Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Soils Newsletter

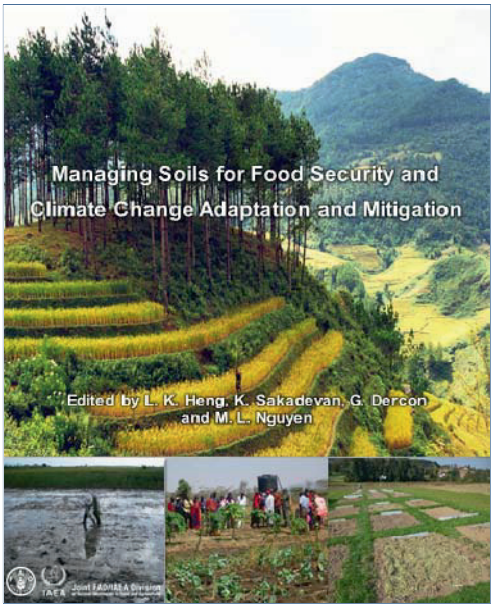
http://www-naweb.iaea.org/nafa/index.html
http://www.fao.org/ag/portal/index_en.html

ISSN 1011-2650

Vol. 37, No. 1, July 2014

Contents

To Our Readers



FAO/IAEA Proceedings on Managing Soils for Food Security and Climate Change Adaptation and Mitigation

It is time for me to say farewell and to express my grateful thanks to all of you for helping me in my duties with the Soil and Water Management & Crop Nutrition (SWMCN) Subprogramme. By 30 June 2014, I will have been working with the Subprogramme for nearly 10 years. It has been a great privilege for me to work with so many colleagues and counterparts in FAO and IAEA Member States through the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture on a range of soil and water management issues for sustainable agriculture and conservation of soil and water resources.

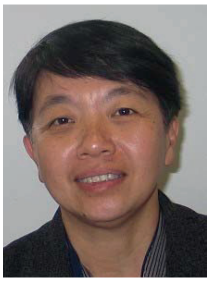
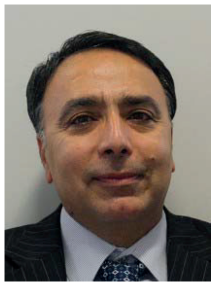
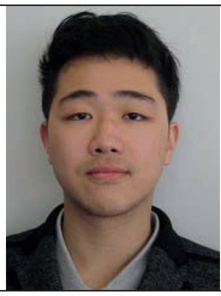
Reflecting back on my tenure with the Joint FAO/IAEA Division, it is most encouraging to see the annual number of technical cooperation (TC) projects for which the SWMCN Subprogramme provides technical support increase from 20 to 51, including ten regional TC projects which encompass approximately 12–15 participating countries in each project. This increase reflects in part, a growing interest from Member States in the use of isotopic and nuclear techniques to address a range of issues relating to nutrient and water use efficiency in both rainfed and irrigated conditions and an emerging concern for the impact of soil erosion and land degradation on food productivity. This also reflects the support that you have provided, through your involvement as project counterparts, and the commitment of the SWMCN Staff in implementing these TC projects. With increasing concern for the impacts of climate change and extreme weather events on the fragility of food production systems, food security and the natural resource base, there is an urgent need to enhance soil resilience to erosion, salinization, droughts, floods, and changes in soil and air temperature. By 2050, the world population will reach nine billion people, compared with the present number of nearly seven billion. The greatest challenge we face, is to meet the food demand associated with this increase in population growth without degrading the natural resource base and at the same time, minimizing greenhouse gas (GHG) emissions, which contribute to climate change. Integrated management of soil and water resources can make a positive difference, not only towards food security and sustainable agriculture but also to sustainable development (SD), since SD as defined by the United Nations, encompasses the importance of soil and water management for food security and poverty alleviation. Isotopic and nuclear techniques play an important role in assessing the impacts of climate change and variability on the natural resource base and evaluating different soil and water management practices on soil fertility, water use efficiency and land productivity for climate change adaptation and mitigation. Some of these aspects will be discussed in detail in one of the feature articles in this Soils Newsletter. More information on the use of isotopic and nuclear techniques in soil and water management can be seen in the FAO/IAEA Proceedings on Managing Soils for Food Security and Climate Change Adaptation and Mitigation which will be published this year. This publication is a compilation of selected papers presented at the International Symposium organized by the Joint FAO/IAEA Division from 23–27 July 2012.

It is sad to leave IAEA and all of you at this exciting time, as you address the global concerns and challenges outlined above. This ReNuAL project will certainly enable the SWMCN Subprogramme to make a major impact in our effort to support Member States in the use and application of isotopic and nuclear techniques towards the development of improved land and water management practices for climate-smart agriculture and sustainable development.

I wish you all every success for the future and thank you for the opportunity to learn and work with each of you.

Minh-Long Nguyen
Head
Soil and Water Management and Crop Nutrition Section

STAFF
Soil and Water Management and Crop Nutrition Subprogramme

			
M. L. Nguyen	L. K. Heng	K. Sakadevan	M. Zaman
			
K. Ajvazi	K. Makovicky	G. Dercon	L. Mabit
			
A. Wahbi	L. Mayr	M. Aigner	M. Heiling
			
G. Weltin	A. Toloza	C. Resch	N. Jagoditsch
			
Y. Mao	B. Gonsalves	X. Chen	J. M. Mletzko

Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture

Vienna International Centre, P.O. Box 100, 1400 Vienna, Austria
Telephone (+43 1) 2600 + ext.; Fax: (+43 1) 2600 7
Email: Official.Mail@iaea.org

Name	Title	Email	Extension
Qu LIANG	Director	Q.Liang@iaea.org	21610

Soil and Water Management and Crop Nutrition (SWMCN) Section

Name	Title	Email	Extension
Minh-Long NGUYEN	Section Head	M.Nguyen@iaea.org	21648
Lee Kheng HENG	Soil Scientist	L.Heng@iaea.org	26847
Karuppan SAKADEVAN	Soil-Water Ecophysiologist	K.Sakadevan@iaea.org	21613
Mohammad ZAMAN	Soil Scientist / Plant Nutritionist	M.Zaman@iaea.org	21645
Ksenija AJVAZI	Team Assistant	K.Ajvazi@iaea.org	21646
Kyoko MAKOVICKY	Team Assistant	K.Makovicky@iaea.org	21647

Soil and Water Management and Crop Nutrition Laboratory (SWMCNL) A-2444 Seibersdorf, Austria

Name	Title	Email	Extension
Gerd DERCON	Laboratory Head	G.Dercon@iaea.org	28277
Lionel MABIT	Soil Scientist	L.Mabit@iaea.org	28677
Ammar WAHBI	Technical Officer	A.Wahbi@iaea.org	28726
Leopold MAYR	Senior Laboratory Technician	L.Mayr@iaea.org	28305
Martina AIGNER	Senior Laboratory Technician	M.Aigner@iaea.org	28212
Maria HEILING	Senior Laboratory Technician	M.Heiling@iaea.org	28272
Georg WELTIN	Senior Laboratory Technician	G.Weltin@iaea.orgt	28258
Arsenio TOLOZA	Laboratory Technician	A.Toloza@iaea.org	28203
Christian RESCH	Laboratory Technician	C.Resch@iaea.org	28309
Norbert JAGODITSCH	Laboratory Attendant	N.Jagoditsch@iaea.org	28406
Yanling MAO	Consultant	Y.Mao@iaea.org	28723
Basil GONSALVES	Consultant	B.Gonsalves@iaea.org	28271
Xu CHEN	Intern	X.Chen@iaea.org	
Joanna Malgorzata MLETZKO	Team Assistant	J.Mletzko@iaea.org	28362

Staff News

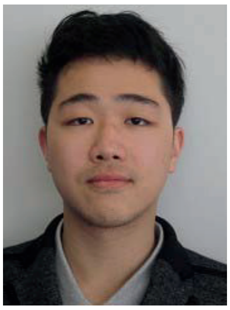
Long Nguyen retired from the Section on 30 June, after almost 10 years as Section Head. Long would like to take this opportunity to thank all current and previous colleagues in both the Section and the Laboratory for their support. In particular, Long would like to thank Mr Felipe Zapata, who is not only a loyal colleague but also a very good friend and Mr Phillip Chalk, for his assistance with the FAO/IAEA International Symposium in 2012.

Leo Mayr, Senior Laboratory Technician, retired in June 2014 after nearly 39 years of service to the SWMCN Subprogramme. On behalf of the Section and the Laboratory, Minh-Long Nguyen and Gerd Dercon thank Leo for his long and excellent service.

Over almost four decades Leo played an important role in the development and adaptation of isotope and nuclear techniques for improving land and water management and crop nutrition at the SWMCN Laboratory. Leo also helped hundreds of scientists and technicians from across the world to discover the secrets of tracing isotopes in soil, plants and water. His technical expertise in advanced analytical tools for measuring isotopes was continuously praised by participants from Member States.

We wish Leo well in his retirement!

Yanling Mao joined the Soil and Water Management & Crop Nutrition Laboratory (SWMCNL) on 12 July 2013 as a consultant for 12 months. She worked successfully on the development and validation of innovative carbon-13 and nitrogen-15 isotope techniques to assess soil organic carbon (SOC) dynamics and determine SOC sequestration mechanisms. Her research was related to CRP D1.50.12 on Soil Quality and Nutrient Management for Sustainable Food Production in Mulch-Based Cropping Systems in Sub-Saharan Africa. Various studies undertaken on soils from Austria, China, Kenya and Senegal have resulted in publications and a presentation at the 2014 European Geosciences Union (EGU) General Assembly in Vienna. Mao completed her assignment with the SWMCNL in July 2014. We congratulate Mao on her very successful work and great dedication and wish her every success in her future endeavours. Mao will be returning to the Department of Resources and Environmental Sciences, Fujian Agriculture and Forestry University, China.



Xu Chen joined the SWMCNL in April 2014 as an intern for 7 months. Mr Chen will receive training in the use of stable isotope and fallout radionuclide techniques with a major focus on the use of ^{137}Cs and stable isotope oxygen-18 in phosphate sources for assessing soil erosion and monitoring nutrient movements, to develop soil conservation measures. Xu Chen holds a MSc degree in Environmental Sciences from the University of Surrey in the UK.

Basil Gonsalves returned as a consultant to the SWMCNL from 17 April to 4 June 2014, to work on the use of gamma-ray spectrometry techniques in fallout radionuclides (FRN), comparing in-situ and laboratory approaches for FRN measurements using gamma ray spectrometry. Basil developed a research protocol with validations on the use of in situ gamma spectrometry for soil erosion assessment in Member States. The results of his work were presented as a poster at the 2014 EGU. Basil is currently undertaking PhD studies at the School of Applied Sciences, University of Huddersfield, UK.

Feature Articles

Climate Smart Agriculture through Isotopic and Nuclear Techniques

Matthew Montavon

FAO-ADD Senior Programme Coordinator

The present world population of 7 billion is expected to reach 9 billion by the year 2050. Most of this increase will occur in developing countries, where the majority of the population depends on agriculture for their livelihoods. With two billion additional people to feed in the next 40 years, there is an urgent need for the world to grow 70% more food to feed everyone adequately. This is a tough challenge, as the effects of climate change are expected to worsen, bringing more droughts, floods, heat waves, unreliable rainfall distribution and extreme weather events, all of which threaten food security and make agricultural production unpredictable.

To address these critical issues of climate change and population growth, FAO and the global scientific community are helping farmers to develop climate-smart agricultural practices and systems which can adapt to the impacts of climate change and variability (i.e., climate change adaptation), while having the potential to increase food production and at the same time reducing greenhouse gas (GHG) emissions (i.e., climate change mitigation); which potentially contribute to climate change.
(http://www.climatesmartagriculture.org/72611/en/).

During the past few years and on many occasions, I have visited the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (AGE), one of the Divisions within the FAO Agriculture and Consumer Protection. The Head Office is based in the IAEA at Vienna International Centre and the associated laboratories are located in Seibersdorf, approximately 35 km from Vienna. During my visits I had the opportunity to see and learn about the innovative techniques in use. Applying isotopic and nuclear-based techniques, the Soil and Water Management & Crop Nutrition Subprogramme of the AGE Division, working closely with other Divisions, assists both FAO and IAEA Member Countries to develop soil and water management practices which serve the joint goals of addressing both climate change adaptation and mitigation.

Nuclear and Isotopic Techniques for Improving Climate Change Adaptation

Adaptation to climate change requires soil and water management practices that are adaptable to drought, floods, land degradation and salinity to enhance the conservation of the natural resource base for sustainable agriculture.

Fallout radionuclides for soil conservation measures: Nuclear and isotopic techniques (NIT) can help to assess the impacts of climate change on land degradation and soil erosion, so that appropriate soil and water conservation management practices can be effectively targeted to control soil erosion and land degradation and preserve both soil and water resources. For example, environmental radionuclides, falling from the sky (originating from cosmic rays or man-made activities) and hence often referred to as fallout radionuclides (FRNs), can assist in establishing soil erosion and deposition rates and patterns and in evaluating the efficiency of soil conservation measures to control soil erosion. This is because these radionuclides, including caesium-137 (^{137}Cs), lead-210 (^{210}Pb), and beryllium-7 (^{7}Be), once deposited on the soil surface by dry deposition and rainfall, are adsorbed into soil particles. The distribution of these FRNs in soil profiles and across agricultural landscapes therefore reflects the movement of eroded soil particles (Fig. 1).

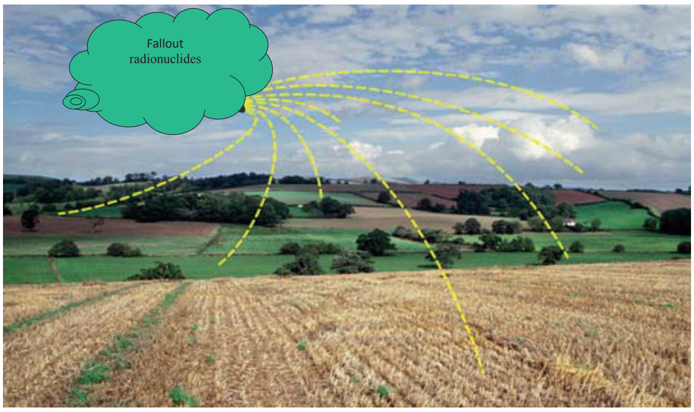


Fig. 1. Schematic diagram of fallout radionuclides (FRNs) deposited on farmlands.

FRN techniques are being widely used in many countries. In China, soil erosion rates in the Loess Plateau, North-Eastern China, Northern China and South West China, as measured by FRNs, were 16–70 t/ha/year. These losses were due to intensive tillage, downslope cultivation, inappropriate crop rotation and over-grazing. With the help of FRNs, soil conservation measures including minimum tillage, contour farming and appropriate grazing techniques were found to reduce soil losses by

77% over a 6-year period and enhanced annual grain yield per capita (347 kg to 570 kg) and farmers' livelihoods (446 Yuan to 1754 Yuan/farmer).

FRN techniques were also successfully used to assess land degradation in the High Pamir and Pamir-Alai Mountains of Tajikistan in a national technical cooperation (TC) project with collaboration from national and international partners (UNU-EHS, GEF and UNEP). Soil erosion (15 cm soil loss over a 50-year period) was found to be caused by inappropriate downhill furrow irrigation practices and wind erosion, resulting from conventional cultivation (Fig. 2). Through the use of FRNs, soil conservation measures such as contoured irrigation and shelter belts have reduced soil erosion from 150 tonnes/ha to 8–15 tonnes/ha.

Fig. 2. Soil erosion through inappropriate irrigation practices in the Pamir-Alai Mountains of Tajikistan.

Stable isotopes for soil conservation measures and soil fertility assessment: Carbon (C) and nitrogen (N) are the essential building blocks of plants. Variations in ^{13}C and ^{15}N signatures in plant components and soils, are used in combination with FRNs as tracers to: (i) identify hot spots of land degradation in agricultural landscapes so as to target appropriate soil conservation measures and (ii) quantify the return of crop residues to arable land for enhancing soil fertility, controlling erosion and improving soil resilience against drought and water runoff (Fig. 3). In addition, ^{15}N can be used to quantify the extent of atmospheric N capture (biological N fixation) by crops for their growth and its contribution as N fertilizers to subsequent crops.

