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

Soils Newsletter

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Contents

A field experiment in Bobo (Burkina Faso) to investigate (top) conventional (labour) and conservation tillage (zero labour) on crop yield and (bottom) the beneficial effect of growing maize in association with Mucuna (Mucuna can take up atmospheric nitrogen and subsequently provide it for maize).

To Our Readers

The global food crisis in 2008 has brought worldwide attention to issues relating to food and agriculture, including the impacts of climate change, extreme climatic variability and finite fossil fuel energy resources on sustainable agriculture. The underlying causes of this food crisis are complex and require not only immediate but also long term solutions. To enhance long term food security, it is important to improve land productivity by improving soil fertility and soil organic matter status and enhancing soil nutrient, fertilizer and water use efficiency under both rain-fed and irrigated conditions. Our preoccupation with addressing the immediate food crisis means that issues such as land management, which require long term solutions, are frequently neglected. Yet inappropriate land management not only causes a reduction in land productivity, thus creating food insecurity and poverty, but it also leads to the degradation of farmers' environments through reductions in the quality and quantity of water supplies for rural and downstream communities and an increase in socio-economic and -political instability.

IAEA International Atomic Energy Agency

To combat land degradation, it is important to restore soil health through improving soil fertility and soil organic matter and also to mitigate the causes of land degradation. Some of these causes include: (i) inadequate use of fertilizers to combat soil nutrient deficiencies and to compensate for nutrient removal from animal and crop products, (ii) intensive land cultivation without adequate crop residue return, (iii) overgrazing or poor grazing management which destroys soil structure through soil trampling by livestock and (iv) poor irrigation, leading to salinity and excessive loss of soil nutrients to groundwater.

At the recent high-level conference entitled: 'Climate change – can soil make a difference?' organized by the Environment Directorate-General of the European Commission in Brussels (12 June 2008), Mr Luc Gnacadja, Conference Chairperson and Executive Secretary of the United Nations Convention to Combat Desertification reminded the audience that very low soil organic matter levels are one of the key factors contributing to degradation/desertification, and that the consequences of degradation/desertification are devastating for the lives of so many of the world's poorest people. Soil organic matter (SOM) plays a key role in providing nutrients for plant growth. It is a storehouse for water and carbon which provide energy for soil micro-organisms. Soil management is an important part of the solution to combat climate change through the increase in capture and storage of carbon dioxide in soil (i.e. soil carbon sequestration) and the reduction of greenhouse gas (GHG) emissions, such as carbon dioxide and nitrous oxides. Soil carbon sequestration can be achieved through an increase in soil fertility for plant growth and crop residues. Conservation agriculture, with minimum or no cultivation, is known to reduce soil carbon dioxide emissions, while nitrous oxide emissions can be reduced through appropriate fertiliser and irrigation/wastewater application and land management to avoid water-logging, the breakdown of soil physical properties (i.e., a reduction in soil porosity) and the denitrification process, a soil biochemical process which occurs predominantly in wet soils and converts soil and fertiliser nitrate to nitrous oxide. Isotopic techniques can act as tracers and help to unravel the interacting processes which influence soil carbon sequestration, fertiliser and water use efficiency, soil nutrient dynamics and GHG emissions which are all affected by factors such as types of crop residue, soil moisture and nutrient status and climate change. The increased emphasis of soil and land management as part of the solution of food security and sustainable agriculture in the face of climate change and climate variability reflects the statement from US President Franklin Roosevelt: "The history of every nation is eventually written in the way in which it cares for its soil," and this remains true today.

The activities of the Soil and Water Management & Crop Nutrition (SWMCN) Section and Soil Science Unit in 2008 both through the network of coordinated research projects (CRPs) and technical cooperation projects (TCPs) have focused on providing information and capacity building in the use of isotopic techniques to Member States as they seek to address the issues outlined above. We have been busy preparing a workplan of activities for 2010-2011 focusing in particular on developing technology packages which will enhance soil carbon sequestration, reduce greenhouse gas emissions and increase soil resilience to climate change and extreme climate variability. Staff members have also been very busy with an evaluation of the subprogramme on sustainable intensification of crop production systems. Preliminary feedback indicates that our activities are relevant to the needs of the Member States. Felipe Zapata, a previous staff member has been invaluable in helping our subprogramme to gather information on SWMCN activities since 2000. I would like to thank you Felipe for your dedicated support.

