational during the Biennium 2005–2006 and Technical Officers Responsible for Implementation

Project Number	Title	Technical Officer
ALG/5/020	Combating Desertification	R. Serraj
ALG/5/021	Optimising Irrigation Systems and Surface Water Management	L. Nguyen
CMR/5/013	Use of Nuclear Techniques in Soil Nutrient and Water Studies	R. Serraj
CPR/5/015	Assessment of Soil Erosion and Effectiveness of Soil Conservation Measures	C. Bernard
CHI/5/048	Integrated Watershed Management for the Sustainability of Agricultural Lands	C. Bernard
ECU/5/022	Efficient Use of Nitrogen Fertilizers I Flower Production	R. Serraj
GHA/5/032	Enhancing Production and Use of Cassava	R. Serraj
HAI/5/003	Enhancing Crop Productivity through the Application of Isotope Nuclear Techniques	R. Serraj
IVC/5/029	Improvement in Yield of Plantain and Cassava through the Use of Legume Cover Crops	R. Serraj
JAM/5/009	Developing Soil Fertility Management	R. Serraj
KEN/5/023	Combating Desertification Using Nuclear Technology	R. Serraj
LIB/5/010	Establishing a Drip Irrigation-fertigation System Using Nuclear Techniques	L. Heng
MAR/5/014	Management Practices for Increased Efficiency of Fertilizers and Improved Productivity of Saline Soils	R. Serraj
MON/5/014	Application of Isotopes in Soil and Plant Studies	G. Hardarson
NAM/5/008	Increasing Crop Productivity and Resource Use Efficiency in the Northern Communal Areas	R. Serraj
PHI/5/031	Assessment of Erosion and Sedimentation Processes for Effective Formulation of Soil Conservation and Water Quality Production Measures	C. Bernard
RAF/5/048	Combating Desertification in the Sahel	C. Bernard
RAS/5/043	Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality (RCA)	C. Bernard
SIL/5/008	Contribution of Nitrogen Fixing Legumes to Soil Fertility in Rice-based Cropping Systems	G. Hardarson
SRL/5/038	Application of Isotope Techniques for Soil Erosion Studies	C. Bernard
TAD/5/002	Assessment of Soil Erosion and Sedimentation for land Use	C. Bernard
TUR/5/024	Improving Crop Productivity through Nuclear and Related Techniques	L. Nguyen
ZIM/5/011	Combating Desertification in Agricultural Drylands	R. Serraj

Past Events

Research Coordination Meetings (RCMs) of FAO/IAEA Coordinated Research Projects (CRPs)

Fourth and Final RCM of CRP on “The Use of Nuclear Techniques for Developing Integrated Nutrient and Water Management Practices for Agroforestry Systems” (D1-20.07), 18–22 April 2005, Vienna, Austria

Technical Officer: Rachid Serraj

The fourth and final research coordination meeting of this CRP was recently held (Vienna, 18-22 April) with participation of the contract holders from Chile, Costa Rica, Kenya, Malaysia, Sri Lanka, Zambia and five agreement holders from Australia, France, Kenya (TSBFI-CIAT), ICRAF and UK, in addition to the staff of the SWMCN Section and SSU Laboratory. The Project Officer, Mr. R. Serraj, also served as the Scientific Secretary of the RCM.

The main purpose of the meeting were to: a) review research results and achievements during the whole period of the project in accordance with the initial objectives and work plan, and b) assess overall progress in the implementation of the project and c) discuss and evaluate the final project reports in terms of potential for economic and environmental benefits of the research outputs, on-farm application and adoption, especially focusing on possibilities for dissemination of promising technologies to farmers, extension workers and policy makers.

The major outputs of the RCM are summarized in p 16-19. The final report of the RCM and CRP will be available at:

<http://www.iaea.org/programmes/nafa/d1>

First RCM of CRP on “Integrated Soil, Water and Nutrient Management for Conservation Agriculture” (D1-50.09), 13–17 June 2005, Vienna, Austria

Technical Officer: Claude Bernard

Eleven researchers from Argentina, Australia, Brazil, Chile, India, Kenya, Morocco, Pakistan, Turkey, Uganda and Uzbekistan attended this first RCM, in addition to staff from the Soil and Water Management and Crop Nutrition Section and the Soil Science Unit. The Project Officer, Mr. C. Bernard acted as Scientific Secretary for the meeting. The overall objective of this CRP is to reach a better understanding of the principles and practices of conservation agriculture, in particular the individual and interactive effects of conservation tillage practices, residue management, crop rotations, nutrient and water in-

puts on soil organic matter stocks, resource use efficiency, agricultural productivity and environmental quality. The participants to the RCM presented their work plan and the results they obtained so far. These results and work plans were discussed. The on-going projects involve several cropping systems (legumes, small grains, cotton, maize), in monoculture or in rotations, different tillage practices ranging from conventional to no-tillage as well as fertilizing adaptations to investigate the impacts of these factors on carbon and nutrient (N and P) dynamics, water use efficiency and soil erosion using appropriate isotope techniques.

These presentations were followed by working sessions where the work plan of the CRP was updated and future activities were discussed. Individual work plans were also modified and updated following the objectives of the project. A visit to the Agency’s agriculture laboratories, in Seibersdorf, completed the program. Presentations on the use of nuclear techniques (^{15}N , ^{13}C , ^{137}Cs and neutron probes) in the context of Conservation Agriculture were provided to the participants. A report of the meeting is under preparation and will be available at: <http://www.iaea.org/programmes/nafa/d1/crp/d1-crp.html>

FAO/IAEA Consultants’ Meeting

Consultants’ Meeting on “The Role of Nuclear and Related Techniques in Water and Soil Resources Management within the Plant Rooting Zone for Food Security and Environmental Sustainability”, 18–20 May 2005, Vienna International Centre, Vienna, Austria

Scientific Secretary: Long Nguyen

Five external consultants with diverse research expertise in crop water productivity, water use efficiency and land-water connectivity within the plant-rooting zone at the agricultural catchment level, together with the FAO-Chief of Water Resources, Development & Management Services, the Soils Team (the SWMCN Section and the SSU at Seibersdorf) and d representatives of the Isotope Hydrology Section of the Agency attended this 3-day consultants’ meeting. The main objective of this meeting was to identify key knowledge gaps and how nuclear/isotopic techniques may be applied to improve both the understanding and management of:

- Crop water productivity and water use efficiency in agriculture
- Land-water connectivity and its influence on water quantity and quality for enhancing food production while mitigating water and soil degradation (environmental sustainability).