Fig. 3. Soil deposition resulting from upland erosion can smother crop growth. Using FRNs and stable isotopes, the extent of erosion-deposition and sources can be assessed.

Soil moisture neutron probes and water use efficiency: Soil moisture neutron probes (SMNPs) are used to measure soil water content. During the measuring process, neutrons emitted from the SMNPs interact with hydrogen atoms in soil water. This interaction slows down the speed of the neutrons. The change in the speed of the neutrons detected by the SMNPs is proportional to the soil water content. The soil moisture readings obtained can then be used to provide information on the availability of water to the crops and to establish optimal irrigation schedules. This will help to save water and nutrient loss resulting from excessive irrigation and to increase crop resilience against drought. The SMNP is the most suitable instrument to accurately measure soil moisture under saline conditions. It is currently used in Qatar and Algeria and this technology has also been successfully introduced to many other countries such as Kenya and Tanzania, to improve water use efficiency and productivity for vegetable and tea production (Fig. 4).

Fig. 4. The soil moisture neutron probe is used to measure soil moisture status and to assist with drip irrigation scheduling for vegetable crops and salt-tolerant Acacia bush plants (Acacia Amphliceps) in Kenya (top) and Qatar (bottom), respectively.

Stable isotopes for enhancing water use efficiency and water conservation: The use of the oxygen isotopic signature (^{18}O) in water vapour can help scientists to determine how much water is lost through soil evaporation and transpiration from plants under different management practices. For example, in Vietnam, by using coffee branches as mulch cover to a depth of between 5 and 7 cm (Fig. 5) and changing irrigation practices from furrow to drip, soil evaporation was reduced from 17% to 5%, which saved 211 m^3 per hectare (ha) of irrigation water per season. With a total coffee growing area of 290 000 ha, approximately 62 million m^3 of irrigation water could be saved.

Fig. 5. Mulching can increase water use efficiency in coffee plantations through a reduction in soil evaporation.

Nuclear and Isotopic Techniques for Climate Change Mitigation

Agriculture contributes approximately 14% of global greenhouse gas (GHG) emissions such as carbon dioxide (CO_2) and nitrous oxide (N_2O). Many farming practices such as soil cultivation and the use of chemical fertilizers or organic residues and excreta from grazing livestock can cause GHG emissions to the atmosphere (Fig. 6). Nuclear techniques can help to identify soil and water management factors that reduce the release of GHG from soil and thus contribute to climate change mitigation. For example, with the help of ^{13}C, ^{18}O and ^{15}N techniques, scientists can determine the extent of C and N accumulation and C-N interactions in soil organic matter from a conservation agricultural system and from recently-added organic manure, crop residues or wastewater. Using the ^{15}N stable isotopic technique can help to identify the source of N_2O production from farmlands, which will assist in targeting appropriate N_2O mitigation tools such as liming to modify soil pH (degree of soil acidity) or N fertilizers with added nitrification inhibitors to reduce the conversion of added N into nitrate, a mobile form, which is readily converted into N_2O under anaerobic conditions.

Isotopic and nuclear-based techniques used in AGE are at the cutting edge of innovative practices. The Joint Division is continually expanding its knowledge in this area and through its Coordinated Research Projects (CRPs) and Technical Cooperation Projects (TCPs), is engaging with developing and developed country scientists in sharing knowledge and building capacity worldwide. Through these CRPs and TCPs, AGE is playing a significant role in addressing the food needs of the future, as well as contributing to a reduction in the impacts of climate change.

Fig. 6. Gas released from farmlands collected for determining greenhouse gas (GHG) emissions.

How to Perform Precise Soil and Sediment Sampling? One solution: The Fine Increment Soil Collector (FISC)

L. Mabit[1], K. Meusburger[2], A-R. Iurian[3], P.N. Owens[4], A. Toloza[1], C. Alewell[2]

[1]Soil and Water Management & Crop Nutrition Laboratory, IAEA, Austria
[2]Environmental Geosciences, Department of Environmental Sciences, University of Basel, Basel, Switzerland
[3]Babes-Bolyai University, Faculty of Environmental Science and Engineering, Cluj-Napoca, Romania
[4]Environmental Science Program and Quesnel River Research Centre, University of Northern British Columbia, Prince George, British Columbia, Canada

Soil and sediment related research for terrestrial agri-environmental assessments requires accurate depth incremental sampling to perform detailed analysis of physical, geochemical and biological properties of soil and exposed sediment profiles. Existing equipment does not allow collecting soil/sediment increments at millimetre resolution.

The Fine Increment Soil Collector (FISC), developed by the SWMCN Laboratory, allows much greater precision in incremental soil/sediment sampling. It facilitates the easy recovery of collected material by using a simple screw-thread extraction system (see Figure 1). The FISC has been designed specifically to enable standardized scientific investigation of shallow soil/sediment samples. In particular, applications have been developed in two IAEA Coordinated Research Projects (CRPs): CRP D1.20.11 on "Integrated Isotopic Approaches for an Area-wide Precision Conservation to Control the Impacts of Agricultural Practices on Land Degradation and Soil Erosion" and CRP D1.50.15 on "Response to Nuclear Emergencies Affecting Food and Agriculture."

The FISC can improve determination of the depth distributions of fallout radionuclides [FRNs] (i.e. ^{7}Be, ^{137}Cs, ^{210}Pb$_{ex}$, $^{239+240}$Pu), which are frequently used for soil erosion and sediment transport studies and/or sediment fingerprinting (see Mabit et al., 2014). This device also offers great potential for the investigation of radioisotope depth distributions associated with recent fallout events such as that associated with nuclear emergencies. Furthermore, prior to remediation activities–such as topsoil removal–in contaminated soils and sediments (e.g. by heavy metals, pesticides or nuclear power plant accident releases), basic environmental assessment often requires the determination of the extent and the depth penetration of the different contaminants. This precision can be provided by using the FISC.

According to Mabit *et al* (2014), in comparison with existing sampling tools, the FISC has the following advantages and benefits: (i) it permits sampling of soil/sediment samples at the top of the profile, (ii) it is easy to adjust to allow for the collection of soil/sediment at mm resolution, (iii) it is simple to operate by one person, (iv) incremental samples can be collected in the field or at the laboratory, (v) it permits precise evaluation of bulk density at millimetre vertical resolution, and (vi) sample size can be tailored to analytical requirements. Moreover, the FISC is easy to transport and can be easily hand-carried in the field. It involves minimum disruption in the field and it can be constructed at very low cost by a mechanical workshop. Its maintenance is minimal and it can be stored in a limited space.

The FISC has recently been disseminated through a peer-reviewed paper in the March 2014 issue of the Journal of Soils and Sediments, (see the full reference below) and a presentation at the European Geosciences Union–General Assembly, which was held in Vienna, Austria, from 27 April to 2 May 2014.

Only one month after officially advertising the FISC, several institutions from Member States have already expressed their interest in using/acquiring this innovative sampling device to perform various investigations. These include for example: (i) the Center for Research in Isotopes, and Environmental Dynamics, University of Tsukuba, Japan, (ii) the Radiation Safety Department of the Federal Authority for Nuclear Regulation (FANR), Abu Dhabi, United Arab Emirates, (iii) Agroscope, Institute for Sustainability Sciences, Zurich, Switzerland, and (iv) the Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, Chengdu, China.

We are pleased to inform our Soils Newsletter readers that the detailed design and construction plans of the FISC are freely available upon request to the Technical Officer in charge i.e. Mr Lionel Mabit (email: L.Mabit@iaea.org).

References

Mabit, L., Meusburger, K., Iurian, A.R., Owens, P.N., Toloza, A., Alewell, C. (2014). Sampling soil and sediment depth profiles at a fine-resolution with a new device for determining physical, chemical and biological properties: the Fine Increment Soil Collector (FISC), Journal of Soils and Sediments 14(3) 630–636.

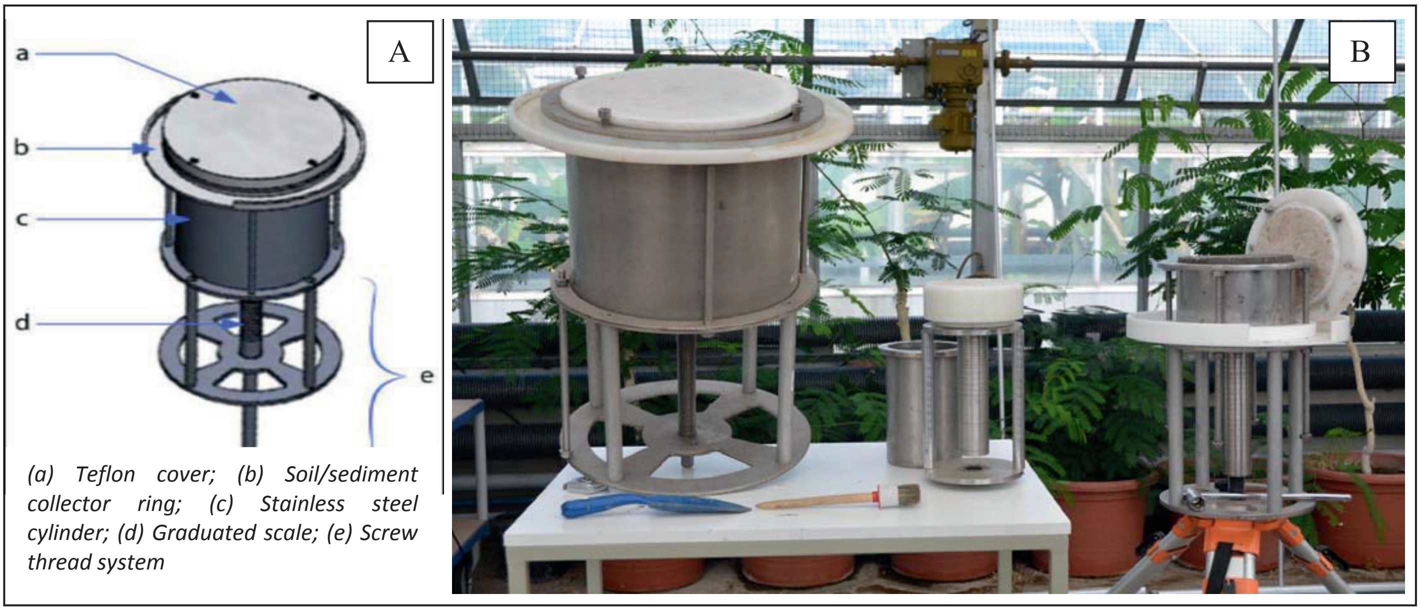


Fig.1. Design of the FISC [A] and examples of three different FISC sizes [B] (i.e. diameters of 13, 20 and 35 cm) used at the SWMCN Laboratory (Adapted from Mabit et al., 2014)

Landscape Erosion Assessment using the ^{137}Cs-based Method through Laboratory and in-situ Gamma Spectrometry: An Update of On-going Research and Progress

B.C. Gonsalves[1], I.G. Darby[2], R.B. Kaiser[2], A. Toloza[1], F. Augustin[1], G. Dercon[1] and L. Mabit[1]

[1]Soil and Water Management & Crop Nutrition Laboratory (SWMCNL), Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture
[2]Nuclear Science and Instrumentation Laboratory (NSIL), Division of Physical and Chemical Sciences

The objective of this research is to compare in-situ ^{137}Cs measurements using an on-site lanthanum bromide ($LaBr_3$ (Ce)) scintillation detector with those from a conventional laboratory-based HPGe detector to assess soil erosion. We aimed to establish (i) the strength of the relationship between in-situ and laboratory based measurements, and (ii) to develop improved tools for landscape-based soil erosion assessments in our continuing research, reported in the January 2013 Soils Newsletter.

In our pilot study, using stratified soil sampling, five soil cores (to a depth of 1m with 5 cm increments) were collected from the experimental research station of the Austrian Agency for Health and Food Safety (AGES) located in Grabenegg, Austria. Three soil cores were sampled in the study site (F1, F2 and F3, with F1 being situated at the top of the field slope, followed by F2 and F3 further down, Figure 1). Two soil cores (REF1 and REF2) were collected from two different reference sites (REF1 situated in an undisturbed orchard field and REF2 in an undisturbed pasture; Figure 1). After pre-treatment, the soil samples were analysed in the SWMCN Laboratory using the HPGe coaxial detector.

The gamma measurements performed in the Laboratory confirmed the undisturbed status of the two reference sites (i.e. exponential decrease in ^{137}Cs content with depth). The ^{137}Cs areal activity of soil cores collected from F1, F2, F3 were established at 2134±465 Bq m^{-2}, 1835±356 Bq m^{-2} and 2553±340 Bq m^{-2}, respectively, and the reference sites at 3221±444 Bq m^{-2} and 3946±527 Bq m^{-2} for REF1 and REF2, respectively. These results highlight the lower ^{137}Cs inventories of F1, F2 and F3 soil samples as compared to the reference sites, confirming the erosion processes affecting the site under investigation.

Fig. 1. Location of the soil cores sampled

Prior to the collection of soil cores (F1, F2, F3, REF1 and REF2), in-situ measurements using a lanthanum bromide scintillator were performed at the same sites. The detector was placed 2 cm above the ground and each measurement was conducted for 900 seconds. Across the study site, a clear variation in ^{137}Cs levels was recorded. To convert these measurements to areal activity (i.e. Bq m^{-2}), an efficiency calibration was performed using the In Situ Object Counting System (ISOCS), a Canberra software package. Using ISOCS, a circular plane model with a diameter of 300 cm and a depth of 20 cm was pre-set, and the soil matrix dirt1 (i.e. H 2.2%, O 57.5%, Al 8.5%, Si 26.2%, Fe 5.6%, density 1.6 g cm^{-3}) was selected. The ISOCS incremental mass activity was calibrated using laboratory measurements of the soil samples collected from the field. Preliminary results are presented in Figure 2.

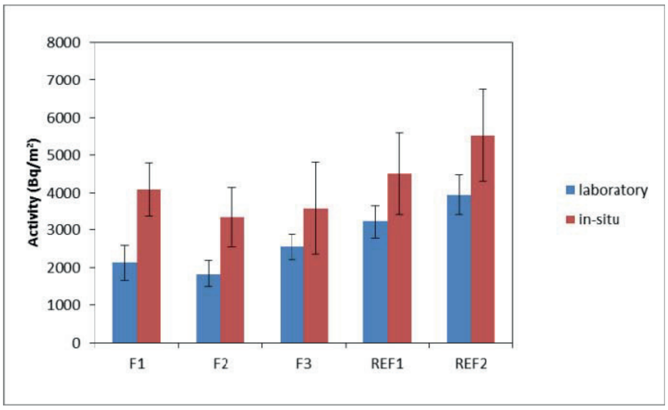


Fig. 2. Comparison of laboratory versus in-situ activity using the circular plane model (all error bars are reported at 2σ)

A significant positive correlation (i.e. R^2=0.85; $p < 0.001$) has been established between the ^{137}Cs areal activities obtained with our in-situ and laboratory based measurements (Figure 3).

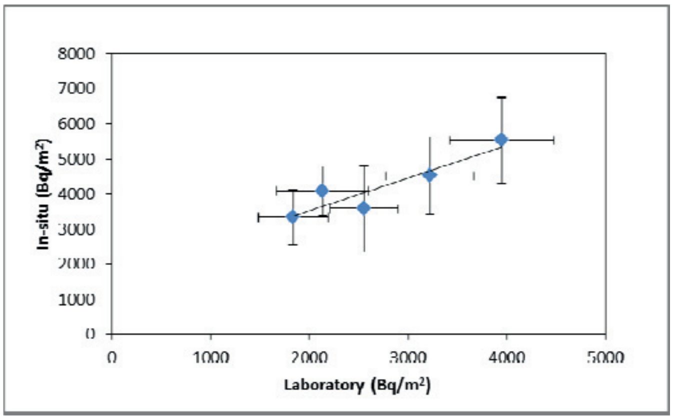


Fig. 3. Laboratory versus in-situ (^{137}Cs), using circular plane model (all error bars are reported at 2σ)

More research and development is required to validate this innovative cost effective in-situ technique and this will be the focus of future investigations conducted by the SWMCN Laboratory. Possible future activities include increasing the height of the LaBr detector above the ground, performing longer count times, and experimentally comparing results against an in-situ HPGe detector.