To all of the CRP participants and our TC counterparts, I also wish to express my appreciation for your input and I look forward to receiving your continuing support in 2009. The successful accomplishment of our subprogramme activities in 2008 has largely been achieved through your commitment and collaboration. I also would like to thank my team members within our subprogramme for their dedication and my colleagues at FAO and IAEA for their support. Our collaboration with FAO, CG centres and national institutions such as the Chinese Academy of Agricultural Sciences (CAAS), the Turkish Atomic Energy Agency, and the United Nations University provides additional synergy and success in assisting Member States to address sustainable land and agricultural water management issues for crop production and conservation of natural resources and agricultural inputs (e.g. energy and fertilizers). The Memorandum of Practical Arrangement that has been signed between Mr. J.F. Girard, President of the Institut de Recherche pour le Development (IRD) and Mr. W. Burkart, the Deputy Director General of the Department of Nuclear Sciences and Applications at the IAEA Headquarters in Vienna on 30 September 2008 will potentially provide valuable future collaboration with French scientists and institutions who are working in the areas of land degradation, soil health and agricultural water management in Member States.

The challenges and opportunities for the SWMCN in 2009 as outlined above are enormous as we seek to contribute technologies and knowledge that will help scientific and farming communities to improve sustainable land management, food security and agricultural water use efficiency. As we face these issues, let me share with you one of the successes that we achieved in 2008.

Our subprogramme received an increase in the number of TCPs to assist Member States covering a range of issues relating to soil and water management. In addition, the SWMCN in-house publication (IAEA-TECDOC) on 'Management Practices for Improving Sustainable Crop Production in Tropical Acid Soils', received the IAEA Departmental Award (Awards initiated by the Deputy Director General, Mr. W. Burkart of the Department of Nuclear Sciences and Applications) for its scientific impact. This publication was the cooperative and cumulative effort of research contract holders, technical contractors and agreement holders of the CRP (D1.50.06) on: 'Development of Management Practices for Sustainable Crop Production Systems on Tropical Acid Soils through the Use of Nuclear and Related Techniques'. The IAEA-TECDOC provides comprehensive coverage of the main technologies which have been adopted to improve agricultural production of tropical acid soils in Africa and Latin America through: (i) use of better adapted plants (P-efficient and Al-tolerant) (ii) amelioration of soil acidity and infertility and (iii) sustainable soil, water, nutrient and crop management. Results show how appropriate crop, soil, water and nutrient management improved soil fertility status, promoted better soil and water conservation and thereby increased crop productivity under local farming conditions. This publication highlights sound strategies and approaches, including the application of nuclear and related techniques needed to foster sustainable agricultural intensification in tropical regions, while paving the way for future research which can improve the health of tropical acid soils and enhance their resilience in the face of climate change and variations in land use activities.

I would like to thank all the participants of this CRP and Mr. Felipe Zapata (Scientific Secretary for this CRP) for his scientific inputs and project management capabilities. My thanks also go to Ms. Rosario Leon de Müllner (one of our Subprogramme administrative assistants) for formatting the publication and Leo Mayr and his analytical team for providing analytical support.

My best wishes to all of our team members and readers for a happy, healthy and successful year in 2009.

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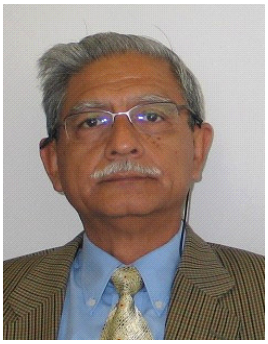
Staff News



Mr. Felipe Zapata, a former staff member, was with the SWMCN Section for six months (17 March to 19 September 2008) as a Consultant to assist with compiling information for the OIOS evaluation review. In addition, Felipe assisted in formulating the Coordinated Research Project on precision conservation and in the preparation of several publications in the areas of soil carbon sequestration, soil erosion and soil quality. We thank Felipe for his valuable inputs and his support for the Subprogramme.

Ms. Doris Gludovacz joined the Soil Science Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory as a temporary member of the General Staff in September 2006. Later she became an FAO/IAEA Staff Member of the Soil Science Unit (Laboratory Technician from May 2007 until September 2008), working on stable isotope analyses using mass spectrometry, as well as on crop nutrition experiments using tracer technology. The dedicated work provided by Doris was greatly appreciated and the staff of the SWMCN Subprogramme wishes her all the best in her new role at Siemens.