Under this main objective, the following specific issues were explored at the meeting:

- Identify and prioritize key research areas to provide Member States with more effective decision-support and management strategies for optimising water use in agriculture, while ensuring crop productivity and minimizing impact on natural (soil-water-nutrient) resources.
- Identify isotopic and associated techniques, plus experimental approaches to be used to investigate these aspects.
- Identify areas for strengthened internal and external collaboration on water resources management for sustainable agriculture, particularly our understanding of water movement and its associated nutrients beyond the plant-rooting zone.

The highlight of this meeting was the cooperative spirit from every participant over a 3-day working period and encouraging support from both the Division Director, Mr. James D. Dargie and the Director of IAEA's Technical Cooperation Department, Division for Africa and Asia and the Pacific (Mr. Manase P. Salema) for our integrated water-soil-plant-nutrient approach to address research and technical issues relating to land-water resource management in agriculture. Three key areas of water resources management for agricultural productivity and sustainable environment were identified for formulation and implementation as future coordinated research projects (CRPs). A report of the meeting is under preparation and will be available at: <http://www.iaea.org/programmes/nafa/d1/>

Technical Cooperation Projects (TCPs)

FAO/IAEA Regional TCP for East Asia and the Pacific (RCA). Combined meeting for Project Conclusion on "Restoration of Soil Fertility and Sustenance of Agricultural Productivity" (RAS/5/039) Part II – Measuring Soil Erosion/Sedimentation and Associated Pesticide Contamination" and Planning Meeting on "Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality" RAS/5/043, 14–19 March 2005, Manila, the Philippines

From 14 to 19 March 2005, participants from China, Malaysia, Myanmar, Mongolia, Pakistan, Philippines, Sri Lanka and Thailand met with the double objectives of 1) concluding TCP RAS/5/039 "Restoration of Soil Fertility and Sustenance of Agricultural Productivity", Part II. "Measuring Soil Erosion/Sedimentation and Associated Pesticide Contamination" and 2) initiating the new regional project RAS/5/043 on "Sustainable Land Use and

Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality". The meeting was held in Manila, Philippines, under the organization of Ms. Elvira Z. Sombrito of the Philippine Nuclear Research Institute (PNRI).

From a technical point of view, many interesting results were generated by the participants to RAS/5/039 Part II. As examples:

- the potential of fallout radio-nuclides to assess actual erosion/deposition rates and to highlight the impacts of some physical and/or agronomical factors on these erosion/sedimentation rates was clearly demonstrated;
- erosion rates estimated from ^{137}Cs data could be compared to measured data obtained from some participating countries;
- the impact of contrasting land uses on soil loss rates could be assessed;
- several crop management practices and strategies such as vegetation on steep slopes, physical barriers such as hedgerows, cultivation on the contour, and terracing were assessed for their erosion control potential;
- the significance of tillage as a source of soil redistribution in the landscape was established;
- the relationship between soil spatial redistribution and the variation of soil quality indicators, such as soil organic carbon, was demonstrated. This suggests that the impact of soil erosion goes well beyond the transportation of soil particles, but also involves soil quality and crop productivity issues.

The results also shed some light on different aspects of the fallout radio-nuclides (FRN) technique itself. First, the importance of correctly selecting a reference site was raised by many participants, since these sites must provide the reference inventory of radio-nuclide, from which erosion/deposition rates are estimated. It was also reported that models that predict the level of fallout radio-nuclides from parameters like longitude, latitude and annual precipitation can provide a first estimate of these fallouts. Low inventories of ^{137}Cs in Southern Hemisphere and under low latitudes in the Northern Hemisphere raise some constraints (increased counting times, higher uncertainty), although not precluding its use. Lead-210 (^{210}Pb) could offer an alternative. Results from China indicate that this isotope behaves similarly to ^{137}Cs as far as soil redistribution in the landscape is concerned. Some conversion models were also used, indicating that showing that different soil erosion estimates can be obtained from different models and thus

raising the point of selecting the appropriate model for a given situation.



Participants to the Manila meeting of TCPs RAS/5/039 part II and RAS/5/043

As a general conclusion, it can be stated, at the end of this regional TC project, that all participating countries now have a good understanding of the FRN approach to investigate soil erosion/sedimentation. They have adequate equipments for soil sampling and ¹³⁷Cs analysis.

All participating countries have produced significant and reliable quantitative data on spatial redistribution of ¹³⁷Cs and soil erosion. In these countries, a good collaboration has been established with partners interested and involved in the ¹³⁷Cs technique for soil erosion/sedimentation studies. The second part of the meeting was devoted to the new regional TCP RAS/5/043. This new project was designed to build on the skills developed in RAS/5/039 part II. The idea is to use radio-isotope data to investigate the potential of different cropping systems and/or agricultural practices to control soil losses.

The main objective of this first meeting was to review the work plan of the participating countries (team composition, planned activities, and needed support) to make sure they are in line with the objectives of the project. A Project Framework Matrix and a global timetable were also developed. Dates and locations for future activities were also agreed on. Finally, recommendations were expressed by the participants to IAEA and countries, in terms of support to the activities needed by the project.



Severely gullied cropland (Courtesy Y. Li , 2005)

FAO/IAEA Regional Coordination Meeting RAF/5/048) Combating Desertification in the Sahel, 15–17 March 2005, Bamako, Mali

From 15 to 17 March 2005, the third Project Coordination Meeting of the regional TC project RAF/5/048 on “Combating Desertification in the Sahel” was held in Bamako, Mali. Representatives of Burkina Faso, Kenya, Mali, Niger, Senegal, and Tanzania, directly involved in the project, or representing organizations interested with the desertification problem attended the meeting. Mr. F. Zapata acted as IAEA expert, in lieu of the technical officer, Mr. C. Bernard



(Participants to the Bamako meeting of TCP RAF/5/048 (Courtesy of F. Zapata, 2005)

The main objectives of the meeting were to assess the progress achieved in the implementation of the second phase (experimentation) phase of the TCP, to identify arrangements and mechanisms for enhanced national implementation and modalities for regional co-operation, to identify required support for national and regional activities, to prepare a work plan for the final phase of the project, emphasising information dissemination, and to initiate upstream work for a more comprehensive regional project on agriculture in arid and semi-arid areas in Africa to be submitted for the forthcoming TC programme 2007-2008.

So far, the progress achieved is satisfactory for all countries. Promising technologies are being developed through the use of nuclear techniques. They are, however, at different stages of development and some results still require further analysis and careful interpretation before they are published.