Assessing the Impact of Climate Change on Land-Water-Ecosystem Quality in Polar and Mountainous Regions: A New Interregional Project (INT5153)

Gerd Dercon[1], Jane Gerardo-Abaya[2], Bulat Mavlyudov[3], Paulina Schuller[4], Vladimir Aizen[5], Tim Stott[6], Lawrence Hislop[7], Matthias Jurnek[8], Andreas Richter[9], Peter Strauss[10], Zaman Mohammad[1], Lionel Mabit[1], Ammar Wahbi[1], Iain Darby[11] and Minh-Long Nguyen[1]

[1]Soil and Water Management & Crop Nutrition Subprogramme, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, IAEA, Austria;
[2]Division for Asia and the Pacific Section 2, Department of Technical Cooperation, IAEA, Austria
[3]Institute of Geography, Russian Academy of Sciences, Moscow, Russian Federation
[4]Instituto de Ciencias Químicas, Universidad Austral de Chile, Valdivia, Chile
[5]Department of Geography, University of Idaho, USA
[6]Faculty of Education, Health & Community, Liverpool John Moore University, Liverpool, UK
[7]GRID-Arendal, Arendal, Norway
[8]UNEP/GRID-Arendal, Vienna, Austria
[9]Department of Microbiology and Ecosystem Science, University of Vienna, Vienna, Austria
[10]Institute for Land and Water Management Research, Federal Agency for Water Management, Petzenkirchen, Austria
[11]Nuclear Science and Instrumentation Laboratory, IAEA, Austria

Aim of Interregional Project INT5153

As a result of the first FAO/IAEA expedition to Antarctica[1] in December 2011 under the TC project RLA/5/051, the IAEA, in close collaboration with expert research groups from various parts of the world, began to develop the interregional technical cooperation project INT/5/153 on “Assessing the Impact of Climate Change and its Effects on Soil and Water Resources in Polar and Mountainous Regions”. In June 2013 a project design meeting was held in Vienna to review and finalize the project proposal, which was approved for four years by the IAEA Board of Governors in November 2013. The project launch is set for June 2014 during the First Coordination Meeting and Workshop for the Preparation of Strategies and Protocols for Investigations in Benchmark Sites for Assessing the Impact of Climate Change. In addition to the scientists and technical experts who participated in the development of the INT5153 project, participants from national scientific institutions and representatives of international organizations such as FAO, UNEP and UNU-EHS, dealing with climate change in polar and mountainous environments have been invited. In total about 35 scientists and experts from over 20 countries will attend the meeting.

The INT5153 project aims to improve the understanding of the impact of climate change on fragile polar and mountainous ecosystems on both a local and global scale for their better management and conservation. Seven core and five related benchmark sites have been selected from different global regions for specific assessments of the impact of climate change with the following expected outcomes and outputs:

Outcomes:

- Improved understanding of the impact of climate change on the cryosphere in polar and mountainous ecosystems and its effects on land-water-ecosystem quality at both local and global scales.
- Recommendations for improvement of regional policies for soil and agricultural water management, conservation, and environmental protection in polar and mountainous regions.

Outputs:

- Specific strategies to minimize the adverse effects of, and adapt to, reduced seasonal snow and glacier covered areas on land-water-ecosystem quality in polar and mountain regions across the world.
- Enhanced interregional network of laboratories and institutions competent in the assessment of climate change impacts on the cryosphere and land-water-ecosystem quality, using isotopic and nuclear techniques.
- Increased number of young scientists trained in the use of isotope and nuclear techniques to assess the impact of climate change on the cryosphere and land-water-ecosystem quality in polar and mountainous ecosystems.
- Platform/database with global access for continuing work and monitoring of impact of climate change on fragile polar and mountainous ecosystems at local and global scales, as well as

[1] In collaboration with the Universidad Austral de Chile, Valdivia, and with logistic support from Chile through the Instituto Antarctico Chileno (INACH) and Uruguay

for communicating findings to policy makers and communities.
- Improved understanding of the effects of climate change disseminated through appropriate publications, policy briefs, and through a dedicated internet platform.
- Methodologies and protocols for investigations in specific ecosystems and conservation/adaptation measures for agriculture areas.

Project Background

Modern climate change has been described as ‘the defining human development challenge of the 21st century’. Model projections suggest that global surface temperature change by the end of the 21st century is likely to exceed 1.5°C relative to 1850 to 1900 for all Representative Concentration Pathways adopted by the IPCC (except RCP2.6) (IPCC, 2013). Nowhere are its effects more visible than in the polar and mountainous regions. Climate change is progressing at a rate several times the global average in Western Antarctica. For example, the Antarctic Peninsula region has experienced a rise of ca. 3°C in surface air temperature over the last 50 years (Turner et al., 2005), and 87% of the 244 glaciers along the west coast of the Antarctic Peninsula (AP) have retreated in the last 50 years (Cook et al., 2005).

Investigations carried out in the soils at the foot of retreating glaciers may provide vital clues to what the future holds for farmers in high mountainous regions across the world. Examining the impacts of climate change in Antarctic and Arctic landscapes can be particularly useful for a better understanding of the future impacts of climate change on landscape dynamics (including land degradation and resulting changes in land, water and ecosystem quality) in mountainous regions across the world.

The United Nations Environment Programme (UNEP) reports indicate the need for better access to existing data, better knowledge of data quality and the generation of new data in a manner that allows data sharing among researchers. The results of climate change impact assessments in Antarctic and Arctic landscapes will enable the modelling of future trends and effects of climate changes, which would otherwise be difficult to acquire in a short period of time.

This information will provide the basis for assisting upland farming communities and regional policy-makers in the adaptation and mitigation of the impacts of climate changes, through improved soil and water management and conservation measures. In particular, communities living in the mountain ranges of Africa, Asia, Europe and North and South America (e.g. in the Alps, Caucasus, Hengduan, Himalayas, Andes, Tibetan Plateau, Rocky Mountains, Sierra Nevada, Cascades, Alaska, Tien-Shan, Mount Kenya and Pamir) will benefit from this information.

The thematic link of global importance, i.e. climate change, and selection of representative benchmark sites in polar and mountainous ecosystems, makes the project INT5153 truly interregional. In particular, the selection of Antarctica as one of the sites in this interregional project gives an additional and specific dimension to its interregional nature. The 1959 Antarctic Treaty handed the Antarctic continent to the world’s researchers, with the explicit goal of ensuring ‘in the interests of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes.’ Some 30 countries now operate research bases in Antarctica. For instance, on King George Island, the major Island in the South Shetlands (Western Antarctica), eleven countries from Asia (China, South Korea), Europe (Germany, Poland and Russia), North and South America (Argentina, Brazil, Chile, Peru, Uruguay and the USA), have established scientific bases (Argentina: Isla 25 de Mayo, Chile: Isla Rey Jorge, Russia: Vaterloo or Waterloo). For this reason, in this interregional project, King George Island will play a major role. A simultaneous and long-term interregional approach focusing on a scientific assessment of the impact of climate change on polar and mountainous regions, culminating in recommendations for policies aiming to help with the adaptation of communities to climate change, is essential.

Announcement

Publication of Report to the General Assembly by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) on the Levels and Effects of Radiation Exposure Following the Nuclear Accident after the Great East-Japan Earthquake and Tsunami in 2011

Technical Officers: Gerd Dercon and Lee Heng

The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture contributed to this report (see below) through the FAO/IAEA Foodstuff Database. Since March 2011, a database has been compiled on radionuclide concentrations in foodstuffs due to the Fukushima-Daiichi NPP accident under the guidance of the FAO/IAEA Joint Division of Nuclear Techniques in Food and Agriculture and in collaboration with the Japanese authorities, including the Ministry of Agriculture, Forestry and Fisheries (MAFF).

The database includes data on over 500 types of foodstuffs sampled in all 47 prefectures in Japan. This data was provided through the FAO/WHO International Food Safety Authorities Network (INFOSAN), based on information published and provided by the Japanese Ministry of Health, Labour and Welfare (MHLW) and compiled by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

The database has been used in the UNSCEAR assessment of exposure and dose assessment for the public and the environment. For the UNSCEAR assessment, approximately 126000 records on food monitoring were compiled, representing the period from March 2011 to March 2012 (only samples collected from 15 March 2011 through 15 March 2012 were included). In September 2012 this data was made available to the respective working groups of UNSCEAR for the assessment of ingested doses by the population of Japan due to the Fukushima nuclear accident through a relational database prepared in Microsoft Access format (hereinafter referred to as the Fukushima Foodstuff Database).

UNSCEAR 2013 REPORT Vol. I

SOURCES, EFFECTS AND RISKS OF IONIZING RADIATION

United Nations Scientific Committee on the Effects of Atomic Radiation
UNSCEAR 2013 Report to the General Assembly, with scientific annexes

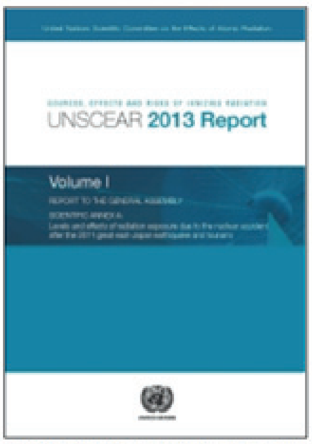
Volume I: Report to the General Assembly, Scientific Annex A

CONTENTS:

Report to the General Assembly [1]
Includes a summary of the materials and conclusions contained in the scientific annex

Scientific Annex:

- Annex A: Levels and effects of radiation exposure to the nuclear accident after the 2011 great east-Japan earthquake and tsunami
  - Attachments of data and methodologies used for the assessment will be available in due course



Available for purchase soon

http://www.unscear.org/unscear/en/publications/2013_1.html

Technical Cooperation Projects

Operational Projects and Technical Officers Responsible for Implementation

Project Number	Title	Technical Officer(s)
ALG5026	Increasing the Genetic Variability for the Improvement of Strategic Crops (Wheat, Barley, Chickpeas and Dates) for Enhanced Tolerance to Biotic and Abiotic Stresses and the Development of Biotechnology Capacities	A. Wahbi in collaboration with Plant Breeding and Genetics Section
ALG5028	Preserving Arid and Semi-Arid Agro-Ecosystems and Combating Desertification by Using Advanced Isotopic Techniques, Developing Decision-Making Tools and Supporting Sensitization of the Local Population on the Needs of Desertification Control	G. Dercon and L. Mabit
ANG5011	Monitoring Soil Fertility in Pasture Areas for Their Improvement and Maintenance	L. Heng
BDI0001	Supporting Human Resource Development and Nuclear Technology Support including Radiation Safety	A. Wahbi
BEN5007	Soil, Crop and Livestock Integration for Sustainable Agriculture Development through the Establishment of a National Laboratory Network	L. Heng in collaboration with Animal Production and Health Section
BGD5028	Assessing Crop Mutant Varieties in Saline and Drought Prone Areas Using Nuclear Techniques	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
BKF5009	Improving Voandzou and Sesame Based Cropping Systems through the Use of Integrated Isotopic and Nuclear Techniques for Food Security and Poverty Alleviation	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
BKF5010	Enhancing Crop Productivity through Small Scale Irrigation Technologies for Peri-Urban Agriculture to Improve the Income and Livelihood of Farmers	L. Heng
BOL5020	Evaluating Soil Fertility Loss by Water Erosion in the Area and Valleys of Intersalar Boliviano, Using Nuclear Gamma Spectrometry and Environmental Radionuclides	G. Dercon
BOT5012	Improving Soil and Water Management Options to Optimize Yields of Selected Crops	K. Sakadevan
CAF5006	Improving Cassava Production through High Yielding Varieties and Sustainable Soil Fertility Management by Using Isotopic and Nuclear Techniques to Ensure Sustainable Farming	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
CHI5050	Using Isotope Techniques to Quantify the Contribution of Agriculture in Greenhouse Gas Production	M. Zaman
CMR5020	Improving Maize Based Cropping System Productivity through the Efficient Management of Organic Matter, Water, Nitrogen and Phosphorous Fertilizers	M. Zaman

Project Number	Title	Technical Officer(s)
COS5029	Strengthening of Good Agricultural Practices (GAP) for Food Safety and Security and Environmental Protection	G. Dercon in collaboration with Food and Environmental Protection Section
COS5031	Consolidating a National Reference Laboratory for the Measurement of Greenhouse Gases	M. Zaman
DOM7004	Developing Human Resources and Supporting Nuclear Technology for Addressing Key Priority Areas including Biodiversity and Environmental Conservation	L. Heng
ECU5028	Consolidating Food Security and Environmental Sustainability in Palm Oil Production Using Nuclear Applications	L. Heng
GUA5018	Evaluating the Impact of Anthropogenic Contamination on Aquatic Ecosystems	K. Sakadevan in collaboration with Isotope Hydrology Section
HON5007	Evaluating Nutrient Pollution and Heavy Metals in Lake Yojoa to Determine the Impact on the Environment and Human Health	K. Sakadevan in collaboration with Isotope Hydrology Section
INS5039	Enhancing Food Crop Production Using Induced Mutation, Improved Soil and Water Management and Climate Change Adaptation	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
INT5153	Assessing the Impact of Climate Change and its Effects on Soil and Water Resources on Polar and Mountainous Regions	G. Dercon and M. Zaman
IRQ5018	Using Fallout Radionuclides and Stable Isotope Techniques to Assess Soil Quality and Dust Production for Enhanced Agricultural Land Productivity	G. Dercon
IRQ5019	Utilizing Nuclear Techniques to Increase Water Use Efficiency and to Improve Soil Management of Degraded Soil	A. Wahbi
IVC5033	Contributing to Food Security and Combating Poverty by Improving the Productivity of the Coconut Palm, Plaintain and Leafy Vegetables by Means of Studying the Effects of Organic and Mineral Fertilizers	K. Sakadevan
KAM5001	Improving Soil Fertility and Crop Management Strategies in Diversified Rice Based Farming Systems	L. Heng
KAZ5003	Increasing Micronutrient Content and Bioavailability in Wheat Germplasm by Means of an Integrated Approach	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
KEN5035	Using Nuclear Techniques for Validation of Integrated Soil Fertility and Water Management Technologies for Increased Agricultural Productivity and Climate Change Adaptation in Arid and Semi- Arid Areas	L. Heng

Project Number	Title	Technical Officer(s)
LAO5001	Enhancing Food Security through Best Fit Soil-Water Nutrient Management Practices with Mutation Induction for Drought Resistant Rice	M. Zaman
MAG5019	Improving the Use of Agricultural Resources and Combating Soil Erosion by Optimizing Conservation Agriculture and Developing Strategies for Its Dissemination	M. Zaman and L. Mabit
MAG5023	Promoting Climate Smart Agriculture to Face Food Insecurity and Climate Change with regard to Basic National Foods (Rice and Maize)	M. Zaman and L. Mabit
MEX5030	Improving Phosphorus Use Efficiency and Agricultural Sustainability in the Acidic Soil of the P'urhepecha Plateau, Michoacan	M. Zaman
MLI5024	Enhancing Sustainable Intensification and Diversification of Sorghum Production Systems in the Southern Zone by an Integrated and Participatory Approach, Phase 2	L. Heng
MLI7003	Assessing Erosion, Sedimentation and Water Resources in River Basins by Using Isotope Techniques	L. Mabit
MOZ5004	Improving Nitrogen and Water Use Efficiency of Maize Varieties in Conservation Agriculture under Smallholder Farming Systems	M. Zaman and G. Dercon
MYA5020	Strengthening Food Security through Yield Improvement of Local Rice Varieties with Induced Mutation (Phase II)	M. Zaman in collaboration with Plant Breeding and Genetics Section
MYA5023	Evaluating Nitrogen Use Efficiency Using Low Nitrogen Tolerant Rice Varieties	K. Sakadevan
NAM5012	Developing High Yielding and Drought Tolerant Crops through Mutation Breeding	L. Heng in collaboration with Plant Breeding and Genetics Section
NER5015	Improving Productivity of the Millet Cowpea Cropping System through Development and Dissemination of Improved Varieties and New Water and Fertilizer Management Techniques	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
NIC5009	Introducing Integrated Environmental Management in the Watershed of the Nicaraguan Great Lakes and the San Juan River: Responding to Future Challenges with Nuclear Techniques	K. Sakadevan
NIC8012	Applying Nuclear Techniques for the Development of a Management Plan for the Watershed of the Great Lakes	G. Dercon
OMA5001	Producing Forage Crops Tolerant to Salinity and Drought	K. Sakadevan