Mr. Stephen Burgess joined the Section on 1 December 2008 as a Consultant on a six-month contract. Steve's duties will be to develop a proposal framework for managing water at the landscape/catchment level ('area-wide basis'). He will also develop specific protocols for tracing water acquisition and use in production systems. Steve will apply his knowledge to manage water in sensitive agro-ecosystems which in many parts of the world are at ecological tipping points.

Feature Articles

Soil Conservation and Nitrogen Dynamics in Hillside Maize Cropping in tropical mountainous regions

by W. Pansak[1], T. Hilger[1], G. Dercon[2], T. Kongkaew[3], G. Cadisch[1]

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Challenge

Land use intensification on steep slopes has led to severe soil degradation by erosion in many tropical countries. This problem has been exacerbated by increased rainfall intensities due to climate change. The overall goal of this study was to assess the short to medium term changes in soil erosion, runoff, nitrogen (N) losses and crop response, as affected by contour barrier/hedgerow and conservation agriculture systems (minimum tillage and retaining crop residues). Particular emphasis was given to changes in the pathways of N loss, for e.g. above vs. below ground losses, and to gaining a better understanding of competition leading to a decline in crop response close to hedges. Finally the magnitude and dynamics of key processes influencing the efficiency of soil conservation measures were assessed by using the WaNuLCAS model (Water, Nutrient and Light Capture in Agroforestry Systems)[1].

[1] http://www.worldagroforestry.org/sea/products/AFModels/wanulcas/index.htm

Experimental design

The study was conducted over a 3-year period (2003-2005) at Ban Bo Muang Noi village in the Loei province of Thailand (17°33' N and 101°1' E, 572 m a.s.l.). The experiment was laid out as a split-plot design, with fertilizer application as the main factor and soil conservation as a subfactor, with two replicates. Plot size was 4 by 18 m with a collection device for runoff water and eroded soil (Fig. 1). In all treatments maize (*Zea mays* L.) was planted along the contours on a moderate slope gradient (21–28%) under minimum tillage conditions and relay cropped with a legume cover crop (*Canavalia ensiformis*). The two main factor treatments were (i) no fertilizer application and (ii) 60 kg N ha^{-1} plus 14 kg P ha^{-1} via split application. Subfactor treatments were: (i) Vetiver grass (*Vetiveria zizanioides* (L.) Nash) barriers, (ii) Ruzi grass (*Brachiaria ruziziensis* Germain et Evrard) barriers, (iii) Leucaena (*Leucaena leucocephala* (Lam) de Wit) hedges, and (iv) a control without hedgerows.