The technologies under investigation include:

- integrated soil, water and nutrient management approach for millet-based cropping systems, using soil preparation on contour lines;
- N inputs from nitrogen fixation in N fixing legumes such as peanut and cowpea and their benefit to the subsequent crops (millet, sorgho), measured with the ^{15}N isotope technique;
- use of local nutrients sources, alone or combined (phosphate rock sources and organic residues/compost), to improve low inherent soil fertility, using appropriate isotope techniques;
- use of water absorbents to improve water and nutrient use efficiency and the productivity of the irrigated agriculture of the Sahel;
- impact of trees, which constitute a basic component of the agro-silvopastoral systems of the Sahel, on soil organic matter and soil fertility status and on water dynamics of parklands, using the stable carbon isotopic ratios at the natural abundance level

During the next phase of the project, the focus of the activities will be on-farm testing of the technologies. Technical bulletins/leaflets will be produced before recommending their adoption. Several mechanisms will be identified to achieve wide dissemination of the results to the farmers. One such mechanism is the production of a brochure that is aimed to report the main results of the TCP and to increase public awareness on the problems investigated and the solutions developed. During the meeting, the contents of the brochure were defined, working groups with a topic coordinator were created to prepare the contributions and a timetable was established for the production of the brochure.

Finally, recommendations to the IAEA, the Governments and the counterpart institutions were produced, with the objective of maximizing the results of this TCP and the dissemination of these results, and improving the linkage with organizations/programs addressing desertification issues.



(Courtesy of K. Traore, Mali, 2005)

Non-FAO/IAEA Meetings

International Conference on “Biotechnology for Salinity & Drought Tolerance in Plants” organised by the National Commission on Biotechnology and NIBGE, 28–31 March 2005, Islamabad, Pakistan

The conference was organized by the Pakistani National Commission on Biotechnology (NCB) in collaboration with Pakistan Atomic Energy Commission (PAEC), the US National Science Foundation and the IAEA. It was attended by participants from several developing countries (Bangladesh, China P.R., Egypt, India, Morocco, Philippines, Tunisia), in addition to participants from USA, Netherlands, international institutes (CIMMYT, ICARDA, IRRI) and around 80 participants from Pakistan.

During the opening session, the chairman of PAEC, the secretary of the Ministry of Science and Technology and the secretary of NCB delivered a welcome address and highlighted the main research activities related to drought and salinity and their impact on agriculture in Pakistan and worldwide.

The technical sessions were spread over three days, organized in seven different sessions addressing five main themes: (1) Biotechnology, stress physiology and ion homeostasis, (2) Stress sensing and signalling, (3) Genomics, metabolomics and proteomics, (4) Gene expression, (5) Whole plant/field studies and management. Poster sessions were also organized daily during the conference. Several participants reported on the recent progress made in biotechnology and genetic engineering for improving crop tolerance to abiotic stresses. Several participants from USA, Netherlands, India, Pakistan and other developing countries presented current advances in using transgenic research in abiotic stress tolerance.

R. Serraj presented a paper on crop improvement of salinity and drought tolerance using nuclear and related techniques, summarizing most of the work being done at the Joint FAO/IAEA Division on drought and salinity. He also chaired the last session on 'Field studies and management', which was followed by a general discussion on the way forward for tackling drought and salinity constraints in agriculture.

The closing session was chaired by the Minister of Agriculture, who highlighted the importance of the 'drought and salinity research in Pakistan and globally in arid and semi-arid areas. R. Serraj also addressed the conference during the closing session to thank the organizers for involving the Joint FAO/IAEA Division in the organisation of this important event and also to highlight the commitment of IAEA for technical assistance to member states in solving R&D issues related to the application of nuclear techniques in Food and Agriculture.

Comprehensive Assessment Workshop on Water Productivity, 10–12 April 2005, Aleppo, Syria

Ms. Lee Heng recently attended the Comprehensive Assessment (CA) Water Productivity (WP) workshop organized by the International Water Management Institute (IWMI). The workshop was held at the ICARDA Headquarters in Aleppo, and was attended by invited authors contributing towards a WP Assessment Chapter. The CA aims to identify a range of means to enhance water productivity in agriculture, assess their potential and the consequences of their adoption. During the meeting, work programme to be included in the CA assessment synthesis report was developed. The group discussed key questions and messages for the synthesis chapter on water productivity as part of the CA Assessment volume and agreed upon the detailed outline of the chapter. The first draft of the chapter is due by the end of July 2005.

General Assembly of the European Geosciences Union, 24–29 April 2005, Vienna, Austria

The Assembly gathered several thousands of researchers from all around the world. Around 10 000 oral and poster presentations were grouped under 23 themes and/or symposia. Atmospheric sciences, geomorphology, hydrological sciences, ocean sciences, soils system sciences are some examples of the themes covered. Under the Soil System Sciences Section of the Assembly, C. Bernard (SWMCN) and L. Mabit (SSU) gave an oral presentation entitled "Using fallout radio-nuclide ^{137}Cs to assess the magnitude and spatial extent of soil erosion and sediment

production areas in the Boyer River watershed (Québec, Canada)".

Relevant staff from SWMCN and SSU also met with the participants of a session on "Soil erosion and landscape scale carbon dynamics" to exchange views on future research needs on this topic, the usefulness of isotope techniques for such experimentations, and potential cooperation with IAEA.

International Conference on "Environment and Livelihoods in Coastal Zones: Managing Agriculture-Fisheries-Aquaculture Conflicts" Bac Lieu, Vietnam, 1–3 March 2005

Long Nguyen was invited to attend and presented a paper entitled: "Land and Water Resources Management in Coastal Zones - Research Collaboration Opportunities: Perspectives from the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture".

The presented paper fitted well into one of the four following themes of the conference:

- To provide an assessment of the dependence of farmers and fishermen on coastal zone resources and the ecological implications of resource use based on case studies and participants' experience.
- To identify processes in, and tools for managing the land-water interface for solving agriculture-aquaculture ecosystem conflicts in coastal areas.
- To exchange the findings on land-water interface management from case studies in various countries.
- To develop collaboration opportunities for future action and research.

The Conference was well organized with one field day trip to selected sites in coastal areas of Bac Lieu in the Mekong Delta, Vietnam. I was very impressed with the Conference venue, the organizational skills of Dr. To Phuc Tuong, Director of Soil and Water Management of IRRI and his organizing committee, and the logistic support of the People's Committee of Bac Lieu Province. The Conference addressed a range of issues concerning land-water resource management for food security, environment and livelihoods in coastal zones. There were over 150 participants from 17 countries including Vietnam.



Participants from over 15 countries plus some local scientists and policy makers at the International Conference on Environment and Livelihoods in Coastal Zones, Bac Lieu, Vietnam (Courtesy of L. Nguyen, March 2005)

The highlights of the Conference were the integrated land-water management approaches that are relevant to those used by the Soils Team in addressing water resource management for agricultural productivity and environmental sustainability. Some of these highlights were:

- Effects of a dramatic shift in land-use practices from rice growing and freshwater aquaculture to high profit shrimp aquaculture on soil and water degradation and conflicts at the farm level between agricultural and aquaculture production in the coastal zones of the Mekong Delta, Vietnam.
- Impacts of land and water use activities within a coastal zone on the livelihoods of coastal communities in Bangladesh, Brazil, Nigeria, Thailand and Vietnam.
- Integrated land-water resource management and participatory approach through capacity building and community involvement to achieve food and environmental sustainability and to manage conflicting demands on coastal resources.