Project Number	Title	Technical Officer(s)
QAT5003	Improving Agricultural Productivity in Saline Land/Areas	K. Sakadevan
RAF5063	Supporting Innovative Conservation Agriculture Practices to Combat Land Degradation and Enhance Soil Productivity for Improved Food Security	L. Mabit
RAF5071	Enhancing Crop Nutrition and Soil and Water Management and Technology Transfer in Irrigated Systems for Increased Food Production and Income Generation (AFRA)	L. Heng
RAS5055	Improving Soil Fertility, Land Productivity and Land Degradation Mitigation	M. Zaman and M.L. Nguyen
RAS5056	Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
RAS5064	Enhancing Productivity of Locally Underused Crops through Dissemination of Mutated Germplasm and Evaluation of Soil, Nutrient and Water Management Practices	K. Sakadevan in collaboration with Plant Breeding and Genetics Section
RAS5065	Climate Proofing Rice Production Systems (CRiPS) Based on Nuclear Applications	L. Heng in collaboration with Plant Breeding and Genetics Section
RAS5068	Developing Effective Practices for Combating Desertification (ARASIA)	M. Zaman
RAS5069	Complementing Conventional Approaches with Nuclear Techniques towards Flood Risk Mitigation and Post-Flood Rehabilitation Efforts in Asia	L. Heng, K. Sakadevan and M.L. Nguyen in collaboration with Plant Breeding and Genetics, Animal Production and Health and Isotope Hydrology Sections
RLA5051	Using Environmental Radionuclides as Indicators of Land Degradation in Latin American, Caribbean and Antarctic Ecosystems (ARCAL C)	G. Dercon
RLA5053	Implementing a Diagnosis System to Assess the Impact of Pesticide Contamination in Food and Environmental Compartments at a Catchment Scale in the Latin American and Caribbean (LAC) Region (ARCAL CII)	G. Dercon in collaboration with Food and Environmental Protection Section
RLA5062	Applying Stable Isotopes to Assess the Impacts of Natural Zeolite to Increase Nitrogenous Fertilizer Use Efficiency, to Improve Soil Fertility and to Reduce Soil Degradation (ARCAL CXXV)	K. Sakadevan and M.L. Nguyen
RLA5064	Strengthening Soil and Water Conservation Strategies at the Landscape Level by Using Innovative Radio and Stable Isotope and Related Techniques (ARCAL CXL)	G. Dercon
RLA5065	Improving Agricultural Production Systems Through Resource Use Efficiency (ARCAL CXXXVI)	K. Sakadevan

Project Number	Title	Technical Officer(s)
SEN5034	Using an Integrated Approach to Develop Sustainable Agriculture in a Context of Degrading Soil Fertility, Climate Change and Crop Diversification	G. Dercon in collaboration with Plant Breeding and Genetics Section
SEY5007	Increasing Crop Production through Effective Management of Soil Salinity in the Coastal Area using Nuclear and Related Techniques	L. Heng
SUD5033	Enhancing Productivity of Major Food Crops (Sorghum, Wheat, Groundnut and Tomato) under Stress Environment Using Nuclear Techniques and Related Biotechnologies to Ensure Sustainable Food Security and Well-being of Farmers	L. Heng in collaboration with Plant Breeding and Genetics Section
THA5051	Evaluating Soil Erosion-Deposition and Soil Quality using Isotopic and Nuclear Techniques in Agricultural Areas Affected by Flooding	M. Zaman and L. Heng
THA5054	Increasing Adaptability for Adverse Environment Tolerance in Rice Germplasm Using Nuclear Techniques	K. Sakadevan
THA5055	Using Isotope Tracer and Fingerprint Techniques for the Assessment of Sediment Processes	L. Heng
YEM5013	Evaluating Selected Wheat Varieties for Greater Agronomic Characteristics Using Carbon Isotope Discrimination and Improved Soil and Water Management	A. Wahbi
ZAI5020	Assessing and Improving the Assimilability of Natural Phosphates Composted with Organic Matter in Marginal Soils through the Use of Isotope and Nuclear Techniques for Improved Crop Nutrition	M. Zaman and G. Dercon
ZAM5029	Evaluating the Impact of Nitrogen and Water Use Efficiency in Upland Rice	K. Sakadevan
ZIM5015	Developing Drought Tolerant and Disease/Pest Resistant Grain Legume Varieties with Enhanced Nutritional Content Using Mutation Breeding and Novel Techniques, Phase II	L. Heng in collaboration with Plant Breeding and Genetics Section
ZIM5020	Optimizing Water Use and Soil Productivity for Increased Food Security in Drylands (Phase II)	L. Heng

Forthcoming Events

FAO/IAEA Events

First Research Coordinated Meeting of the CRP on Minimizing Farming Impacts on Climate Change by Enhancing Carbon and Nitrogen Capture and Storage in Agro-Ecosystems, 3rd quarter 2014, Vienna, Austria

Technical Officer: Zaman Mohammad

Second Research Coordination Meeting of the CRP D1.20.13 on Landscape Salinity and Water Management for Improving Agricultural Water Productivity, 8–12 September 2014, Beijing, China

Technical Officer: Lee Heng

Second Research Coordination Meeting of the CRP D1.20.12 on Optimizing Soil, Water and Nutrient Use Efficiency in Integrated Cropping-Livestock Production Systems, 3–7 November 2014, Nairobi, Kenya

Technical Officer: Karuppan Sakadevan

INT 5153: Assessing the Impact of Climate Change and its Effects on Soil and Water Resources on Polar and Mountainous Regions, 2–6 June 2014, Vienna, Austria

Technical Officer: Gerd Dercon

RAS 5069: Complementing Conventional Approaches with Nuclear Techniques towards Flood Risk Mitigation and Post-Flood Rehabilitation Efforts in Asia, 10–13 June 2014, Vienna, Austria

Technical Officer: Lee Heng

RAS 5065: Phenotyping and Integrated Plant Mutation Breeding with Best Fit Soil and Water Management Practices for Climate Change Adaptation, 1–25 July 2014, IRRI, Los Baños, Philippines

Technical Officer: Lee Heng

RAS 5056: Use of C-13 in Soil Organic Matter Studies and in Assessment of Plant Tolerance to Abiotic Stress (Drought and Salinity), 4–8 August 2014, Beijing, China

Technical Officer: Karuppan Sakadevan

RAS 5055: IAEA/RCA Workshop on the Establishment and Maintenance of the Databases of Compound Specific Stable Isotopes (CSSI) and Fallout Radionuclides (FRN) data of the Region, third quarter 2014, Kathmandu, Nepal

Technical Officer: Zaman Mohammad

RLA 5065: Use of ^{15}N based techniques for quantifying BNF, 6–17 October 2014, Montevideo, Uruguay

Technical Officer: Karuppan Sakadevan

Training Course on Using Fallout Radionuclide and Compound Specific-stable Isotope Techniques for Precision Soil Conservation, 6–31 October 2014, Seibersdorf, Austria

Technical Officer: Gerd Dercon

This training course will target scientists and technicians from TC projects funded by the IAEA, in the area of soil management. Approximately 20 fellows can be accepted. If professional and technical staff from Member States are interested in participating in the above mentioned course, please contact Gerd Dercon, Head of the Soil and Water Management & Crop Nutrition Laboratory for further information.

Non-FAO/IAEA Events

World Conference on Natural Resource Modeling, 8–11 July 2014, Vilnius, Lithuania

http://www.resourcemodellingconference2014.com/

9th International Soil Science Congress on the Soul of Soil and Civilization, 14–16 October 2014, Side, Antalya, Turkey

http://www.soil2014.com/invitation.aspx

16th World Fertilizer Congress, 20–24 October, 2014, Rio de Janeiro, Brazil http://www.16wfc.com/

Agriculture and Climate Change: Adapting Crops to Increased Uncertainty, 15–17 February 2015, Amsterdam, The Netherlands

http://www.agricultureandclimatechange.com/index.html

3rd Global Science Conference on Climate Smart Agriculture, 16–18 March 2015, Montpellier, France

http://www.food-security.nl/sites/default/files/case/save_the_date_climate_smart_agriculture_conference.pdf

Global Soil Security Symposium, 19–21 May 2015, Texas A&M University, USA

https://globalsoilsecurity.tamu.edu

Announcement of a New Coordinated Research Project (CRP):

A new Coordinated Research Project (CRP) entitled “Minimizing farming impacts on climate change by enhancing carbon and nitrogen capture and storage in Agro-Ecosystems” has been approved (http://cra.iaea.org/cra/explore-crps/all-opened-for-proposals.html.).

The overall objectives of this CRP (D1.50.16) are to mitigate nitrous oxide (N_2O) emissions and minimize nitrogen losses from agricultural systems whilst enhancing agricultural productivity and sequestering soil carbon (C).

This CRP is now open for applications of research and technical contracts and agreement holders from Member States. How to apply, please visit our website and obtain the relevant forms: http://cra.iaea.org/cra/forms.html. Please submit your application form together with the proposal to IAEA via email to Official.Mail@iaea.org, by 10 July at the latest for evaluation. We aim to hold the first Research Coordinated Meeting (RCM) of this CRP in the IAEA Headquarter, Vienna International Center, Vienna, Austria during 3rd quarter of 2014.

Past Events

Meetings at the IAEA

Consultancy Meeting on Minimizing Farming Impacts on Climate Change by Enhancing Carbon and Nitrogen Capture and Storage in Agro-Ecosystems, 7–11 April 2014, Vienna, Austria

Technical Officers: Zaman Mohammad and Minh-Long Nguyen

A consultants meeting was held from 7–11 April at the IAEA’s Headquarter in Vienna to develop a new Coordinated Research Project (CRP) on Minimizing farming impacts on climate change by enhancing carbon and nitrogen capture and storage in Agro-Ecosystems. Four consultants from the UK, Czech Republic, Germany and Slovenia attended the meeting. The proposed CRP offers a holistic approach that takes into account mitigating nitrous oxide (N_2O) emissions and increasing carbon (C) sequestration as well as improving crop productivity by delivering cost effective and robust climate smart agricultural technology to Member States. The first Research Coordinated Meeting (RCM) of the CRP will be held in the IAEA Headquarter in Vienna, Austria in the 3rd quarter of 2014.

Duty Travel

Zimbabwe: To review project progress and revise the 2014–2015 work plan for the Technical Cooperation (TC) project ZIM5018 on Optimizing Water Use and Soil Productivity for Increased Food Security in Drylands through Farmer Participation in Sustainable Technologies, 10–13 December 2013, Harare, Zimbabwe

Technical Officer: Lee Heng

The purpose of the travel was to meet the project team in the Chemistry and Soil Research Institute (CSRI), to review and evaluate project progress; discuss challenges faced and identify key actions to be implemented under ZIM5018. The visit was also to review work done under the regional project RAF5058 on Enhancing the Productivity of High Value Crops and Income Generation with Small-Scale Irrigation Technologies, in which the project counterpart is also participating.

Field visits to Chikwaka and Marondera research sites also took place where experiments on maize-soybean rotation, biological nitrogen fixation and liming on low soil pH soil are being carried out. These experiments are being conducted to improve low soil pH and to quantify nitrogen fixation and its beneficial effect on subsequent maize yields. At Marondera station, the IAEA work at the Soil Productivity Research Laboratory (SPRL) is being carried out in collaboration with the international funding organization N2Africa on rhizobial inoculants production. The team provides low-cost inoculant packages to poor farmers enabling them to inoculate their crops and improve soil fertility.

Jordan: To participate in and contribute to the deliberations of the FAO Near East and North Africa Land and Water Days, 15–18 December 2013, Amman, Jordan

Technical Officer: Karuppan Sakadevan

The Technical Officer was invited by the FAO Regional Office for the Near East and North Africa (FAORNE) to present case studies on land and water management carried out in Iran, Qatar and Tunisia. The title of the presentation was Case Studies on Land and Water Management for Improving Agricultural Productivity in Near East and North Africa. The Near East & the North Africa Land and Water Days aim to fill the land and water management knowledge gap, by providing countries of the regions and their development partners with a platform to learn from each other, share experiences and discuss lessons for managing land and water in the region. The FAORNE Land and Water Days built on the FAO Global Land and Water Days held in May 2012 in Rome, in cooperation with the International Fund for Agricultural Development and the World Food Programme.

The Technical officer participated in all sessions relevant to the Joint FAO/IAEA work programmes on soil and water management. These included:

1. Discussion and sharing experience on decades of land and water intervention in the region;

2. IAEA Technical Cooperation and Coordinated Research Projects in the region; and

3. Discussion with practitioners and researchers on land and water information to help develop policies.

A number of thematic sessions which are of special interest to the SWMCN Subprogramme are:

1. Coping with water scarcity in Near East and North Africa–shifting gear;

2. Exploring alternative water sources- lessons learned from experiences and the way forward;

3. Making research and science reach farmers and end users;

4. Sustainable watershed and land management-learning experiences;

5. Building resilience in agricultural systems: soil conservation and fertility management; and

6. Irrigated agriculture-modernizing irrigated systems and adaptation strategies.

Water scarcity issues in the NENA region were discussed and land and water management practices/options to address water scarcity and agricultural productivity were proposed. Adopting a catchment approach to land and water management, improving water productivity and sustainable use of salt affected soils and saline water for improving agricultural production and water resource protection were identified as some of the priority areas for intervention.

Indonesia: To organize the second regional technical meeting of the regional technical cooperation project RAS5064 on Enhancing Productivity of Locally-Underused Crops Through Dissemination of Mutated Germplasm and Evaluation of Soil, Nutrient and Water Management Practices, 3–7 February 2014, Denpasar, Indonesia.

Technical Officer: Karuppan Sakadevan

The Technical Officer organized the meeting with Mr Ho-Seung Lee, Programme Management Officer of the project. Mr Muhrizal Sarwani, Director, Indonesian Centre for Agricultural Land Resources Research and Development, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Indonesia was the organizing coordinator for the technical meeting. The purpose of the technical meeting was to:

(1) discuss the results obtained from field studies,

(2) review the progress of the project since January 2012,

(3) identify constraints for project implementation, and

(4) refine/adjust the regional and respective national work plans and activities to meet the objectives of the project.

National counterparts from Bangladesh, Cambodia, China, Indonesia, Malaysia, Myanmar, Philippines, Sri Lanka and Thailand attended the workshop. The meeting focused on crop improvement through plant breeding and genetics and soil and water management practices.

The meeting discussed key results obtained from field studies carried out by participating countries and included: (1) Nutrient management for improving the productivity of salt tolerant mung beans, peanuts, millet and sweet corn in saline, sandy, acid and low fertility soils and dry conditions, (2) evaluation of the effect of different rates of N fertilizer and soil and water management practices on the growth and yield of the putative mutant adlai (short, early maturing, high yielding, and resistant to pests and diseases), a stable and underutilized food crop.

In addition to discussing results, the meeting also reviewed project progress and constraints to project implementation. An agreed and revised RAS5064 project work plan including potential hosts for the planned group activities in 2015 was identified. The gaps between project objectives and outputs during the first two years have been identified and additional national work plans for 2014–2015 were proposed for the participating countries.