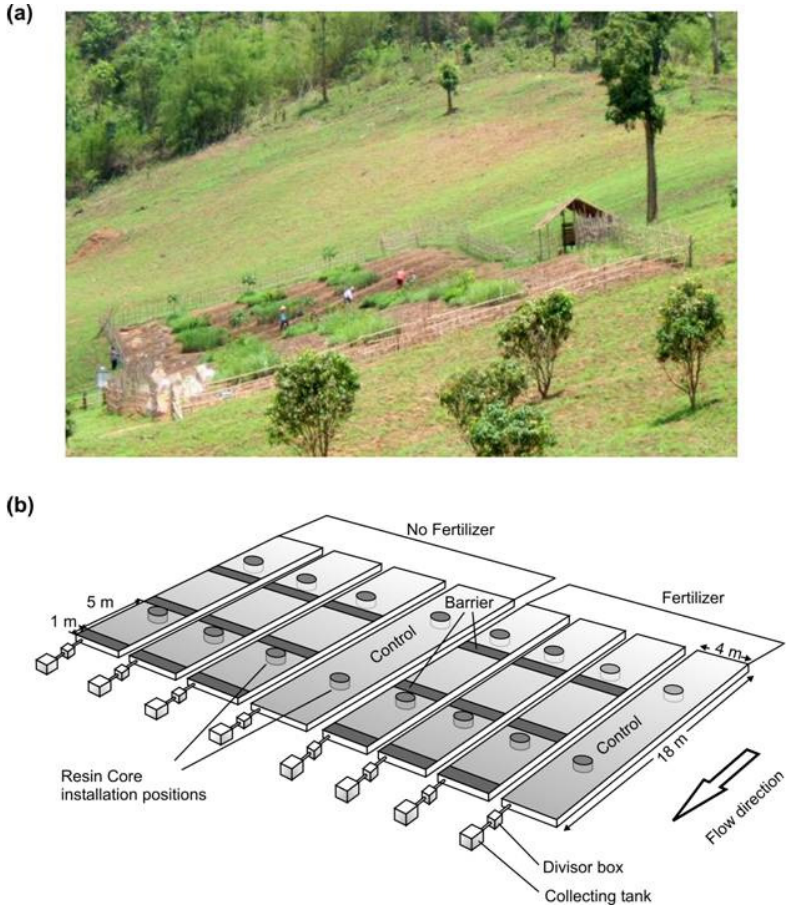


Fig. 1 (a) Experimental layout of erosion plots at Ban Bo Muang Noi, Loei province, Northeast Thailand. (b) Schematic of measurement setup used for collecting runoff and soil loss, and N leaching.

Temporal dynamics of crop response, erosion, runoff and N losses[2]

After three years, maize grain yields increased from 1.5 and 3.2 to 3.8 and 5.5 Mg ha^{-1} in the unfertilized and fertilized control plots respectively. Over the same period, yield increases were lower for soil conservation treatments reaching yields of 2.0-2.7 Mg ha^{-1} without fertilizer and 3.9-4.2 Mg ha^{-1} with fertilizer, because of barriers/hedgerows reducing the cropping area and competing with the crops in the alleys.

Three years after the establishment of soil conservation measures, runoff (190-264 m^3 ha^{-1}) and soil loss (0.2-1 Mg ha^{-1}) in fertilized plots with barriers showed an average decrease of 72% and 98%, respectively, as compared to 2003, the reduction being lower in unfertilized plots. The control (without barriers or hedgerows) had the largest soil loss in the first year (24.5 Mg ha^{-1}), but also showed strongly reduced erosion (1.6-2.5 Mg ha^{-1}) in the third year, partly due to reduced rainfall but also due to the combined effects of minimum tillage and surface mulch.

Average cumulative N losses through runoff, soil loss and leaching were reduced from 55 kg N ha^{-1} in the control to 37-40 kg N ha^{-1} in the barrier treatments. The dominant N loss pathway shifted from above ground N losses to leaching with the establishment of barriers and

[2] Pansak, W., Higer. T.H., Dercon, G., Kongkaew, T., Cadisch, G., 2008. Changes in the relationship between soil erosion and N loss pathways after establishing soil conservation systems in uplands of Northeast Thailand. Agriculture, Ecosystems and Environment, 128, 167-176.

hedges. However, N fertilizer application did not lead to an increase in N loss.

Competition for nitrogen and water between crops and barriers/hedgerows[3]

Due to the lower crop response close to the barriers/hedgerows, ^{13}C isotopic discrimination based techniques were used to understand the processes driving competition between barriers/hedgerows and crops. The spatial variability in maize grain yield was assessed for two contour hedgerow systems based on Ruzi grass barriers and Leucaena hedges without or with fertilizer as described above. Soil available NO_3^--N was analyzed across the slope. In addition, shoot N concentration and $\delta^{13}C$ values in leaves were measured for maize plants in the centre of the alley and in the row next to and at the upper side of barriers or hedges. Despite variable field conditions, $\delta^{13}C$ values in leaves were significantly ($p<0.05$) less depleted in ^{13}C close to the barriers or hedges, except for 2 out of the 16 plots, suggesting that water deficiency was not the main driver for spatial variability along the alleys. The negative correlation between ^{13}C isotopic discrimination and available NO_3^--N in the soil, with R^2 ranging from 0.5 ($p<0.10$) to 0.9 ($p<0.01$), assigned a major role to N availability in the reduced crop response towards the barriers.

Modelling impact of soil conservation measures on runoff and soil loss

A data set of the control without hedgerow and Leucaena hedge treatments in both with and without fertilizer treatments for three years (2003–2005) from the above described field experiment was selected to simulate the impact of soil conservation measures on runoff and soil loss by using the WaNuLCAS 3.2 model.

The results indicated that WaNuLCAS was applicable to hillside cropping systems in Northeast Thailand, as correlation coefficients of 0.82 and 0.80 were obtained between observed and predicted runoff and soil loss, respectively.

The model simulations showed that (i) soil conservation measures were effective techniques to control runoff and soil loss by providing a barrier and surface mulch, (ii) increased recycling of organic material (from cover crops or hedges) altered soil structure over time thereby reducing runoff and soil loss and (iii) relay cropping with Jack bean in control treatments played a significant role in reducing soil loss by providing an increased soil cover.