Another highlight of the Conference was an opportunity for me to visit my birthplace and to promote the role of

the Joint FAO/IAEA Division in the use of nuclear and related techniques to address issues relating to Food and Agriculture in Member States. I had valuable scientific discussions with the Deputy Minister of Agriculture (Dr. Nguyen Van Bo), the Director of Agricultural Planning and Projection (Dr. Vu Nang Dzung) and the Vice-Chairman (Dr. Bui Tuan) and other officials of the Vietnamese Atomic Energy Commission.



Dr. Bui Van Tuan, Vice Chairman of the VAEC (left) and Long Nguyen in front of VAEC after the meeting (Courtesy of L. Nguyen, 2005)

The Vietnamese Government recognizes the importance of agriculture in its national economy and the need for optimizing water utilization within the plant-rooting zone for food security and environmental sustainability. Despite the high annual rainfall of 2000 mm a year in the northern part and even higher rainfall in the central part of the Country, the agricultural sector is significantly constrained by the dry season (October until April) and hence the Vietnamese Authorities see the need for water harvesting and water storage within the rooting zone during the dry season. This view clearly endorses the relevance of the activities of IAEA and our Soils team in addressing land-water resources issues depending on the particular situation of a Member State.

Status of Coordinated Research Projects

Use of Nuclear Techniques for Developing Integrated Nutrient and Water Management Practices for Agroforestry Systems (D1-20.07)

Technical Officer: Rachid Serraj

The final RCM of this CRP was recently held (Vienna, 18-22 April, see Past Events). All participants presented their final reports summarizing the major achievements of the project. Four working sessions were organized to present and discuss all the results obtained by the contact holders. This was followed by two working group sessions, which focused on project evaluation, discussion of the major achievements and outputs of the CRP and formulation of final project reports.

Some of the most important general conclusions were:

- The work conducted under the CRP has demonstrated that trees provide significant benefits for agricultural systems, including improved soil structure, nutrient and water availability, reduced nutrient loss through reduced leaching and general improvement in soil fertility.
- The experiments run during the project allowed a quantification of the contribution of fixing trees in term of C and N for each system. The use of ^{15}N tracing in combination with N balances provide a new insight into the use efficiency of sources of N, particularly through the labelling of fertiliser and/or of organic matter (tree ^{15}N injection method).
- Technical knowledge gained from this CRP could be applied to a broad range of Agroforestry systems (AFS) studies to improve understanding of system interactions in agroforestry. However, there is further potential to use ^{13}C and ^{18}O to better understand the physiology of trees and responses to seasonal variation in climate, C and water dynamics of AFS. In particular, ^{13}C can identify the response of plants to water stress, with the potential to improve matching of trees to environment.
- Improvement of soil physical properties (infiltration, aggregates, bulk density and water supply) under AFS. The improved soil properties complemented the nutrients in improving post-fallow maize yields. Long term improvement were associated with coppicing and mixed fallows.
- More improvement of soil biology in tree systems compared to no-tree systems.
- AFS such as those studied in the CRP, have other benefits from the presence of the trees: shading for animals, browsing during the dry period, high quality biomass for livestock (18 % protein in tree leaves), and an increase or restoration of biodiversity (fauna, birds, insects, etc.).
- Trees are able to access nitrogen (N) from deeper soil layers than crops, which may be an important way to increase N supply to crops.
- The demonstration that trees generally access N and water from deeper soil layers than crops is consistent with the deeper root distribution of trees in the alley cropping system as compared to the tree alone.
- The N contribution from trees either through the root system or through the above-ground parts, as determined by ^{15}N use recovery, varied substantially between different systems.
- Stable isotope techniques provide a useful method for monitoring competition between AFS components for water. The ^{18}O signature from water and plants, allowed identification of the source of water for crop and tree. As expected, the trees were generally able to use deeper water than annual crops, so that the competition for water would depend on depth of available water and its accessibility to roots, rooting depth, tree species, and differences in soil water content.
- A special concern for establishing AFS is the competition between trees and crops for water. However, there is some evidence from the humid tropics (Malaysia) and sub-tropics (China) that competition for water is mostly confined to the early phases of establishment. In these areas, once trees have established, they are able to access water from deeper in the soil profile and may actually improve water availability for crops through hydraulic lift/redistribution.
- The water availability in AFS should not only be considered in term of competition between tree and crop, but, if limiting, also a factor that drives the synchrony between crop uptake and organic source release and therefore strongly affect N use efficiency and possible N losses.

The final report of the RCM and CRP will be available at <http://www.iaea.org/programmes/nafa/d1>. In addition to the publication of an IAEA-TECDOC reporting the major project achievements, it was also decided to publish several individual and group papers in a special issue of an international scientific journal.

Selection for Greater Agronomic Water-Use Efficiency in Wheat and Rice Using Carbon Isotope Discrimination (D1-20.08)

Technical Officer: Rachid Serraj

The overall objective of this CRP is to contribute to increasing the agronomic water-use efficiency of wheat and rice production, where agronomic water-use efficiency is defined as grain yield/total water use including both transpiration and evaporation. The CRP is also aimed at increasing wheat productivity under drought and rice yield in salt-affected areas

During the first RCM, progress reports were presented, and project objectives and outputs were revisited and a detailed work plan was also established for future research activities in each participating country and in line with the project objectives. The report of the first RCM is available at <http://www.iaea.org/programmes/nafa/d1>.

In order to cover all project objectives and strengthen the research aspects on rice and salinity, in addition to drought effects on wheat, it was recommended by the first RCM, after consultation with Director NAFA, to invite more research contracts to work on these aspects. Given the amount of research work needed on rice and the direct involvement of the team at IRRI, previously involved as agreement holder, it was suggested to award a technical contract to IRRI. Similarly, two new research contracts were awarded (Bangladesh and PR China) to work, in collaboration with IRRI on the application of carbon isotope discrimination in the improvement of salinity tolerance in rice. An additional contract was awarded to University of Aleppo (Syria) to work on experimental sites characterisation, wheat simulation modelling and field evaluations in relation to the CRP objectives. In addition to the initial six contract holders from Algeria, PR China, India, Morocco, Pakistan, and Yemen, who are mainly focusing on wheat.

There are three technical contractors from CSIRO-Australia, CIMMYT-Mexico and IRRI-Philippines, and one agreement holder (UCR, USA). They are all world experts in crop improvement of water use efficiency under a wide range of environmental conditions.