Cote d'Ivoire: To review project progress and revise the work plan for 2014–2015 for the technical cooperation (TC) project IVC5033 on Contributing to Food Security and Combating Poverty by Improving the Productivity of the Coconut Palm, Plaintain and Leafy Vegetables by Means of Studying the Effects of Organic and Mineral Fertilizers, 3–5 March 2014, Abidjan, Cote d'Ivoire

Technical Officer: Karuppan Sakadevan

The National Project IVC5033 commenced in January 2012. The objective of the project is to improve the soil fertility, soil quality and productivity of coconut palms, bananas (plantain) and leafy vegetables to enhance food security and combat rural poverty through improved soil, water and nutrient management in the northern savannah and the southern coastal plains.

The Technical Officer met the project counterparts Mr Thierry Tacra Lekadou, and Mr Olivier Guy Joël Atsin from Centre national de recherche agronomique (CNRA) to discuss the current activities and project progress. During this meeting, Mr Lekadou, Team Leader, Marc Delorme Coconut Research Station and Mr Atsin, Team Leader, Plantain, Bimbresso Research Station briefly outlined progress with the progress of the project since 2012, particularly in the areas of human resource capacity building and field studies carried out in the southern coast of the Cote D'Ivoire (coconut palms and plantain).

The Technical Officer visited: (1) a field study site established to improve the nitrogen status of soils and plantain yield. In this field study cowpeas, peanuts, soybeans and pieraria (a legume cover crop) were grown and are followed by plantain. This preliminary field study was completed with soil and plant samples collected and they are currently being analyzed to identify the contribution of legumes to plantain yield and nitrogen uptake. Further field studies are planned using N-15 labelled nitrogen fertilizer to quantify the amount of nitrogen fixed by these leguminous crops and their subsequent contribution to plantain nitrogen requirements under irrigated conditions. This project is also supported by the World Bank through the West Africa Productivity Programme for implementing irrigation systems that help to quantify the response from water management (drip irrigation) to plantain yield and water use efficiency (WUE), (2) a coconut field site established to study the effects of organic and chemical fertilizers on yield, WUE and nitrogen uptake for coconut varieties. Access tubes were installed to use soil moisture neutron probes. This will help to quantify the WUE of coconut production systems. Preliminary field studies have been completed and further experiments will be carried out in 2014 to quantify nitrogen use efficiency using N-15 labelled nitrogen fertilizer, and (3) the Crop Research Station, CNRA, Bouake, where studies on water and nutrient management for leafy vegetable production will be carried out in 2014. The productivity of plantain and coconut can be improved using irrigation and nitrogen fixing crops such as cowpeas, peanuts and other cover crops. In the northern Savannah region the introduction of irrigation can help produce cash crops which will enhance food security and reduce rural poverty.

Tanzania: First Coordination Meeting of the Regional TC Project RAF5071 on Enhancing Crop Nutrition and Soil and Water Management and Technology Transfer in Irrigated Systems for Increased Food Production and Income Generation (AFRA), 24–28 March 2014, Dar es Salaam, The United Republic of Tanzania

Technical Officer: Lee Heng

Ms Lee Heng travelled to Dar es Salaam, Tanzania with Mr Abdou Ndiath, Project Management Officer (PMO) in the Division, of Africa, Department of Technical Cooperation, to conduct the first coordination meeting of the Regional Project RAF5071 on Enhancing Crop Nutrition and Soil and Water Management and Technology Transfer in Irrigated Systems for Increased Food Production and Income Generation (an AFRA project). The purpose of the meeting was to review and evaluate work done and results obtained in the previous cycle under the RAF5058 project on Enhancing the Productivity of High Value Crops and Income Generation with Small-Scale Irrigation Technologies, to welcome new Member States and to finalize a detailed work plan for the next four years for each participating country. The project aims to enhance food security, income and the resilience of smallholding farmers through climate change adaptation, mitigation and coping strategies. The meeting was attended by national counterparts from seventeen African countries: Algeria, Benin, Botswana, Cameroon, Egypt, Ghana, the Ivory Coast, Kenya, Mali, Mauritius, Morocco, Nigeria, the Seychelles, Sudan, Uganda, Tanzania and Zimbabwe. The meeting was hosted by the Tea Research Institute of Tanzania (TRIT) and also attended by private companies and TRIT staff. One of the main outputs achieved in this project was to introduce the use of information and communication technology (ICT) to smallholder farmers, where real-time decisions on when and how much irrigation is required by the crop can be obtained at the click of a button on a mobile phone. A pilot test is currently being implemented in Kenya.

First Coordination Meeting of the RAF5071 in Dar es Salaam, Tanzania

Costa Rica: To organize the final technical meeting to review project progress and technical outputs since January 2012 of the regional technical cooperation project RLA5062 on Applying Stable Isotopes to Assess the Impacts of Natural Zeolite to Increase Nitrogenous Fertilizer Use Efficiency, to Improve Soil Fertility and to Reduce Soil Degradation, 7–11 April 2014, San Jose, Costa Rica.

Technical Officer: Karuppan Sakadevan

The focus of the final technical meeting was to (1) discuss and analyse information collected from field studies, and (2) identify strategies for disseminating project outputs to farmers. National counterparts from Bolivia, Colombia, Costa Rica, Cuba, Ecuador, Guatemala and Panama attended the meeting. The first two days of the meeting focused on discussions of the progress made in each country, particularly with field studies, results obtained and lessons learned. The discussion included presentations by counterparts on the results of field studies carried out in each country from January 2012 to December 2013 and their outputs. At the end of the two day presentation and discussion, the following key outputs from the projects were identified:

1. Yield and nitrogen uptake of forage barley in the Bolivian Altiplano showed that urea with zeolite application increased barley yield from 2.17 to 5.64 tons/ha compared to no urea application. Fertilizer use efficiency was highest (41.0%) in the treatment that received fertilizer and zeolite compared with that receiving fertilizer alone (37.2%).

2. In Colombia, use of N-15 labelled urea with zeolite showed that the maize cultivar ICA V-305 grain yield increased with zeolite application (7.56 tons/ha vs 7.01 tons/ha). Nitrogen use efficiency increased under zeolite application by 8 kg N/ha under zeolite.

3. The vegetative growth and development of coffee were studied in the Costa Rican Central Valley. Results showed that zeolite application along with urea increased crop biomass by 31% after six months of growth.

4. Under irrigated rice production in Cuba, urea mixed with 15% zeolite reduced the nitrogen fertilizer application rate by 25% (from 153 to 118 kg N/ha). A preliminary economic assessment of the results obtained with zeolite showed that saving of 34.8 USD per ton of newly imported fertilizer.

5. The pilot study in Ecuador with potatoes (Fripapa) in the province of Chimborazo, Riobamba showed that plots receiving fertilizer and zeolite increased their yield (25 tons/ha) compared to plots not receiving fertilizer and zeolite (10 tons/ha).

6. Farmer field trials in Guatemala for maize and beans have shown that the combined application of urea and zeolite increased maize yield by 4% and for beans, zeolite application with urea increased the yield by 13% (2150 to 2400 kg/ha).

7. Results from field studies carried out to evaluate the effect of zeolite application on biomass and grain yield in Panama showed that zeolite application along with fertilizer at 100 kg N/ha increased biomass yield from 9.5 to 13.1 tons/ha and rice grain yield increased from 4.1 to 4.4 tons/ha.

The project was successful, measured by the cooperation between counterparts as well as the exchange and sharing of results, experience and expertise. Further, the capacity of many participating countries to use ^{15}N isotopes for quantifying fertilizer use efficiency and the role of zeolite in improving soil physical characteristics and plant growth has been enhanced during the project.

Senegal: Second Coordination Meeting of the Regional TC Project RAF5063 on Supporting Innovative Conservation Agriculture Practices to Combat Land Degradation and Enhance Soil Productivity for Improved Food Security, 7–14 April 2014, Dakar, Senegal

Technical Officer: Lionel Mabit

Mr Lionel Mabit travelled to Dakar, Senegal together with Mr Abdou Ndiath (PMO of RAF5063) to conduct the Second Coordination Meeting of the Technical Cooperation Regional Project RAF5063 on Supporting Innovative Conservation Agriculture Practices to Combat Land Degradation and Enhance Soil Productivity for Improved Food Security.

The overall objective of this project is to develop a regional network for strengthening conservation agriculture practices in Africa to combat land degradation and enhance soil quality and productivity. This regional project focuses on the use of fallout radionuclides [FRNs] (primarily ^{137}Cs, and also ^{210}Pb and ^{7}Be) as a means of obtaining quantitative information on African soil degradation, soil erosion and sedimentation redistribution rates within agricultural landscapes, over a range of time scales.

The meeting was attended by national counterparts from Algeria, Benin, Côte d'Ivoire, Madagascar, Mali, Morocco, Senegal, Tunisia, Uganda and Zimbabwe and was hosted by the Institut de Technologie Nucléaire Appliquée (ITNA), Faculté des Sciences et Techniques, Université Cheikh Anta Diop de Dakar (UCAD). All participants appreciated the support provided by the host and the Senegal counterpart Mr Ahmadou Wague (who is also the Director of ITNA) and his local team.

The purpose of this second Coordination Meeting was to present individual country progress reports and the national and regional activities carried out in 2012–2013. The meeting was also to adapt/develop the project work plan and detailed implementation strategies for the second phase of RAF5063 (2014–2015) to ensure the expected outputs from each country are delivered.

Second Coordination Meeting of the RAF5063 in Dakar, Senegal

LAO P.D.R: To discuss key activities of the Technical Cooperation (TC) project LAO5001 on Enhancing Food Security through Best Fit Soil-Water Nutrient Management Practices with Mutation Induction for Drought Resistant Rice, 23–25 April 2014, Vientiane, LAO P.D.R.

Technical Officer: Zaman Mohammad

The purpose of this three days travel to LAO P.D.R. was to hold meetings with the NLO, CP and technical staff at the National Agriculture and Forestry Institute (NAFRI) on key project activities. These included selection of soil type, preparing a detailed work plan for setting up field trials under irrigated and rain-fed conditions, data collection and analyses of soil and plant samples, application of nuclear techniques such as N-15 and C-13 to measure nutrients and water use efficiencies, group fellowships and procurement, within the framework of the Technical Cooperation project LAO5001. A stepwise protocol/guideline developed by the technical officer on best management practices for enhancing rice production was also discussed with researchers at NAFRI.

Chile: First Coordination Meeting of the Regional TC project RLA5064 on Strengthening Soil and Water Conservation Strategies at the Landscape Level by Using Innovative Radio and Stable Isotope and Related Techniques, 28 April–2 May 2014, Valdivia, Chile

Technical Officer: Gerd Dercon

Mr Gerd Dercon and Mr Johannes Seybold of the Division of Latin America, Department of Technical Cooperation, participated in the first coordination meeting of the TC project on Strengthening Soil and Water Conservation Strategies at the Landscape Level by Using Innovative Radio and Stable Isotope and Related Techniques (ARCAL, RLA5064). The meeting was held at the Universidad Austral de Chile in Valdivia, Chile from 28 April to 2 May 2014.

The purpose of the meeting was: (i) to conduct a strategic programming exercise focusing on the identification of existing technical capabilities of participating Member States, the priorities, roles and responsibilities of project participants and (ii) to develop an agreed and coordinated roadmap for implementation of the project. This meeting was attended by representatives of the academic, nuclear, agriculture and environment sectors from the following countries: Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Haiti, Mexico, Nicaragua, Paraguay, Peru, Uruguay and Venezuela. Representatives of the FAO Regional Office in Chile and private forestry companies also participated in the meeting.

This project aims to strengthen strategies for soil and water conservation and for the protection of agricultural, forest and natural ecosystems of 20 countries in the region, using innovative stable and radioisotope techniques such as Compound Specific Stable Isotopes (CSSI) and Fallout radionuclides (FRNs), in combination with other related techniques such as MIRS (Mid-InfraRed Spectroscopy) and AMS (Accelerator Mass Spectrometry) in an integrated way. This will facilitate the development and dissemination of more cost-effective soil and water conservation measures in selected test sites of the regions. This project will build partnerships with national and international organizations in the field of sustainable soil management for improved food security. Most of the institutions of the Member States involved in this proposal have the infrastructure and the capability to develop the mentioned methods as well as the required human resources.

First Coordination Meeting of RLA5064 in Valdivia, Chile

United Arab Emirates (UAE): To organize and facilitate training in the use of nuclear techniques to combat land degradation and desertification and discuss key activities of the regional Technical Cooperation project RAS 5068 on Developing Effective Practices for Combating Desertification, 4–8 May 2014, Dubai, UAE.

Technical Officer: Mohammad Zaman

A regional training course on efficient water and fertilizer use using new techniques was organized by the IAEA in cooperation with the Government of the United Arab Emirates through the International Center for Biosaline Agriculture (ICBA), Dubai, United Arab Emirates from 4–8 May 2014. The purpose of this one-week regional training course was to provide knowledge and training in the use of nuclear techniques such as N-15, C-13, O-18 and H-2 for developing effective soil-water management and cropping practices to address the issues of land degradation, as well as desertification caused by soil salinity, low productivity and water shortages. Fourteen participants from UAE, Yemen, Lebanon, Jordan, Iraq, the Syrian Arab Republic and Oman attended this five day training. During the five-day training, participants visited different field trials on bio-saline agriculture, lab facilities and a museum in ICBA. In addition to the training, all participants also discussed their experimental designs and other key activities relating to their regional TC project with the technical officer.

Regional training course at ICBA, Dubai, UAE

Germany: 4th COSMOS Workshop, 5–8 May 2014, Leipzig, Germany

Technical Officer: Ammar Wahbi

Mr Ammar Wahbi travelled to Leipzig, Germany to participate in the 4th COSMOS (Cosmic-Ray Soil Moisture Observing System) Workshop, jointly organized with TERENO (Terrestrial Environmental Observatories) and the Helmholtz Centre for Environmental Research, on the use of cosmic-ray neutron probes in environmental research.

The Cosmic Ray Neutron Probe is a young and promising technology for non-contact moisture measurements with a footprint of about 600 m in diameter and 10–70 cm in soil depth.

The fourth COSMOS workshop focused on:

1. Progress and challenges of cosmic-ray neutron monitoring;

2. Applications of the cosmic-ray probe to earth sciences, including agriculture (e.g. monitoring irrigation), meteorology (e.g. weather forecasting), civil engineering (e.g. slope stability); and

3. Strategic development of a global COSMOS network in Europe, America, Australia, Asia, Africa.

The workshop consisted of invited and contributed oral presentations. During the workshop, Mr Wahbi delivered an oral presentation on the calibration and validation of the cosmic ray neutron probe, jointly prepared with Mariette Vreugdenhil, Georg Weltin, Lee Heng, Markus Oismueller and Gerd Dercon. The Soil and Water Management & Crop Nutrition Laboratory (SWMCNL) has installed the first such probe in Austria in a research station at the Technical University of Vienna in Petzenkirchen, 100 km west of Vienna.

On the last day of the workshop, Mr Wahbi visited a small catchment (1.44 km^2) within the Harz Mountains, where water dynamics are explored on multiple scales using Lysimeters, soil-moisture networks and cosmic ray neutron probes, in combination with the exploration of subsurface structures using geophysical tools, remote sensing and soil-landscape modelling. On the return trip Mr Wahbi visited the UFZ Research Station in Bad Lauchstädt, where amongst others the TERENO (http://teodoor.icg.kfa-juelich.de/overview-en) SoilCan projects and the Global Change Experimental Facility, a large infrastructure for climate manipulation experiments, was presented. More information can be found at http://www.ufz.de/cosmos/.

Uruguay: To organize the first regional technical coordination meeting to develop national and regional work plans for the new regional technical cooperation project RLA5065 on Improving Agricultural Production Systems Through Resource Use Efficiency (RCAL CXXXVI), 5–9 May 2014, Montevideo, Uruguay

Technical Officer: Karuppan Sakadevan

The new project was initiated in 2014 and counterparts from Argentina, Bolivia, Brazil, Chile, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Mexico, Nicaragua, Paraguay and Uruguay attended the meeting. The counterpart from Cuba was unable to attend the meeting. The objective of the project is to improve resource use efficiency in different agricultural production systems with emphasis on crop productivity, biological nitrogen fixation, nutrient use efficiency and soil fertility improvements.