Conclusions

Contour barriers/hedgerows combined with minimum tillage and legume relay cropping provide sustainable options for farmers to generate cash income and reduce agricultural risks through a reduction in runoff, soil erosion and soil N loss. However, hedgerows and barriers are probably only required in the establishment phase and thereafter, maize cropping under minimum tillage, combined with legume relay cropping (conservation agriculture) is a viable option, at least for the study areas with moderate slopes.

[3] Pansak, W., Dercon, G., Hilger, T.H., Kongkaew, T., Cadisch, G., 2007. ^{13}C isotopic discrimination: a starting point for new insights in competition for nitrogen and water under contour hedgerow systems in tropical mountainous regions. Plant and Soil, 298, 175-189.

SWMCN Seminar Series

Thanks to the various speakers who gave their valuable time to present seminars to the SWMCN team and other interested IAEA staff. The topics were diverse and interesting. Abstracts of the seminars are reproduced below in italics for your information

Soil and land management under climate change

By Winfried E.H. Blum

Professor Winfried E. H. Blum (Professor of Soil Science and Director of the Institute of Soil Research, Department of Forest and Soil Sciences at the University of Natural Resources and Applied Life Sciences (BOKU) in Vienna/Austria), visited the SWMCN Section at IAEA Headquarters on 14 June and presented a seminar on soil and land management under climate change.

The seminar focuses on the sustainable use of soil and land, based on the six main functions of soil, as well as the provision of goods and services for human society and the environment. The impact of climate change on the provision of goods and services and its possible impact on civilisation is then discussed. In order to understand the current state of civilisation, a short introduction to the historical development of the relationship between nature and human society is given, explaining the development of land use on a world wide level and the growth of the world population during the last 10 000 years. This defines the current state of human civilisation in a physical, social, economic, environmental and cultural context.

Based on this, different scenarios of climate change, particularly those referring to changes in precipitation and annual mean temperatures are given, thus explaining what climate change means for the provision of surface and ground water for the human population, the development of biodiversity, especially soil biodiversity, the impact on human health and the impact on biomass production, i.e. the impact on the food chain and food security on a world-wide level. World-wide food trading and food disposal is based on food production from 12% of the land surface with the best soil quality. The world food resources are produced by about 25% of the world's population.

Different scenarios regarding the sensitivity of agro-ecosystems to global climate change are explained, showing examples for changes in rain fed cereal production as well as food produced by irrigation.

Finally the question of climate change in relation to changes in the chemistry of the atmosphere is discussed, together with possible causes of climate change, looking into the basic views on the relationship between human beings and nature, social and economic theories and the problem of globalisation of social and economic decisions in terms of their impact on the trade of agricultural and other commodities.

In summary, the seminar will demonstrate that:

1. through climate change, the provision of goods and services for civilisation will change tremendously;
2. the impact of these changes will be very different for specific world regions and predominantly negative for developing countries;
3. adverse impacts are expected mainly regarding the following issues:

- *water resources for agricultural production (by irrigation),*
- *generation of energy and industrial production,*
- *rain fed agriculture,*
- *biodiversity (in and above the soil),*
- *human health and living conditions in specific world regions,*
- *adverse feedback processes between soil and atmosphere, accelerating climate change;*

4. possible causes of climate change derive from world views on the relationship between humans and nature, wrong economic and social theories and the increasing globalisation of decisions regarding the production and marketing of agricultural-biological commodities, without considering regional-local ecological, social and economic conditions;
5. any mitigation of climate change and its impacts must be based on a re-orientation of world views and consequently adequate reactions by the world economy, through the establishment of new economic rules and steering operations.

Cherenkov Counting

By Michael F. L'Annunziata

Dr. Michael F. L'Annunziata, President of The Montague Group, Technical Services, USA, visited the SWMCN Section at IAEA Headquarters on 27 June and presented the following seminar on Cherenkov Counting.

The speaker discusses the historic discovery of Cherenkov radiation and the principle, and applications of Cherenkov counting for the analysis of radionuclide activities important to many fields of the applied sciences as well as applications in the field of high-energy particle physics. The applications to be discussed in the applied sciences will encompass those utilized for the analysis of beta-emitting radionuclides in a broad spectrum of fields including radionuclide analysis in chemistry, biology, agriculture, radiopharmaceutical sciences and

environmental studies. Dr. L' Annunziata also describes the discrimination of beta- and gamma-radiation by Cherenkov counting and the use of ring imaging Cherenkov (RICH) counters applied to particle identification (e.g., protons, kaons, muons and electrons) by researchers in the field of high-energy particle physics. Applications of Cherenkov counting to nuclear safeguards will not be included in this discussion.