During the first RCM, progress reports were presented, and project objectives and outputs were revisited and a detailed work plan was also established for future research activities in each participating country and in line with the project objectives. The report of the first RCM is available at <http://www.iaea.org/programmes/nafa/d1>. The second RCM will be held in 21–25 November 2005 in Meknes, Morocco.

Significant progress has been achieved during the first phase of this CRP, leading to several scientific publications, including the following two papers by the contractor holders from India and Pakistan.

Development of Management Practices for Sustainable Crop Production Systems on Tropical Acid Soils through the Use of Nuclear and Related Techniques (D1-50.06)

Technical Officer: Long Nguyen

The final RCM was held in Vienna from 15 to 19 November 2004 (Refer to last Soils Newsletter, Vol. 27, No. 2) under the chairmanship and guidance of Mr. Felipe Zapata, a previous staff member and a technical officer for this CRP since its inception. The objectives of the meeting were to: a) review all the research results obtained during the duration of the project (2000-2004); and b) evaluate the overall implementation of the CRP in accordance with the log-frame and work plan of the project.

Six research contract holders (Brazil (2), Burkina Faso, Cuba, Mexico and Venezuela), three technical contractors (IFDC-USA (2) and Germany) and two research agreement holders attended the meeting. In addition, staff of the Section and the Science Unit, IAEA Seibersdorf Laboratories participated. During the opening Dr. Long Nguyen, Head of the Soil and Water Management & Crop Nutrition Section, welcomed the participants on behalf of the FAO/IAEA Division and made remarks regarding the sustainable intensification of agricultural production in tropical acid soils, and the need to take necessary steps to maximize the outcomes of the project and ensure the transfer of the generated technologies to the end-users.

The first two days consisted of presentations by the participants grouped by savannahs of Latin America and Africa and supportive research. The participants presented their final research reports highlighting their main achievements. It was noted that the results from the savannahs of Latin America and Africa are site-specific due to their particular environmental (soil and agro-climatic) and socio-economic conditions. Thereafter, the participants divided into four working groups formulated conclusions and recommendations on the main research topics of the project, i.e. a) identification of genotypes (Al-tolerant, N- and P-efficient) adapted to acid soils, b) management practices for correcting soil acidity and N infertility (i.e., liming, fertilizer N, biological nitrogen fixation in grain legumes, organic residues, cover crops/green manures), c) management practices for correcting P infertility (water-soluble P fertilizers, phosphate

rock(PR) agronomic database and decision support system for direct application of PR), and d) improved soil management practices (no tillage, soil organic carbon and nitrogen accumulation). At the end of the meeting, Mr. F. Zapata revised the outputs of the project and assessed the criteria for the project evaluation, i.e. efficiency, and effectiveness. A task ahead will be to communicate the results and transfer these to the end-users to achieve the desired impact and relevance of the project. The project has generated a wealth of information on all the topics mentioned above that need to be properly interpreted and synthesized. The publication of the research results was also discussed in a general session. It was decided to produce an IAEA TECDOC as final publication of the CRP. In addition, the participants will prepare manuscripts for publication in scientific journals. Activities and deadlines to ensure completion of this work were established. Overall, significant progress in the development of sustainable agricultural production practices for predominant cropping systems in the tropical savannahs of Latin America and Africa has been achieved.

The full report of the CRP including the final RCM is available at the website:

<http://www.iaea.org/programmes/nafa/d1>

Integrated Soil, Water and Nutrient Management for Sustainable Rice-Wheat Cropping Systems in Asia (D1-50.07)

Technical Officer: Long Nguyen

The technical officer for this CRP at the time of its implementation on 1 October 2001, was Phil Chalk. After nearly four years of operation and two RCMs, the first in Vienna (4–8 March 2002) and the second in Nanjing, People's Republic of China (8–12 December 2003), significant data accumulation and project progress has been made, with some changes in the number of research contracts and participants: Manbir Sachdev from India was unable to be involved in this CRP because of other commitments, while both Md Akter Khan from Bangladesh and Fayyaz Hussain from Pakistan received additional support from Murshedul Alam and Abdul Rashid, respectively.

As the new technical officer for this CRP since late October 2004, I look forward to meeting the six contract holders from Bangladesh, China (2), India, Nepal, and Pakistan, two technical contractors from Australia and the Philippines (IRRI) and two agreement holders from Australia (CSIRO) and India (CIMMYT) at the 3rd RCM in Dhaka, Bangladesh on 11–15 July 2005. This meeting

is important for preparation of the final plan to complete the experimental work and to ensure the accomplishment of the following CRP objectives:

- To improve the productivity and sustainability of rice-wheat cropping systems through increased efficiency of water and nutrient use.
- To modify existing water and nutrient management systems, and improve soil management in both traditional and emerging (raised beds, non-puddled soil, direct seeding) tillage systems, for sustainable intensification of cereal production.
- To create a data set for the DSSAT (Decision Support System for Agrotechnology Transfer) rice and wheat models, specifically to simulate water and nitrogen interactions in the rice-wheat cropping systems.

Assess the Effectiveness of Soil Conservation Measures for Sustainable Watershed Management Using Fallout Radionuclides (D1-50.08)

Technical Officer: Claude Bernard

This CRP is in its third year of implementation. The overall objective is to develop diagnostic tools for assessing soil erosion and sedimentation processes and effective soil conservation measures for sustainable watershed management. More specific research objectives are related to: i) further develop fallout radionuclide (FRN) methodologies, with particular emphasis on the combined use of ^{137}Cs , $^{210}\text{Pb}_{\text{ex}}$ and ^7Be for measuring soil erosion over several spatial and time scales, ii) establish standardized protocols for the combined application of the above techniques, and iii) utilize these techniques to assess the impact of short-term changes in land use practices and the effectiveness of specific soil conservation measures.

A total of nineteen researchers from Argentina, Australia, Austria, Brazil, Canada, Chile, China, Japan, Morocco, Pakistan, Poland, Romania, Russia, Switzerland, Turkey, UK, USA, and Viet Nam are currently participating in the project. The individual studies cover a wide range of conditions (land use, environment, spatial scales) that should allow a robust testing of the potential of the FRNs to assess the efficiency of soil conservation practices. The first RCM was held in Vienna and Seibersdorf, Austria, 18–22 May 2003. The second RCM was in Istanbul, Turkey, on 4–8 October 2004. The third one will be held in Morocco, in May 2006. Reports from the RCMs are available from the Soil and Water Management and Crop Nutrition Section web site, at:

<http://www.iaea.org/programmes/nafa/d1/crp/d1-crp.html>

Integrated Soil, Water and Nutrient Management in Conservation Agriculture (D1-50.09)

Technical Officer: Claude Bernard

The overall objective of this new CRP, planned to be implemented from 2005 to 2010, is to enhance the productivity and sustainability of farming systems through a better understanding of the principles and practice of conservation agriculture. More specifically, the individual and interactive effects of conservation tillage practices, residue management, crop rotations, nutrient and

water inputs on soil organic matter stocks, resource use efficiency, agricultural productivity and environmental quality will be investigated.