The meeting was focused on analyzing the current national programmes in participating countries on soil fertility improvements in agricultural production systems. These included: (1) presentations from counterparts on crops important for both national food security and export, fertilizer usage for major crops, followed by a group discussion, (2) visiting the isotope laboratory of the Facultad de Agronomia: Universidad de la Republica, Uruguay and the Estacion Experimential "la Estanzuela" of Instituto Nacional de Investigacion Agropecuria to exchange information on long term (50 year) field studies on crop rotations and soil fertility improvements relevant to the project, (3) developing regional and national work plans. Participants agreed to establish glasshouse and field studies to investigate nitrogen uptake in different cropping systems and implement two training programmes on: (1) the use of isotopic and nuclear techniques for assessing crop nutrient use efficiency and biological nitrogen fixation, soil and sampling, and sample preparation for analysis, and (2) interpretation of data collected from the field studies. In addition Bolivia, Ecuador, Nicaragua and Guatemala will be provided with expert advice to support their field study designs. The meeting also identified key agro-eco regions and cropping systems that are important for national food security.

First technical meeting of RLA5065 in Montevideo, Uruguay

Vietnam: To conduct a second regional coordination meeting of the regional Technical Cooperation project RAS 5055 on Improving Soil Fertility, Land Productivity and Land Degradation Mitigation, 9–13 December 2013, Da Lat, Vietnam

Technical Officer: Minh-Long Nguyen

The Technical Officer organized this meeting with Mr. Munim Awais, Project Management Officer and the strong logistic support of the Vietnam Nuclear Research Institute (NRI) in Da Lat. The focus of the meeting was to: (i) discuss project progress (status of planned activities) in Member States, (ii) formulate measures to be adopted by all participants to achieve project objectives and (iii) evaluate the progress on the development of precision soil conservation strategies at a landscape level.

The meeting was attended by National Project Coordinators from the following 14 Member States: Australia, Bangladesh, the People's Republic of China, India , Indonesia, the Republic of South Korea, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Sri Lanka, Thailand and the Socialist Republic of Vietnam.

The technical review of each individual project established that significant progress has been made in most participating countries on the_use of fallout radionuclides (FRNs) to assess soil erosion-deposition rates. Additional support will be provided to Myanmar and Thailand for FRN data interpretation and to Nepal for technical assistance in the use of FRNs to assess soil erosion-deposition and soil conservation measures. Vietnam will provide analytical support to the Republic of South Korea for ^{137}Cs and ^{210}Pb analyses. Regarding the use of the compound specific stable isotope (CSSI) to identify the sources of land degradation, further effort is required to enhance participants' ability in soil sampling, soil processing and soil extraction for CSSI analyses and data interpretation.

Participants of the second regional coordination meeting project RAS 5055

Scientific Visitors

- Dr Ibrahim Abdulrazzaq, Director General of the Agricultural Research Directorate, Ministry of Science and Technology (Iraq) visited the SWMCN Laboratory, Seibersdorf from 14 to 16 May 2014 to discuss the work plan for TC project IRQ5019.
- Dr Wanpen Wiriyakitnateekul, Division of Soil Chemistry, Thailand, visited the SWMCN Subprogramme, from 16 to 20 June to discuss the latest developments in the use of isotope and nuclear techniques to improve soil and water management in Thailand.
- Mr Anicet Manga from UFR des Sciences Agronomiques, University of Gaston Berger, Senegal, and Mr. Tariqual Islam from the Bangladesh Institute of Nuclear Agriculture, Bangladesh, visited the SWMCN Laboratory from 4 May to 27 July 2014 for training in the use of isotope and related conventional techniques in agricultural water management research. They will be implementing the research activities in the SWMCN Grabenegg research trials, 100 km west of Vienna.
- Prof Dr Silvia Haneklaus and Prof Dr Ewald Schnug from the Institute of Crop and Soil Science, Julius Kühn-Institute, Braunschweig, Germany, visited the SWMCN Section on 15 May 2014 to discuss common interests and areas of collaboration in the use of isotopic and conventional techniques in crop nutrition-soil fertility-land management research.

Visit of Prof Dr Silvia Haneklaus and Prof Dr Ewald Schnug from Institute of Crop and Soil Science, Julius Kühn-Institute, Braunschweig, Germany to the SWMCN Section

Status of Coordinated Research Projects (CRPs)

Soil Quality and Nutrient Management for Sustainable Food Production in Mulch-Based Cropping Systems in Sub-Saharan Africa (D1.50.12)

Technical Officers: Mohammad Zaman and Minh-Long Nguyen

This Coordinated Research Project (CRP) is now in its second year. The second research coordination meeting (RCM) was held in Antananarivo, Madagascar, from 14–18 October 2013 to review each participant's project work plan and research progress, to ensure the accomplishment of the CRP objective. Mr Mohamad Zaman, a newly appointed Technical Officer (TO) in the SWMCN Section, will replace Mr Dercon as the principal TO for this CRP, since Mr Dercon has additional responsibilities, with his new role as Head of the SWMCN Laboratory.

The overall objective of this CRP is to improve the livelihoods of farmers with low socio-economic development and rural communities in a region that is dominated by a savannah ecosystem in its natural state. The CRP aims to address the following four key issues relating to soil quality and nutrient management for sustainable food production in mulch-based cropping systems in Sub-Saharan Africa: (1) improve soil fertility and soil health by promoting carbon (C) sequestration and applying the principles of conservation agriculture, (2) increase productivity in integrated crop-livestock systems across different spatial scales in the moist and dry savannahs of Sub-Saharan Africa, (3) enhance on-farm and area wide ecosystem service efficiency (e.g. nutrients, water, labour and energy use efficiency), and (4) assess economic feasibility and conduct socioeconomic and environmental impact assessments of mulch-based farming systems.

The CRP was formulated on the recommendations of a consultants' meeting held at the IAEA, Vienna, 5–8 July 2010. The first Research Coordination Meeting (RCM) was held in Vienna, 30 January–3 February 2012. Fifteen participants, with seven research contract holders from Benin, Kenya, Madagascar, Mauritius, Mozambique, Pakistan and Zimbabwe, three technical contract holders from China, the Czech Republic and the United Kingdom and five Agreement holders from Austria, Belgium, Kenya, New Zealand and United States of America attended the first RCM.

The SWMCN Laboratory team initiated a series of research activities to support this CRP. A long term field experiment of over 15 years at Gross Enzersdorf (BOKU Research Station, 8 km east of Vienna) has been selected to assess carbon sequestration and the stability of organic carbon using ^{13}C and ^{15}N techniques. Two additional experiments have also been initiated to validate ^{13}C and ^{15}N techniques for assessing sequestration in: (i) a long term field experiment in Grabenegg, at the experimental research station of the Austrian Agency for Health and Food Safety (AGES), west of Vienna, and (ii) a greenhouse column experiment within the SWMCN Laboratory. Soil samples collected from three long-term field trials in Belgium, Kenya and China have been analyzed for ^{13}C and ^{15}N in the SWMCN Laboratory. The SWMCN Laboratory team in Seibersdorf is also currently developing real-time soil moisture measurement protocols to better understand the role of applying mulch on soil water dynamics in various cropping systems (Grabenegg). Testing of low-cost methods for ^{13}C-labelling of organic materials has also been initiated by the SWMCN Laboratory team to provide ^{13}C labelled materials for local research on soil organic carbon dynamics to the CRP D1.50.12 participants.

Approaches to Improvement of Crop Genotypes with High Water and Nutrient Use Efficiency for Water Scarce Environments (D1.50.13)

Technical Officers: Karuppan Sakadevan and Pierre Lagoda

The CRP commenced in December 2011 and is in its third year of implementation. Ten research contract holders (Bangladesh, China, Kenya, Malaysia (two participants), Mexico, Pakistan, Peru, Uganda and Vietnam), one technical contract holder (Peru) and one agreement holder (South Africa) participated in the first research coordination meeting held from 12-16 December 2011 in Vienna. The overall objective of this CRP is to increase crop productivity and food security by developing improved crop varieties and soil, water, nutrient and crop management technologies and making them readily available to farmers, to ensure that their cropping systems are resilient to biotic and abiotic stress in water scarce environments. The specific objectives are to:

- increase the productivity of improved mutant varieties of crops tolerant to environmental stresses under existing soil and climatic conditions.
- enhance nitrogen and water use efficiency of crops tolerant to environmental stress through best practice soil, water, crop and fertilizer management.

The second RCM was held in Malaysia from 24–28 June 2013 and all participants attended the meeting. During this RCM all participants presented results from their first field experiments and the constraints they faced in this research. The country work plans were revised to ensure that they align with the objectives of the project. All projects have been renewed based on project progress reports and renewal towards the end of 2013. The mid-term review of the project is due later in 2014. Since the second RCM, the counterparts have carried out additional field studies and collected additional information. Progress reports of research and technical contracts will be reviewed towards the end of the year and individual projects will be renewed.

Response to Nuclear Emergencies Affecting Food and Agriculture (D1.50.15)

Technical Officers: Gerd Dercon and Lee Heng

This CRP aims to develop and assess systems of innovative data collection, management and geo-visualization platforms that can be used both in routine monitoring and also for emergency response to nuclear and radiological incidents that could affect food and agriculture. Through these CRP networks of institutions and governments involved in nuclear emergency the response for food and agriculture will be strengthened. The CRP will also assist in compiling Standard Operating Protocols (SOPs) for actions required in case of a nuclear emergency affecting food and agriculture, as well as sampling analytical SOPs for activity measurements. The objectives of the CRP are:

1. To identify sampling and analytical strategies in nuclear emergencies affecting food and agriculture

2. To determine how online geo-visualization tools can influence emergency response strategies, approaches to learning from nuclear accidents, and end-users ability to generate future short-term and long-term scenarios about the impact of nuclear accidents on food and agriculture

3. To ensure that systems use common or standardized protocols that can be shared across different software platforms

4. To produce low-cost computer-based platforms that are robust and can be used both routinely to monitor every-day sampling as well as in nuclear emergency situations

5. To produce decision support tools that will help rapid analysis of the situation in radionuclide contamination of food stuffs.

The first RCM was held from 16 to 20 December 2013 in Vienna. Four research contract holders (from China, Morocco, the Russian Federation and Ukraine), two technical contract holders from France and Macedonia and three agreement holders from Japan (two) and India attended the RCM.

To date, a detailed draft of the first protocol for data collection, management and visualization for the emergency phase (food restriction phase) has been developed by the technical contract holders in close collaboration with colleagues in the IAEA. The protocol aims to optimize the response time of Member States regarding decision making on food restrictions and food safety communication strategies in case of nuclear or radiological emergencies. In order to make rapid, timely decisions whether food restrictions need to be enforced, simple procedures/protocols for collecting samples, managing minimal sample's attributes and minimal sample's laboratory result attributes and geo-visualisation for effective emergency communication are needed. A first information system is currently being developed in such a way that it can be linked with existing data exchange platforms (compatibility) of the IAEA. The system should allow international organizations to follow up on the nuclear emergency response for food safety (for advice purposes on food restrictions when requested at national and international level).

Integrated Isotopic Approaches for an Area-wide Precision Conservation to Control the Impacts of Agricultural Practices on Land Degradation and Soil Erosion (D1.20.11)

Technical Officers: Gerd Dercon and Minh-Long Nguyen

The overall objective of this CRP is to develop integrated isotopic approaches to identify hotspots or critical source areas of land degradation in agricultural catchments and apply effective soil conservation measures (precision conservation) to them. The specific objectives of this CRP are to: (i) establish soil redistribution patterns and rates over several temporal scales on an area-wide (catchment) basis using a combination of fallout radionuclide (FRN) and conventional techniques with spatial analysis (ii) develop and validate protocols for the application of compound specific stable isotope (CSSI) techniques to identify and apportion the amount of source soils (degraded land areas) from main land uses or management (cropland, grassland and forestland) in the catchment, (iii) integrate nuclear-based approaches with other non-nuclear techniques through modelling and other tools to establish comprehensive soil redistribution studies on an area-wide basis, and (iv) create a basis for developing decision support tool(s) (DST) to implement precision conservation and contribute to sustainable land management.

This CRP, which was formulated on the recommendations of a consultants' meeting held at the IAEA, Vienna, 5–7 November 2007, is in its final year. The first research coordinated meeting (RCM) was held at the IAEA in Vienna from 8–12 June 2009. The second RCM was held at the National Centre for Atomic Energy, Nuclear Sciences and Applications [Centre National de l'Energie, des Sciences et des Techniques Nucleaires (CNESTEN)] in Rabat, Morocco, from 27 September to 1 October 2010. A mid-term review of the CRP was successfully carried out in November 2011. The third RCM was held in Vienna from 23–27 July 2012 in conjunction with the FAO/IAEA International Symposium on Managing Soils for Food Security and Climate Change Adaptation and Mitigation.

In 2012–2013 the protocol for the application of CSSI techniques to identify critical areas of land degradation at the catchment scale was validated under different agro-ecological conditions and land use systems (i.e. Chile, China, Morocco, Poland, the Russian Federation, Syrian Arab Republic and Vietnam). A staff member from the Soil and Water Management & Crop Nutrition Laboratory (C. Resch) was trained in the use of the CSSI technique at the University of Hohenheim, Stuttgart (3–14 December 2012). This training enabled Mr Resch to "train the trainers", so that he can now provide expertise and training in this technology to other SWMCNL staff, allowing them to start the next step of disseminating this novel analytical technique to Member States through group or individual fellowship training to be conducted at the Seibersdorf laboratories.

The fourth and final RCM was held in Vienna from 4–8 November 2013. The purpose of the final RCM was: (i) to review and discuss the final research results obtained since the last RCM in 2012, (ii) to evaluate the main achievements in accordance with the project objectives and agreed work plan, and (iii) to plan the dissemination of research results. Seven research contract holders from Chile, China, Morocco, Poland, the Russian Federation and the Syrian Arab Republic, four technical contract holders from Belgium (University of Ghent), China (Chinese Academy of Agricultural Sciences) and Germany (University of Hohenheim) and five agreement holders from Australia (CSIRO), Canada (University of Manitoba), New Zealand (National Institute of Water & Atmospheric Research) and the United Kingdom (University of Exeter and University of Plymouth) attended the fourth RCM.

Optimizing Soil, Water and Nutrient Use Efficiency in Integrated Cropping-Livestock Production Systems (D1.20.12)

Technical Officers: Karuppan Sakadevan and Minh-Long Nguyen

The project was started in July 2013 and the first RCM was held in Vienna, Austria from 22–26 July 2013. Seven research contract holders and two agreement holders participated in the meeting. During the first RCM, all participants provided an overview of current research and development activities in integrated–cropping livestock production in their respective countries. These included: (1) soil, water and nutrient management, (2) greenhouse gas emission, and (3) carbon sequestration. The national project objectives were revised to align with the overall objective of the project and work plans were revised to meet the national project objectives.

The overall objective of this CRP is to enhance food security and rural livelihoods through improving resource use efficiency and the sustainability of integrated crop-livestock systems under a changing climate. The specific objectives are to: (1) optimize water and nutrient use efficiency in integrated crop-livestock production systems, (2) identify the potential for improving soil quality and fertility in integrated crop-livestock systems, (3) assess the influence of crop-livestock systems on greenhouse gas (GHG) emissions, soil carbon sequestration and water quality, (4) assess the socio-economic and environmental benefits of crop-livestock systems, and (5) develop soil, water and nutrient management options in integrated crop-livestock systems for potential adoption by farmers.

Nine research contract holders (Argentina, Brazil (two participants), China, India, Indonesia, Kenya, Uganda and Uruguay) and three agreement holders (France, International Institute for Tropical Agriculture in Nigeria and the United States of America) participated in this project. Since the first RCM, all participants have established field studies and information is currently being collected. All counterparts have been requested to submit their first year progress report with the renewal form. Progress reports and renewal forms will be reviewed by July 2014 and based on progress, projects will be renewed for 2014. The second RCM will be held in Nairobi, Kenya in November 2014.