As applied to the chemical, biological, and agricultural sciences, the accurate measurement of tracer radionuclides, such as ^{32}P, ^{36}Cl, ^{86}Rb (tracer for K) by Cherenkov counting, and the measurement of ^{90}Y activity by Cherenkov counting applied in the radiopharmaceutical sciences is discussed. In the environmental sciences, the application of Cherenkov counting to the analysis of ^{89}Sr + $^{90}Sr(^{90}Y)$ is another application which is discussed. The Cherenkov effect and the beta-particle (electron) threshold energies required for the Cherenkov effect is reviewed in light of various media used to measure radionuclide activity, including water, plastic, and glass, where samples are analyzed in aqueous solution or in a dry state. The optimization of counting parameters, such as pulse height discriminator settings for highest counting efficiency versus background, sample counting geometry, and color quench correction techniques is described. Emphasis is given to the advantages of Cherenkov counting over the conventional liquid scintillation counting technique, particularly with respect to the application of this technique in IAEA Technical Cooperation Projects and Coordinated Research Projects in developing Member States. Some of the advantages of using Cherenkov counting for samples in aqueous solution are discussed, including (i) the total elimination of all expensive and hazardous chemicals used in liquid scintillation techniques, (ii) the elimination of expense incurred in the disposal of hazardous chemical waste, (iii) the possibility of carrying out further analytical tests (e.g., enzyme activity analysis, spectroscopy, etc.) on samples after Cherenkov counting, which are counted in aqueous solution and thus unadulterated by chemicals, (iv) in the case of short-lived radionuclides, such as ^{32}P, the reuse of counting vials after Cherenkov counting and allowance of sufficient time for radionuclide decay, and (v) the absence of interference and background from other radionuclides that have beta-particle or gamma-ray emissions with energies below the threshold energy for the Cherenkov effect.

Satellite Imagery and GIS for Land and Agricultural Management

By Bob Truong

Dr. Bob Truong (Ph.D., P. Eng., Senior Officer, Canadian Safeguards Support Program, Directorate of Security and Safeguards, Canadian Nuclear Safety Commission) visited the SWMCN Section at IAEA Headquarters on 21 November and presented a seminar on Satellite Imagery and GIS for Land and Agricultural Management.

Commercial satellite imagery in combination with the Geographical Information System (GIS) has been used at the IAEA for verification, the monitoring of nuclear operations, and detection of potential clandestine activities. However, these tools can also be applied to many other areas outside the safeguards domain, such as mineral exploration, forestry, agriculture and resource/asset management.

The main objective of this presentation is to provide a general overview and to outline the potential applications of remote sensing and GIS tools in the areas of land and agricultural management.

A large part of the presentation is dedicated to remote sensing using various available commercial (low and high resolution) satellites. Examples relevant to the detection capabilities (including change detection), of various satellite sensors, both optical (such as Landsat and QuickBird) and radar (such as RADARSAT and JERS), their advantages and disadvantages, will be presented.

Some of these examples may not directly address the topic of resource management, but they are useful for demonstrating the analogy and concepts which can be applied to land management topics such as the inventory of vegetation coverage, identification of different crops, and the detection of changes due to for example, insect infestation/spraying and the effects of fertilizer application or irrigation over time.

A smaller part of the presentation is devoted to GIS as a 'point-and-click' map-based system with a drill-down capability tool which can be used to manage information of various kinds, e.g. satellite imagery, diagrams, ground truth pictures, spread sheets, word processing documents, trip and scientific reports, etc.