Eleven researchers from Argentina, Australia, Brazil, Chile, India, Kenya, Morocco, Pakistan, Turkey, Uganda and Uzbekistan participate to the CRP.

The first Research Coordination Meeting was held in Vienna, Austria, from 13 to 17 June 2005. The report of the meeting will soon be available on the Soil and Water Management and Crop Nutrition Section website, at <http://www.iaea.org/programmes/nafa/d1/crp/d1-crp.html>

Laboratory Activities

Research

Study of water erosion processes using radioisotopes

L. Mabit (SSU) and C. Bernard (SWMCN)

Conservation of soil and water resources is a major concern in the context of sustainable agriculture and environ-



Fig. 1 Soil erosion and degradation after rainfall events. Soissons, France (Courtesy of L. Mabit and C. Bernard)

ment. Runoff and associated water erosion (Fig 1), is a major factor of non-point source pollution and constitutes the principal way of conveying sediments, agri-chemicals plus nutrients to receiving waters and thus contribute to water quality degradation (Fig 2).



Fig. 2 Soil erosion, sediment transport and deposition in an hydrosystem. Soissons, France (Courtesy of L. Mabit, Laverdière and C. Bernard)

Erosion is the end-result of a combination of several processes. Before new management practices are proposed to land owners to solve this problem, erosion must be well documented in terms of extension: field, farm or watershed. Water erosion studies, which were initiated during the first half of the twentieth century, have commonly involved conventional sediment loading measurement at spatial scales ranging from micro-plots to large-sized plots (under simulated or natural rainfall) and more recently at watershed scale.

Soil movement mapping, at scales exceeding fields, is complex. Investigations on the relationships between agrosystems and receiving waters raise many methodological problems.

Traditional monitoring techniques, water levels and quality measurements in small watersheds, require many years of measurements to integrate the inter-annual variability of precipitation erosivity, soil erodibility and effect of cropping practices. These measurements generate sediment production figures, but give no information on the spatial origin of these sediments or on the processes at the origin of the solid loads.

Recently, Cesium-137 (^{137}Cs), an anthropic fallout radionuclide, was shown as an effective tracer for the quantification and spatialization of erosion. ^{137}Cs (half-life: 30.12 years) is a radioisotope that was artificially introduced in the environment through the extensive high-atmosphere bomb tests that took place in the 1950s and 1960s. Due to its environmental behaviour in soils, this isotope is a particularly interesting soil movement indicator. Its spatial redistribution reveals soil movements that were initiated some 40 years ago. The rates and spatial extent of soil loss and deposition areas can be established, and soil movement budgets are easily estimated, at scales ranging from small plots to watersheds. Generally, soil movements are estimated by comparing the activity of ^{137}Cs (expressed in Bq/m^2) of cultivated soils to that of so-called reference sites (e.g. old prairie or forest soils) where soil erosion is assumed to be negligible.

This technique is useful to quantify, spatialize and map net soil movements. It thus appears as a fast and well-adapted method that complements other soil erosion assessment techniques. It has been used by numerous researchers in most regions in the last two decades.

In order to support the CRP D1.50.08 entitled “Assess the effectiveness of soil conservation measures for sustainable watershed management using fallout radionuclides”,

studies using ^{137}Cs to quantify soil loss risks at the watershed scale have been initiated with Canada and are being developed in Austria in collaboration with Boku University (Universität für Bodenkultur, Department für Wasser-Atmosphäre-Umwelt, Institut für Hydraulik und landeskulturelle Wasserwirtschaft).

It was planned to develop researches to investigate the water erosion effect on particle size and nutrients (N, P) and develop different new aspects of radioisotope techniques (relationship between the soil and radionuclide loss, relationship between soil quality parameters and soil loss as estimated by radioisotopes, relationship between the severity of erosion and the quality of eroded sediments). An experimental study was undertaken at the plot scale using simulated rainfall and ^{134}Cs enrichment. Like ^{137}Cs , this radioisotope (half-life: 2,05 years) is known to be strongly adsorbed onto exchangeable sites of soil clay particles and organic matter. Physical processes like erosion are the dominant factors moving this isotope within the landscape and its measurement is easy by gamma spectroscopy.



Fig. 3 Superficial insertion of ^{134}Cs at the soil-plot scale

Twenty soil boxes of 0,35 m², filled with a loamy soil and placed on a 5 % slope were used for this purpose. After the ^{134}Cs was applied to the soil surface (Fig. 3) three successive artificial rainfalls were applied at 24 hours intervals, with identical intensity but different durations (Fig. 4). The first results of this study indicate the potential of ^{134}Cs on an event basis to trace particle transport and to quantify soil erosion process under controlled experimentation. The data on soil and water losses generated by this experimentation are under analysis.

Training

Fellowships and Scientific Visit

Mr. F. Al-Ain (SYR/04055) received training for one month in the use of crop simulation modelling (APSIM) with Ms. Lee Heng for simulating wheat yield data from field experiments that were carried out in the semi-arid region, south of Damascus (Syria) to evaluate seed rates and nitrogen fertilizer effects on wheat yield. Good agreement between measured and predicted yields was obtained; the simulation study helped to identify new areas for research and new experiments are now being conducted in Syria.



Fig. 4 Rainfall simulation on experimental soil equipped plots (Courtesy of L. Mabit and C. Bernard)

Six fellows are expected to arrive for fellowship training in the next few months at the Soil Science Unit: **Ms. Lu Li** (CPR/05017), **Mr. Daniel Asare** (GHA/05003), **Mr. Komider Barhmi** (MOR/03004), **Ms. Jocelyn Louissaint** (HAI/05001), **Ms. Jargal Altangerel** (MON/05008) and **Ms. Maivalee Walker** (JAM/05001), **Mr. Jean Serge Antoine** (HAI/05002V). They will be trained in the field of crop nutrition, water management and erosion measurements.

Supportive Services

Isotope Analytical Services

L. Mayr

The Soil Science Unit performed nearly 18 000 stable isotope measurements during the year 2004 for CRPs, TCPs, as well as for research and training activities. These measurements included natural abundance and enriched ^{15}N , as well as ^{13}C and ^{18}O at natural abundance levels.