Landscape Salinity and Water Management for Improving Agricultural Productivity (D1.20.13)

Technical Officers: Lee Heng and Karuppan Sakadevan

The objective of this CRP is to address soil and water salinity in agricultural landscapes and to optimize the use of salt affected soils and saline water through improved soil, water and crop management practices, to better understand how salinity responds to land and water management at the field and landscape scale. The potential impact of on-farm practices on regional crop productivity, water and salt stores and fluxes under current and future climatic conditions, will be studied using numerical modelling approaches.

The first RCM was held in Vienna, Austria from 15–19 July 2013. Eleven participants, with seven research contract holders from Bangladesh, China, India, Iran, Pakistan and Vietnam (two participants) and four agreement holders from Australia, Germany, Spain and the USA attended the meeting. Research activities in individual countries were presented, and work plans were discussed and revised during the meeting. Two technical contracts were subsequently awarded to assist in the simulation of salt-affected soil using the HYDRUS-1D model and to test new soil water and electrical conductivity sensor technology for irrigation and salinity management. In the SWMCN Laboratory, work is in progress to evaluate the use of the cosmic ray neutron probe (CRNP) for area-wide soil water measurement. A CRNP has been installed in a research station of the Technical University of Vienna in Petzenkirchen, 100 km west of Vienna, to compare its soil water content with field point measurement.

All research contract holders have completed their first year field studies and their progress reports are being evaluated for renewal of contracts. The second RCM will be held in Beijing, China in September 2014.

Strategic Placement and Area-wide Evaluation of Water Conservation Zones in Agricultural Catchments for Biomass Production, Water Quality and Food Security (D1.20.10)

Technical Officers: Karuppan Sakadevan and Lee Heng

This project is now closed and the final RCM was held in Vienna from 26–30 August 2013. All participants presented their results and major findings for the project. In addition to their presentations, all participants have worked towards developing the TECDOC publications. The draft TECDOC is expected to be completed by the end of 2014. The overall objective of this CRP was to assess and enhance services provided by water conservation zones (farm ponds, wetlands and riparian buffer zones) for optimizing water storage, nutrients biomass production and food security within agricultural catchments. The specific objectives of the project were: (1) to optimize water storage in water conservation zones for downstream irrigation use, (2) to regulate nutrient cycling in water conservation zones to improve bio-fuel crops and fuel wood production, and (3) to optimize the use of water conservation zones for crop production.

Key results

(1) In Tunisia, a farm pond occupying approximately 3% of the catchment area (272 ha) was able to capture surface runoff and subsurface water (up to 140 000 m^3) and associated nitrogen (up to 280 kg) generated from the catchment. The captured water and nitrogen are used for growing high value vegetable crops of 6 tonnes per ha per year and potentially reduce the nitrogen contamination of downstream water by 90%.

(2) In Iran, 30 surface ponds (Ab-bandans) in the Caspian lowlands occupying approximately 3% of the catchment area (10 400 ha) were able to capture 7 million m^3 of water, together with 86 tonnes of N and 17 tonnes of phosphorus. This water, along with the nutrients helped to increase the irrigation area from 730 to 1500 ha and rice production from 2560 to 5050 tonnes.

(3) In Northeast China, wetlands can be used to cultivate 10 tonnes/ha of rice, without nitrate contamination of surface and ground water, through optimizing water conservation in these rice wetlands.

(4) Wetlands in the Manafwa catchment, Uganda were able to remove 64 tonnes of N (70%) from the incoming river water in a single growing season and were used for rice production, providing a net economic return of US$1 300 per ha per cropping season.

(5) Riparian buffer zones of alder trees used for fuel wood remove between 170 and 350 kg N/ha/year and reduce nitrate contamination of downstream water by 50%. Most of this removal was accompanied by denitrification to N_2 gas, thus also reducing greenhouse gas emission to the atmosphere.

The project results showed that isotopic signatures of O-18, H-2 and N-15 in run-off, rainwater, stream water and water conservation zones (WCZ) along with water balance calculations, are useful for identifying water sources in the water conservation zones. Information collected from this research is useful for preparing guidelines and management practices that help policy makers and farmers to optimize the capture and storage of water and nutrients in WCZ and their subsequent use for agricultural production and to improve downstream water quality and quantity.

Activities of the Soil and Water Management and Crop Nutrition Laboratory, Seibersdorf

FAO/IAEA Training Course on Integrated Nutrient-Water Management at Field and Area-wide Scale, 19 May–27 June 2014, Seibersdorf, Austria

Ammar Wahbi[1], Georg Weltin[1], Gerd Dercon[1], Lee Heng[2], Karuppan Sakadevan[2], Leo Mayr[1], Christian Resch[1], Martina Aigner[1], Norbert Jagoditsch[1], Markus Enekel[3], Peter Strauss[4], Dirk Raes[5], Francis Campbell[6], Tony Bunce[7], Bernard Vanlauwe[8], Minh-Long Nguyen[2]

[1]Soil and Water Management & Crop Nutrition Laboratory, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Seibersdorf, Austria
[2]Soil and Water Management & Crop Nutrition Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Vienna, Austria
[3]Centre for water Resources Systems, Technical University, Vienna, Austria
[4]Institute for Land and Water Management Research, Federal Agency for Water Management, Petzenkirchen, Austria
[5]Division of Soil and Water Management, Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium
[6]Quality Assurance Section, Department of Technical Cooperation, IAEA, Vienna, Austria
[7]Office of Safeguards Analytical Services, IAEA, Seibersdorf, Austria
[8]International Institute of Tropical Agriculture, Nairobi, Kenya

The FAO/IAEA training course on Integrated Nutrient-Water Management at Field and Area-Wide Scale was held at the Soil and Water Management & Crop Nutrition Laboratory (SWMCNL) from 19 May to 27 June 2014 at Seibersdorf, Austria. This training was given by scientists and technicians from the SWMCN Subprogramme, in close collaboration with scientists from the public and private sector, i.e. universities, national and international research for development organizations and companies, based in Austria and abroad.

Twenty fellows from eleven Member States (Bangladesh, Botswana, Benin, Burundi, Iraq, Ivory Coast, Kenya, Oman, Senegal, Yemen and Zimbabwe) with various backgrounds (researchers and technicians mostly in the field of irrigation management), participated in the training.

The main focus of the training course was on: (i) improving nutrient management in rainfed and irrigated agriculture, (ii) monitoring nutrient balances and water use efficiency at the field scale, (iii) increasing the efficiency of water management in rainfed and irrigated agriculture at field and area-wide scales, (iv) monitoring soil moisture at both field and area-wide scales, (v) assessing soil water balance and crop water relations, and (vi) training on the use of FAAO's AquaCrop model to improve soil water management and irrigation scheduling.

The training was funded by the IAEA Technical Cooperation Department through national TC projects.

Besides lectures and laboratory and field work, a field excursion was organized to research stations of the Austrian Agency for Health and Food Safety (AGES) and the Federal Agency for Water Management in Grabenegg and Petzenkirchen (100 km west of Vienna), to demonstrate on-farm research on nutrient and water management at field and area-wide scale.

Mr Dirk Raes from the KU Leuven (Belgium), participated as a lecturer on the use of the AquaCrop model for yield response to water and irrigation scheduling, which was very much appreciated, as he has been the main developer of this model. Mr Bernard Vanlauwe from IITA (Nigeria) also delivered a keynote lecture on integrated nutrient-water management in Sub-Saharan Africa through an on-line conference.

In addition, experts from Pessl Instruments (Austria) and Eijkelkamp Agrisearch Equipment (The Netherlands) demonstrated the latest tools and equipment used to assess crop water use and sample soils of all kinds of physical properties. The use of Unmanned Arial Vehicles (UAVs) for applications in nutrient and water management was also demonstrated by Precision Hawk (USA-Canada).

A self-assessment at the end of the training activity gave the organizers the opportunity to validate the effectiveness of the training course at an individual level. Feedback from the participants showed that the hands-on training with equipment was highly appreciated.

Preliminary investigations to assess the usefulness of Be-7 as a radiotracer in soil covered by vegetation

Andra-Rada Iurian[1,2,], Gerd Dercon[2], Joseph Adu-Gyamfi[2], Lionel Mabit[2], Gyula Kis-Benedek[3], Alessia Ceccatelli[3], Sandor Tarjan[3] and William Blake[4]*

[1]*Faculty of Environmental Science and Engineering, Babes-Bolyai University, Cluj-Napoca, Romania*
[2]*Soil and Water Management & Crop Nutrition Laboratory, Joint FAO/IAEA Division for Nuclear Techniques in Food and Agriculture, Seibersdorf, Austria*
[3]*Terrestrial Environment Laboratory, IAEA Environment Laboratories, Department of Nuclear Sciences and Applications, International Atomic Energy Agency, Seibersdorf, Austria*
[4]*School of Geography, University of Plymouth, Plymouth, UK*
[*]*Current address: Terrestrial Environment Laboratory, IAEA Environment Laboratories, Department of Nuclear Sciences and Applications, International Atomic Energy Agency, Seibersdorf, Austria*

Different factors may affect the extent of radionuclides' interception by plants and therewith their inventories in soil covered areas. In particular, there is interest in assessing the impact of the vegetation factor for different soil coverage conditions, when using ^{7}Be as radiotracer of soil redistribution in cropped farmland.

Common beans at the early growing stage were selected to conduct this experimental study in the Soil and Water Management & Crop Nutrition Laboratory in close collaboration with the Terrestrial Environmental Laboratory, as these plants are known to provide a large foliar surface in a relatively short time. ^{7}Be activity concentration was determined using high resolution gamma-ray spectrometry. A relatively high ^{7}Be interception factor (normalized to the leaf area index-LAI) of 0.62 (LAI value 0.85) was determined after 0.4 mm precipitation. After a second 7.2 mm rainfall, the interception factor had a value of 0.37, for a 3.0 LAI value. Wash-off experiments with deionized water determined several hours and 10 days after the wet foliar interception showed that the released ^{7}Be fraction was limited to only 35% of the initial concentration of leaf deposit. ^{7}Be incremental depth profiles confirmed that the radionuclide reached only the upper 20 mm of the soil, independently of precipitation amount or soil coverage, having a maximum in the first 2.5 mm layer. Moreover, ^{7}Be was not found in plant roots, thus excluding its direct uptake from soil.

Our results suggest that ^{7}Be foliar interception of bean plants is likely to affect the radionuclide inventories and their spatial uniformity in covered soil. Reliable results on short-term erosion using ^{7}Be can be obtained in cropped farmland with limited cover, but only when taking into account the interception factor. The impact of the interception factor is highly dependent on rainfall intensity and duration, crop species and the growing stage of the plants. Further investigations into these variables are required.

Update on ^{13}C-labelling of plant materials through the use of walk-in growth chambers

Leo Mayr, Christian Resch, Georg Weltin and Gerd Dercon

In 2013, the Soil and Water Management & Crop Nutrition Laboratory installed a pair of walk-in growth chambers with an effective volume of about 12 m^3 each (Figure 1). These growth chambers with temperature, relative humidity and carbon dioxide (CO_2) control, are being used within the framework of research activities for improving climate-smart agriculture in Member States.

Fig. 1. Walk-in growth chambers

In the first phase, the growth chambers were sealed to minimize CO_2 losses and more important losses of ^{13}C labelled CO_2. Such $^{13}CO_2$ is currently being used in the labelling of plant materials for incubation experiments, to better understand soil organic carbon dynamics under a changing climate.

Leakage rates were measured by filling the chambers with elevated levels of CO_2 (about 300 ppm) and monitoring the decline of the CO_2 concentration over time. Leakage rates were calculated from the decay constant of the exponential decay curve of the CO_2 concentration (Figure 2). The delivered growth chambers were originally found to have a leakage rate of about 25% per day. The feed through of the CO_2 supply and the cooling tubes were identified as the major source of leaking. Sealing these leaks with silicone reduced the leakage rate to less than 5% per day.

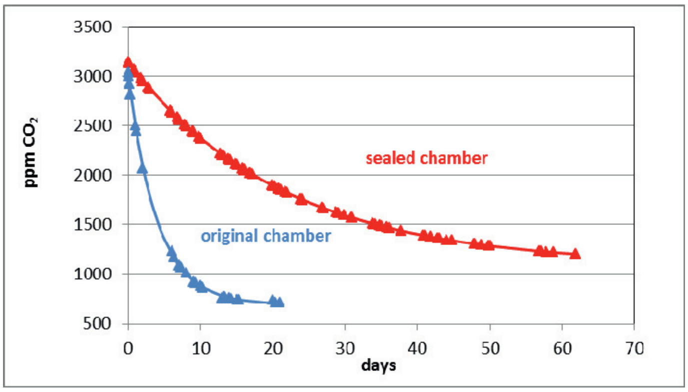


Fig.2. decline of CO_2 levels in closed chambers

The CO_2 gas inlet was modified to introduce a mixture of (a) pure CO_2 at natural abundance level and (b) CO_2 with 99 atom% ^{13}C (Sigma Aldrich) into the chamber for a period of 15 seconds after a decrease of 10 ppm of the CO_2 level was monitored. The flow rates of the two gases (200 ml/min and 2 ml/min) are controlled by mass-flow-controllers, ensuring that the ^{13}C enrichment of about 350 δ‰ is constant over the whole growing period (continuous labelling).

In addition, automatic drip irrigation systems were placed in the growth chambers in combination with complementary air humidity controls, avoiding the need to enter the growth chambers during the ^{13}C-labelling of plant materials.

The adaptation of the growth chambers has allowed the Soil and Water Management & Crop Nutrition Laboratory to start new research activities, within the climate change framework. This achievement may become a significant area of support for Member States.

External Quality Assurance: Annual Proficiency Test on ^{15}N and ^{13}C isotopic abundance in plant materials

Martina Aigner

The annual Proficiency Test (PT) on ^{15}N and ^{13}C isotopic abundance in plant materials jointly organized by the University of Wageningen, The Netherlands and funded by the IAEA Soil Water Management and Crop Nutrition Laboratory (SWMCNL) has been successfully completed. The Wageningen Evaluating Programs for Analytical Laboratories (WEPAL http://www.wepal.nl) is accredited for the organization of Inter-laboratory Studies by the Dutch Accreditation Council. In total, twelve stable isotope laboratories participated in this WEPAL IPE (International Plant-Analytical Exchange) programme IPE 2013.2.

A bulk amount of uniformly ^{15}N-enriched plant material was produced by the SWMCNL and sent to WEPAL for milling, homogenization and bottling through the routine test sample production process for PTs. This ^{15}N-enriched plant material (0.5 to 2.5 atom %, i.e. 370 to 6000 δ ‰ "delta per mille") was then sent out together with 3 other, non-enriched plant samples, each weighing 20g. Participants were requested to perform analysis of ^{15}N (enriched and/or natural abundance level), total N (N-elementary), Kjeldahl-N, ^{13}C and total C (C-elementary) on these samples within a set time limit and the results of these analyses were returned to WEPAL. The participation fee for round IPE2013.2 has been covered by the IAEA.

Test sample no.1 (WEPAL material code 187) was enriched with ^{15}N and only the results of this test sample were evaluated by IAEA. In total twelve laboratories reported isotope abundance data: Africa (1): Morocco; Asia (3): Malaysia, Pakistan, Philippines; Europe (5): Belgium, France, Germany, Italy and Turkey; Latin America (3): Argentina, Brazil and Chile) (Fig. 1).

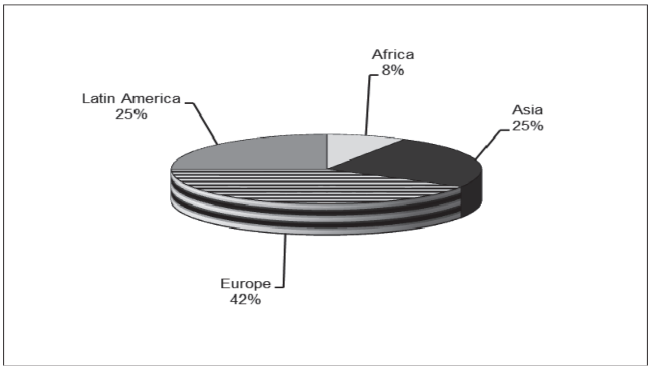


Fig.1. Geographical distribution of participants

Results and Discussion

Eight out of twelve laboratories (67 %) participating in the nitrogen analysis reported ^{15}N-data within the control limits for the enriched plant sample (Fig. 2) and eight out of nine (89%) participating laboratories for carbon analysis reported ^{13}C isotopic abundance results within the control limits for this test sample (Fig. 3).