Technical Cooperation Projects

Operational Projects and Technical Officers responsible for implementation

Project Number	Title	Technical Officer
AFG5003	Sustainable increase in crop production in Afghanistan	L. Nguyen/P. Lagoda
ALG5020	Combating desertification	G. Dercon
ALG5021	Optimising irrigation systems and surface water management	L. Heng
ALG5022	Nuclear techniques for sustainable use of saline groundwater and wastelands for plant production	L. Heng
ANG5005	Effect of biofertilizer and inorganic fertilizer uses on the growth and yield of maize and bean in Ferralitic Soils of Huambo	G. Hardarson
BGD5026	Increasing agricultural production in the coastal area through improved crop, water and soil management	Q. Shu /J. Adu-Gyamfi
CHI5048	Integrated watershed management for the sustainability of agricultural lands	I. Ferris/ L. Mabit
CMR5016	Development of N and P fertilizer management for Sustainable Intensification of agricultural production in Cameroon	L. Heng
CPR5015	Assessment of soil erosion and effectiveness of soil conservation	G. Dercon
ECU5022	Efficient use of nitrogen fertilizers in flower production	L. Heng
ECU5024	Improving Productivity of the African Palm through Better Fertilization and Water Management Practices	G. Dercon
ELS8009	Study of sedimentation in the reservoirs of four CEL hydroelectric power stations	T. Vitvar/G. Dercon
ERI5004	Improving crop productivity and combating desertification	P. Lagoda/J. Adu-Gyamfi
GHA5032	Enhancing production and use of cassava	L. Heng
HAI5003	Enhancing crop productivity through the application of isotope nuclear techniques	L. Heng
INS5035	Application of Nuclear Techniques for Screening and Improving Cash Crop Plants in Coastal Saline Lands	Q. Shu/G. Dercon
IVC5029	Improvement of yield in plantain and cassava through the use of legume cover crops	G. Hardarson
KEN5026	Isotope techniques for assessment of water and nitrogen use efficiency in cow-pea/maize intercropping systems	J. Adu-Gyamfi
MAG5014	Use of environmental radioisotopes for the assessment of soil erosion and sedimentation in the province of Antananarivo, Madagascar	L. Mabit
MAG5015	Optimization of phosphate fertilization of Ferralsols (classically deeply weathered red or yellow soils found in humid east Madagascar) in the highlands of Madagascar	G. Dercon
MAR5017	Investigating the N dynamics in the crop-soil system of a multiple cropping system to optimize fertilizer use	L. Nguyen
MLI5021	Sustainable intensification and diversification of sorghum production systems in the southern zone of Mali, Phase I	L. Heng

Project Number	Title	Technical Officer
MLI5022	Assessment of soil erosion and sedimentation in the Niger watershed with the use of radioisotopes, Phase I	L. Mabit
MON5014	Application of Isotopes in soil and plant studies	G. Hardarson
MON5015	Implementation of the fallout radionuclide technique for erosion measurement	G. Dercon
NAM5008	Increasing crop productivity and resource use efficiency in the northern communal areas	L. Heng
NER5012	Improvement of the productivity and sustainability of cowpea with finger millet	G. Dercon/M. Spencer
PHI5031	Assessment of erosion and sedimentation processes for effective formulation of soil conservation and water quality protection measures	G. Dercon
QAT5002	Developing Biosaline Agriculture in Salt-affected Areas in Qatar	P. Lagoda/L. Nguyen
RAS5043	Sustainable land use and management strategies for controlling soil erosion and improving soil and water quality	G. Dercon
RLA5050	Strengthening laboratory capacity to assess the implementation of good agricultural practices in the production of fruit and vegetables in Latin America	I.Ferris/G.Dercon
SAU5003	Improving Fertilization under Saline Conditions for Sustainable Crop Production	P. Lagoda/L. Nguyen
SEN5030	Integrated approach to develop sustainable agriculture in Senegal	G. Dercon/M. Spencer
SEY5002	Nutrient and moisture determination in the soils of seychelles to establish a programme of fertilization and irrigation in the face of limited water supply and low soil fertility	L. Heng
SIL5008	Contribution of nitrogen fixing legumes to soil fertility in rice-based cropping systems	G. Hardarson
SLO5002	Protecting groundwater and soil against pollutants using nuclear techniques	J. Adu-Gyamfi/ I. Ferris
SRL5038	Application of isotopes for soil erosion studies	G. Dercon
SUD5030	Increasing productivity of selected crops using nuclear related techniques	Q. Shu/J. Adu-Gyamfi
TAD5002	Assessment of soil erosion and sedimentation for Land Use	G. Dercon
TUR5024	Improving crop productivity through nuclear and related techniques	L. Nguyen
UGA5029	Developing soil conservation strategies	G. Dercon
YEM5002	Drip Irrigation and Fertigation for Improved Agricultural Productivity	J. Adu-Gyamfi
ZAI5017	Use of isotope techniques in relation with the nitrogen dynamics and the quality of organic plant material in agricultural soil management	G. Dercon
ZIM5011	Combating desertification in agricultural lands	L. Heng

Forthcoming Events

FAO/IAEA Events

Consultants Meeting on Assessing the Impact of Soil and Land Management Practices on the Fate of Agrochemicals and their Residues within Agricultural Ecosystems using Nuclear and Related Techniques

Technical officers: Gerd Dercon and Long Nguyen

The three-day (10 to 12 December) Consultants Meeting (CM) on 'Assessing the impact of soil and land management practices on the fate of agrochemicals and their residues within agricultural ecosystems using nuclear and related techniques' will be held at the Vienna International Centre in Vienna, Austria.