Samples received:

CRP	4257	54.4%
TC	2014	25.7%
Seibersdorf	1551	19.8%
Total	7822	100.0%

Requested analyses:

¹⁵ N enriched level	5592	69.9%
¹⁵ N nat. ab.	414	5.2%
¹³ C nat. ab.	1566	19.6%
¹⁸ O nat. ab.	429	5.4%
Total	8001	100.0%

Measurements carried out:

¹⁵ N enriched level	8119	45.8%
¹⁵ N nat. ab.	3219	18.2%
¹³ C nat. ab.	5985	33.8%
¹⁸ O nat. ab.	390	2.2%
Total	17713	100.0%

During the months of May and June 2005 the stable isotope analytical facilities are being renovated. All except one mass specs have been moved into storage so that during this period only ¹⁵N can be analysed. In July it is planned to start a full analytical operation again with four mass spectrometers, one of which has just been purchased and is to be installed in July.

External Quality Assurance. Annual proficiency testing (PT) on ¹⁵N and ¹³C abundance and total N and C in plant materials (EQA2004, EQA2005)

M. Aigner

Proficiency Testing

The eighth round of proficiency testing (PT) exercise in ¹⁵N and total nitrogen analysis of plant materials has been conducted during the period January to November 2004. From this year on additional ¹³C (at the natural abundance level) and total carbon analysis of plant materials are offered to the institutes.

A test panel containing three different plant materials with unknown ¹⁵N atom abundance, delta ‰¹³C and total C and total N content including instructions for analysis and result reporting was sent in March 2004 to each participating laboratory. Five months (April to August 2004) were given to submit the results. The choice of the instruments and methods was up to the participant. A certificate covering the period of the year 2004 and stating the successful participation in the exercise was provided to those labs that submitted "class I results" (i.e. within the accepted limits set by the Soil Science Unit).

Twenty-eight applicants covering five regions (Table 1) were provided with the test panel. Seventeen laboratories (i.e. 61 %) reported a full set of data within the deadline. Five laboratories used mass spectrometers for ¹⁵N atom abundance (and ¹³C-) determination and the other used emission spectrometers. Eight laboratories indicated technical problems with their emission spectrometers.

A remarkable improvement of the analytical performance was achieved in Bangladesh after an 8-week analytical training at the Seibersdorf laboratory of the technician from Bangladesh in charge of the analyses. In total, twelve laboratories in Argentina, Bangladesh, Belgium, Chile, Iran, New Zealand, Pakistan, Poland, Thailand, Turkey, Venezuela and Vietnam received certificate for successful participation in the exercise.

Table 1. Summary of responses:

Region	Number of participating laboratories	Number of laboratories receiving the certificate (I)	Number of laboratories producing satisfactory results (II)	Number of laboratories producing results outside control limits (III)	Number of laboratories not submitting results
Africa	6	0	0	0	6
Latin America	7	3	1	0	3
East Asia & The Pacific	7	4	2	0	1
West Asia	5	2	2	0	1
Europe	3	3	0	0	0
TOTAL	28	12	5	0	11

First Experience with PT on ^{13}C and total carbon

Four laboratories expressed their interest to analyze also ^{13}C at the natural abundance level and total C content of plant materials by mass spectrometry. They were provided with some background information on how to report the results and they received two secondary standard reference materials to calibrate their instruments. The test samples had to be analysed for ^{15}N , total N, ^{13}C and total C.

Three of the laboratories reported data perfectly within the control limits set by the Soil Science Unit, one lab needs to improve the method.

New round of PT “EQA2005”

In the new round of proficiency testing exercise EQA2005, which has started in January 2005, the forms for the Proficiency Test have been re-designed to harmonize all external quality assurance activities that are offered by the IAEA in accordance with relevant international standards (ISO17025).

Additionally to reporting the measurement data of the test samples, several questions on the implemented Quality Control system were included in the report forms. The purpose of these questions is to enable the SSU to understand the Quality Control measures employed in determining the laboratories' results. It is also useful in the evaluation of the submitted data and allows judgement on the correctness of the estimate given by the participating laboratories.

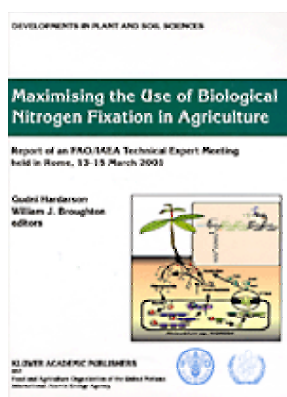
Publications

Recent Publications of the Sub-programme

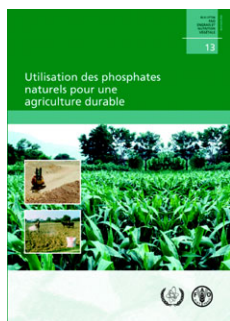
A list of articles from Soils Section and Unit staff published in Scientific journals and Conference Proceedings are available on our SWMN Section website at the URL http://www.iaea.org/programmes/nafa/d1/public/d1_pbl_1.html

Departmental Award

Mr. Gudni Hardarson, Head of the Soil Science Unit, received the Departmental Award for the best Technical Report published during the year 2003. The publication entitled "Maximising the Use of Biological Nitrogen Fixation in Agriculture" was a report of an FAO/IAEA Technical Expert Meeting held in Rome, 13-15 March 2001. It was published by Kluwer Academic Publishers and FAO/IAEA both as a hard cover book and as an issue of *Plant and Soil*, Volume 252 (1) 2003. Incorporating contributions from microbiologists, molecular biologists, plant breeders and soil scientists this volume reports the results and recommendations of an FAO/IAEA meeting of twelve experts on biological nitrogen fixation



Recent titles



Utilisation des phosphates naturels pour une agriculture durable. Bulletin FAO Engrais et Nutrition Végétale No. 13. (French version of the "Use of phosphate rocks for sustainable agriculture". FAO Fertilizer and Plant Nutrition Bulletin No.13). F. Zapata and R.N. Roy, editors. Food and Agriculture

Organization of the United Nations. Rome, 2004, + 151 pages. ISBN 92-5-205030-2. Soft cover. A joint publication of the FAO Land and Water Development Division and the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

Papers in Scientific Journals and Conference Proceedings

Akhter J, Mahmood K, Tasneem MA, Malik KA, Naqvi MH, Hussain F, Serraj R. 2005. Water-use efficiency and carbon isotope discrimination of *Acacia ampliceps* and *Eucalyptus camaldulensis* at different soil moisture regimes under semi-arid conditions. *Biologia Plantarum* 49: 269-272.

Aye, T.M.; Nguyen, M.L., Bolan, N.S., Hedley, M. J. Phosphorus in soils of riparian and non-riparian wetland and buffer strips in the Waikato area, New Zealand. *New Zealand of Agricultural Research* (In review).

Bayala, L. and Heng, L.K. 2005. Hydraulic lift study in native tree species in an agroforestry parkland of West African dry savanna. FAO/IAEA Technical Meeting Combating Soil Degradation to Enhance Food Security in Africa: The Role of Nuclear Techniques in Developing Improved Soil, Water and Nutrient Management Practices. Nairobi, Kenya.