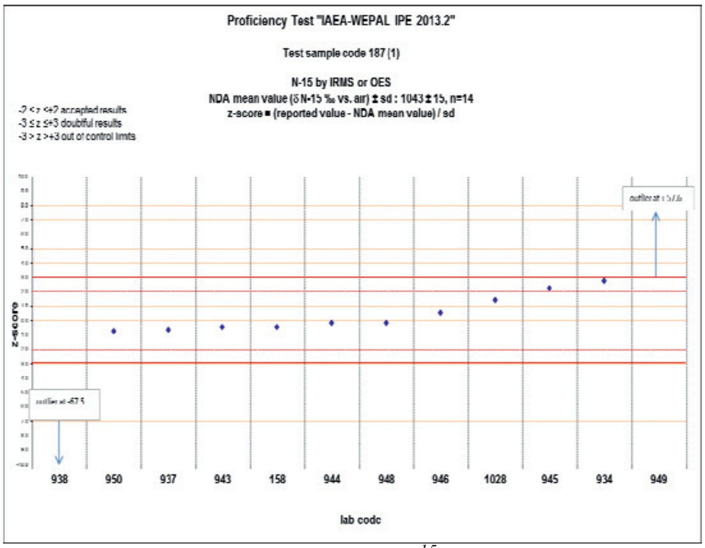


Fig. 2. Z-score evaluation of the ^{15}N analysis of plant material 187 (1)

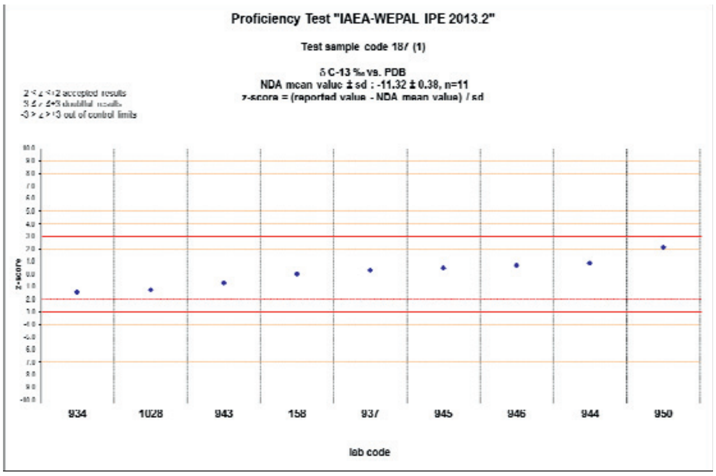


Fig. 3. Z-score evaluation of the ^{13}C analysis of plant material 187 (1)

Table 1 shows the reported analytical data and WEPAL-evaluation of the ^{15}N enriched plant material produced by SWMCNL.

Table 1. Summary of results of plant material 187 (1)

type of analysis	unit	material code	sample no.	remark	Lab no.	reference value (NDA mean)	SD	reported result	based on statistics all participants)	* straggler, ** outlier
C - elementary	g/kg	187	1		158	449.7	14.7	440.89	-0.60	
C - elementary	g/kg	187	1		934	449.7	14.7	441.43	-0.56	
C - elementary	g/kg	187	1		937	449.7	14.7	450.93	0.08	
C - elementary	g/kg	187	1		943	449.7	14.7	438.46	-0.76	
C - elementary	g/kg	187	1		945	449.7	14.7	408.20	-2.81	*
C - elementary	g/kg	187	1		946	449.7	14.7	465.96	1.10	
C - elementary	g/kg	187	1		950	449.7	14.7	421.54	-1.91	
C - elementary	g/kg	187	1		1028	449.7	14.7	481.00	2.12	*
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	158	-11.32	0.38	-11.32	0.00	
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	934	-11.32	0.38	-11.85	-1.41	
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	937	-11.32	0.38	-11.20	0.32	
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	943	-11.32	0.38	-11.58	-0.69	
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	944	-11.32	0.38	-11.00	0.85	
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	945	-11.32	0.38	-11.14	0.47	
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	946	-11.32	0.38	-11.06	0.69	
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	950	-11.32	0.38	-10.51	2.15	*
delta 13C	‰ V-PDB	187	1	^{13}C nat.ab.	1028	-11.32	0.38	-11.80	-1.28	
delta 15N	‰ Air	187	1	^{15}Nenriched	158	1043	15	1036.53	-0.45	
delta 15N	‰ Air	187	1	^{15}Nenriched	934	1043	15	1086.10	2.76	*
delta 15N	‰ Air	187	1	^{15}Nenriched	937	1043	15	1033.24	-0.66	
delta 15N	‰ Air	187	1	^{15}Nenriched	938	1043	15	0.35	-67.51	**
delta 15N	‰ Air	187	1	^{15}Nenriched	943	1043	15	1036.51	-0.45	
delta 15N	‰ Air	187	1	^{15}Nenriched	944	1043	15	1041.00	-0.16	
delta 15N	‰ Air	187	1	^{15}Nenriched	945	1043	15	1078.00	2.23	*
delta 15N	‰ Air	187	1	^{15}Nenriched	946	1043	15	1051.55	0.52	
delta 15N	‰ Air	187	1	^{15}Nenriched	948	1043	15	1041.00	-0.16	
delta 15N	‰ Air	187	1	^{15}Nenriched	949	1043	15	1933.24	57.58	**
delta 15N	‰ Air	187	1	^{15}Nenriched	950	1043	15	1031.90	-0.75	
delta 15N	‰ Air	187	1	^{15}Nenriched	1028	1043	15	1065.90	1.45	
N - elementary	g/kg	187	1		158	13.73	0.62	14.21	0.78	
N - elementary	g/kg	187	1		934	13.73	0.62	13.90	0.28	
N - elementary	g/kg	187	1		937	13.73	0.62	16.60	4.65	**
N - elementary	g/kg	187	1		943	13.73	0.62	14.34	0.99	
N - elementary	g/kg	187	1		945	13.73	0.62	13.40	-0.53	
N - elementary	g/kg	187	1		946	13.73	0.62	14.65	1.49	
N - elementary	g/kg	187	1		950	13.73	0.62	11.89	-2.97	*
N - elementary	g/kg	187	1		1028	13.73	0.62	14.20	0.77	
N - Kjeldahl (as N)	g/kg	187	1		158	13.23	0.84	12.30	-1.10	
N - Kjeldahl (as N)	g/kg	187	1		937	13.23	0.84	15.67	2.89	*
N - Kjeldahl (as N)	g/kg	187	1		938	13.23	0.84	0.01	-15.69	**
N - Kjeldahl (as N)	g/kg	187	1		948	13.23	0.84	14.20	1.15	
N - Kjeldahl (as N)	g/kg	187	1		949	13.23	0.84	15.36	2.52	*
N - Kjeldahl (as N)	g/kg	187	1		950	13.23	0.84	13.20	-0.04	

Remark: In two cases (lab no. 938 and 949) it seems the ^{15}N-data were correctly measured but were not correctly reported, which is a prerequisite for high quality work.

All participants received a certificate of participation.

Worldwide comparison of stable ^{15}N and ^{13}C isotope measurements will provide confidence in the laboratory's analytical performance and is hence an invaluable tool for external quality control. It is hoped that in the future more stable isotope laboratories will make use of this unique opportunity to assess their analytical performance and provide evidence of the high quality of their analytical data.

For more information on the joint WEPAL-IAEA Proficiency Test on stable isotopes 15N and 13C in plant materials supported by the SWMCNL, please contact Martina Aigner (M.Aigner@iaea.org).

Thirteen contributions from the Soil and Water Management & Crop Nutrition Subprogramme at the EGU 2014, Vienna

The 2014 European Geosciences Union (EGU) General Assembly, held in Vienna from 28 April to 2 May 2014, received a total of 1547 abstracts, with approximately 10% (1480 abstracts) in the Soil System Sciences (SSS) Division for 52 scientific sessions, in addition to 836 abstracts in 28 sessions co-organized by the SSS Division. This makes the SSS Division the second largest of the EGU, indicating the importance of soils in the earth system. The EGU is an appropriate platform for the Soil and Water Management & Crop Nutrition Subprogramme to interact with other Geoscientists.

This year, the Soil and Water Management & Crop Nutrition Subprogramme participated with thirteen contributions, i.e. ten from the SWMCN Laboratory and three from the Section. Eight scientists and technicians from the SWMCN Subprogramme participated in the EGU2014 to present work done at the Joint FAO/IAEA Division. The presentations dealt with the use of isotope and nuclear techniques in the field of soil erosion, soil organic carbon dynamics and agricultural water management at landscape level.

All details of the contributions from the SWMCN Subprogramme can be found in the Publications of this Newsletter. More information about the EGU2014 is available on the following website: http://www.egu2014.eu.

Joint FAO/IAEA Division
of Nuclear Techniques in Food and Agriculture
50 years, 1964–2014

50TH ANNIVERSARY: 1964-2014 & Beyond

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

Established on 1 October 1964, the FAO and IAEA created the Joint FAO/IAEA Division as a strategic partnership in order to mobilize the talents and resources of both organizations and hence to broaden cooperation between their Member States in the peaceful application of nuclear science and technology in a safe and effective manner to provide their communities with more, better and safer food and agricultural produce while sustaining natural resources.

Fifty years later, this FAO/IAEA partnership still remains unique, with its key strengths based on interagency cooperation within the United Nations family. It is a tangible joint organizational entity with a fusion of complementary mandates, common targets, a joint programme, co-funding and coordinated management. It entails close cooperation, greater efficiency and shared approaches, and geared to demand-driven and results-based services to its Members and to the international community at large.

Nuclear applications provide added value to conventional approaches in addressing a range of agricultural problems and issues, including food safety, animal production and health, crop improvement, insect pest control and sustainable use of finite natural resources. Over the past 50 years, this partnership has brought countless successes with distinct socio-economic impact at country, regional and global levels in Member States.

During the past 50 years the mission of the Joint Division has proactively evolved to embrace the adaptation to and mitigation of climate change and the adverse effects of globalisation, to increase biodiversity and to further contribute to agricultural development and global food security. Today, both FAO and IAEA strive to mobilize commitment and concerted action towards meeting the Millennium Development Goals and the Sustainable Development Goals through appropriate use of nuclear and related technologies for sustainable agriculture and food security.

Ren Wang
Assistant Director-General
FAO

Daud Mohamad
Deputy Director General
IAEA

Publications

Alewell, C., Meusburger, K., Juretzko, G., Mabit, L., Ketterer, M.E. (2014). Suitability of $^{239+240}$Pu and ^{137}Cs as tracers for soil erosion assessment in mountain grasslands. Chemosphere, 103, 274–280.

Alewell, C., Meusburger, K., Juretzko, G., Mabit, L., Ketterer, M.E. (2014). Suitability of $^{239+240}$Pu and ^{137}Cs as tracers for soil erosion assessment in Swiss mountain grasslands. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-2935.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-2935.pdf

Arata, L., Meusburger, K., Bissig, N., Mabit, L., Alewell, C. (2014). ^{137}Cs re-sampling as a method for soil erosion assessment in Alpine grasslands. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-3360.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-3360.pdf

Blake, W., Taylor, A., Abdelli, W., Gaspar, L., Al Barri, B., Ryken, N., Mabit, L. (2014). Evaluating uncertainty in ^{7}Be-based soil erosion estimates: an experimental plot approach. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-10651.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-10651.pdf

Gonsalves, B.C., Darby, I.G., Toloza, A., Mabit, L., Kaiser, R.B., Dercon, G. (2014). Assessing soil erosion at landscape level: A step forward in the up-scaling of ^{137}Cs measurements through the use of in-situ lanthanum bromide scintillator. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-1996.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-1996.pdf

Heng, L.K., Nguyen, M.L., Gong, D.Z., Mei, X.R., Amenzou, N. (2014). Separating soil evaporation and crop transpiration to improve crop water use efficiency. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union—General Assembly 2014. Abstract EGU2014-1934.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-1934.pdf

Leifeld, J., Heiling, M., Hajdas, I. (2014). Age and thermal stability of particulate organic matter fractions indicate the presence of black carbon in soil. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-12777.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-12777.pdf

Mabit, L., Meusburger, K., Iurian, A.R., Owens, P.N., Toloza, A., Alewell, C. (2014). Sampling soil and sediment depth profiles at a fine-resolution with a new device for determining physical, chemical and biological properties: the Fine Increment Soil Collector (FISC). Journal of Soils and Sediments, 14(3), 630–636.

Mabit, L., Meusburger, K., Iurian, A.R., Owens, P.N., Toloza, A., Alewell, C. (2014). Fine Increment Soil Collector (FISC): A new device to support high resolution soil and sediment sampling for agri-environmental assessments. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union– General Assembly 2014. Abstract EGU2014-1992.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-1992.pdf

Mao, Y.L., Heiling, M., De Clercq, T., Resch, C., Aigner, M., Mayr, L., Vanlauwe, B., Thuita, M., Steier, P., Leifeld, J., Merckx, R., Spiegel, H., Cepuder, P., Nguyen, M.L., Zaman, M., Dercon, G. (2014). Soil organic matter stability in agricultural land: New insights using δ^{15}N, δ^{13}C and C:N ratio. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-3321.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-3321.pdf

Meusburger, K., Leitinger, G., Mabit, L., Mueller, M.H., Walter, A., Alewell, C. (2014). Soil erosion by snow gliding– a first quantification attempt in a sub-alpine area, Switzerland. Hydrology and Earth System Sciences Discussions, 11, 3675–3710.

Mueller, M.H., Meusburger, K., Leitinger, G., Mabit, L., Alewell, C. (2014). The interaction of soil, vegetation and snow - results of a case study in the Central Swiss Alps. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-7032-2.pdf. http://meetingorganizer.copernicus.org/EGU2014/EGU2014-7032-2.pdf

Sakadevan, K., Shalmani, M.A.M., Nguyen, M.L. (2014). Wetland Water and Nutrient Budgets for Improving Irrigation Performance in Caspian Low Lands. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-10651.pdf.
https://meetingorganizer.copernicus.org/EGU2014/EGU2014-1853.pdf

Vreugdenhil, M., Weltin, G., Heng, L., Wahbi, A., Oismueller, M., Dercon, G. (2014). Cosmic Ray Neutron Probe Soil Water Measurements over Complex Terrain in Austria In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-3702.pdf.
http://meetingorganizer.copernicus.org/EGU2014/EGU2014-3702.pdf

Wahbi, A., Miwak, H., Singh, R. (2014). Effects of Conservation Agriculture on Soil Physical Properties and Yield of Lentil in Northern Syria. In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-3280-1.pdf.
http://meetingorganizer.copernicus.org/EGU2014/EGU2014-3280-1.pdf

Zaman, M and Nguyen, M.L. (2014). Mitigating Nitrous Oxide Emissions from Agricultural Landscape: The Role of Isotopic Techniques In: Geophysical Research Abstracts, Volume 16, European Geosciences Union–General Assembly 2014. Abstract EGU2014-10651.pdf.
http://meetingorganizer.copernicus.org/EGU2014/EGU2014-3546-1.pdf

Websites

- Soil and Water Management and Crop Nutrition Section:
  http://www-naweb.iaea.org/nafa/swmn/index.html

- Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture:
  http://www-naweb.iaea.org/nafa/index.html

- Food and Agriculture Organization of the United Nations (FAO):
  http://www.fao.org/about/en/

- FAO/AGL (Land and Water Development Division):
  http://www.fao.org/nr/water/landandwater_what.html

Impressum

Soils Newsletter Vol. 37, No. 1, July 2014

The Soils Newsletter is prepared twice per year by the
Soil and Water Management & Crop Nutrition Section,
Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and
FAO/IAEA Agriculture & Biotechnology Laboratory, Seibersdorf.

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, July 2014

14-25481