Bernard, C., Mabit, L. and Laverdière, M.R. 2005. Using fallout radionuclide ^{137}Cs to assess the magnitude and spatial extent of soil erosion and sediment production areas in the Boyer River watershed (Québec, Canada). In: *Geophysical Research Abstracts* (CD-Rom), Volume 7, EGU General assembly 2005, ISSN: 1029-7006. Abstract EGU05-J-06075. pdf, 2 pages.

Çağırğan, M. İ., Özbaş, M.O., Heng, L. and Afza, R. 2005. Genotypic Variability for Carbon Isotope Discrimination in the Mutant and Improved Lines of Barley. Issue 3, September 2005, IEHS.

Misra SC, Randive R, Rao SP, Sheshshayee MS, Serraj R, Monneveux P. 2005. Relationship between carbon isotope discrimination, ash content and grain yield in wheat in the peninsular zone of India. *European Journal of Agronomy* (Submitted).

Nguyen, M.L.; Gold, A.J.; Groffman, P. M.; Zaman, M. ; Kellog, D. Q.; Wilcock, R.J.(2005) Nitrous oxide generation, denitrification and nitrate removal in a seepage wetland intercepting surface and subsurface flows from a grazed dairy catchment *Journal of Environmental Quality* (In review).

Quilbé, R., Serreau, C., Wicherek, S., Bernard, C., Thomas, Y. and Oudinet, J.-P. 2005. Nutrient transfer by runoff from sewage sludge amended soil under simu-

lated rainfall. *Environmental Monitoring and Assessment* 100:177-190.

Stafford, A. D., Nguyen, M. L., Campbell, D. I., McLay C. D. (2005). Determining and modelling subsurface artificial drainage effectiveness on a Waikato dairy farm. *N.Z. Journal of Agricultural Research* (In Review).

Tanner C.C., Nguyen, M.L., Sukias, J.P.S. (2005). Constructed wetland attenuation of nitrogen exported in subsurface drainage from irrigated and rain-fed dairy pastures. *Water Science and Technology* (in press).

Tanner, C.C.; Nguyen, M.L.; Sukias, J.P.S. (2005). Nutrient removal by a constructed wetland treating subsurface drainage from grazed dairy pasture. *Agriculture, Ecosystems and Environment* 105: 145-162.

Tanner C.C., Nguyen, M.L., Sukias, J.P.S. (2005). Export of nitrogen in subsurface drainage from irrigated and rain-fed dairy pastures and its attenuation in con-

structed wetlands. Proceedings of the 18th Annual Fertiliser and Lime Research Centre Workshop: Developments in Fertiliser Application Technologies and Nutrient Management, Massey University, Palmerston North, NZ. 9-10 February.

Websites

The Soil and Water Management and Crop Nutrition Section is updated on a regular basis.

Please visit the website and make comments.

<http://www.iaea.org/programmes/nafa/d1/index.html>

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture:

<http://www.iaea.org/programmes/nafa>

FAO website: <http://www.fao.org>

FAO/AGL (Land and Water Development Division)

<http://www.fao.org/AGL/portals.stm>

VACANCY ANNOUNCEMENT

INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)

Position and Grade: **Soil Scientist / Plant Nutritionist (P-4)**
Organizational Unit: Soil Science Unit, FAO/IAEA Agriculture and Biotechnology Laboratory
[Agency's Laboratories \(Seibersdorf and Headquarters\)](#)
[Department of Nuclear Sciences and Applications](#)
Duty Station: Seibersdorf, Austria
Application Deadline: **11 July 2005**
Type/Duration of Appointment: [Fixed term](#), 3 years (subject to a probationary period of 1 year)

Organizational Setting: The Agency's Laboratories are located in Seibersdorf, approximately 45 km south of Vienna. The Soil Science Unit, with a staff of 3 professional scientists and 6 technical staff, is one of 5 Units in the FAO/IAEA Agriculture and Biotechnology Laboratory. The primary role of the Unit is to provide training and technical support, including research and direct laboratory services, within the FAO/IAEA subprogramme on sustainable intensification of crop production systems.

Assignment: The successful applicant is responsible for the following duties:

- To plan, develop and implement laboratory and field research in support of coordinated research projects (CRPs) on the use of isotopes in crop nutrition and water management, in particular the use of carbon-13 isotope discrimination and oxygen-18 in relation to water use efficiency, evaluation of abiotic stress and the use of stable isotopes (natural abundance) in the above determinations, as well as to report on the research results;
- To supervise the training of fellows including the allocation of resources and technical support and to supervise technicians in the implementation of laboratory work;
- To provide technical input to subprogramme planning, implementation and reporting, including input into the IAEA and FAO programme and budget;
- To evaluate results from CRPs, including the use of modelling methodology;
- To coordinate and provide technical expertise to technical cooperation projects in Member States and to prepare research results and training guidelines for publication

Education and Key Experience

- Advanced university degree PhD or equivalent in crop science, plant physiology, soil science or agronomy.
- 10 years of relevant experience in the area of crop adaptation and land-water interactions including 4 years at the international level, preferably in developing countries.
- Experience with the application of nuclear techniques to evaluate nutrient status and dynamics in agricultural and natural ecosystems.
- Experience in the supervision of technical staff and in working in multidisciplinary teams, if possible in the field of research on crop nutrition and water management.

Knowledge, Skills and Abilities

- A sound knowledge of and practical work experience in, supported by refereed publications, the use of isotopic tracers in water management and crop nutrition (particularly those based on natural abundance e.g. carbon-13 and oxygen-18) and other methods for identifying crop germplasm with superior tolerance to abiotic stresses, including drought, salinity or nutrient deficiencies/toxicities, is required.
- Thorough and in-depth knowledge of the use and measurement of oxygen-18 and carbon-13 isotope discrimination in relation to water use efficiency.
- Good general understanding of land-water-plant-nutrient interactions and agricultural production in developing countries and the global problems associated with abiotic stress in crop production.
- Ability to formulate and implement research projects on water use efficiency.
- Practical skills in the supervision and training of junior scientists and laboratory/field technicians.
- Well-developed computer application skills including familiarity with modelling.
- Fluency in spoken and written English is essential. Working knowledge of German useful

Applicants need to complete and submit a IAEA Personal History Form (PHF) before 11 July 2005, quoting the vacancy notice No. 2005/027. Online application is encouraged at: <http://www.iaea.org/About/Jobs>. If this is not possible, a PHF can be obtained from the above Internet address or by mail: Division of Personnel – International Atomic Energy Agency – Wagramer Strasse 5 – P.O. Box 100 – A-100 Vienna, Austria.



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