This CM aims at assessing the processes and pathways of agrochemicals (primarily insecticides and herbicides) within agricultural ecosystems and identifying the main issues involved in optimizing the use of agrochemicals through improved soil and land management practices to mitigate the impact of agrochemicals on the quality and thus productive capacity of the soil. In addition, the CM will explore isotopic and nuclear techniques, which can be effectively employed to give more insight into soil-agrochemical processes and to track the fate of agrochemicals within agro-ecosystems.

The proposed CM and a subsequent CRP is in synergy with the CRP that is currently managed by the Food and Environmental (FEP) Subprogramme. This FEP-managed CRP entitled 'Integrated analytical approaches to assess indicators of the effectiveness of pesticides management practices at a catchment scale' aims at establishing quality monitoring schemes for surface water to assess the effectiveness of good agricultural practices (pesticide management) at a catchment scale.

First RCM of the CRP on 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: Lee Heng and Long Nguyen

The first RCM for this CRP will be held at IAEA Headquarters from 15 to 19 December 2008. Participants from nine countries (seven contract holders, two agreement holders and two observers) will attend this meeting. Planning is well under way, for more information about this CRP please refer to the New Coordinated Research Projects section. The purpose of this meeting is to (i) discuss common objectives, (ii) review individual experimental plans of the research and technical contract holders, (iii) examine the overall log frame and work plan of the project, and (iv) develop detailed experimental and sampling protocols for identifying and tracing pathways and sources of water and nutrients.

Non-FAO/IAEA Meetings

- 4th World Congress on Conservation Agriculture, 4 to 7 February 2009, Delhi, India. http://www.icar.org.in/wccagri/index.html or http://www.wccagri.ernet.in/
- 10th International Meeting on Soils with Mediterranean Type of Climate, 22 to 26 June 2009, Beirut, Lebanon. http://www.iuss.org/10IMSMTC%20final%20announcement%20(pdf).pdf
- 16th Nitrogen Workshop, 28 June to 1 July 2009, Turin, Italy. http://www.nitrogenworkshop2009.org/
- 6th International Symposium on Ecosystem Behaviour, 29 June to 3 July 2009, Helsinki, Finland. http://www.environment.fi/syke/biogeomon2009
- 11th International Symposium on Soil and Plant Analysis, 20 to 24 July 2009, Santa Rosa, California. http://www.spcouncil.com/symposium.htm
- 2nd World Congress of Agroforestry, 23 to 28 August 2009, Nairobi, Kenya. http://www.worldagroforestry.org/wca2009/
- 2nd Bishkek Global Mountain Summit (BGMS-2), 1 to 3 October 2009, Bishkek, Kyrgyz Republic. http://bgms.kgportal.com/eng/
- 5th Conference of the Africa Soil Science Society (ASSS) on Soils and New Challenges for Sustainable Development in Africa, 22 to 28 November 2009, Yaoundé, Cameroon. http://www.asssonline.org/ or http://www.asssland.org/

Past Events

Duty Travel

Tajikistan for TC project TAD5002 and the IAEA-UN-Kyrgyzstan-Tajikistan- collaborative project on Sustainable Land Management in the High Pamir and Pamir-Alai Mountains (PALM)

Technical Officer: Gerd Dercon

Mr. Gerd Dercon participated in the inception meeting of the project on Sustainable Land Management in the High Pamir and Pamir-Alai Mountains (PALM) at the invitation of the United Nations University (UNU) and the United Nations Environment Programme (UNEP). The meeting was held in Dushanbe, Tajikistan (14 to 19 June).

This project is an integrated trans-boundary initiative of the governments of Kyrgyzstan and Tajikistan. It aims to address the problems of land degradation and poverty within one of Central Asia's critical mountain regions. State Agencies for Environment Protection and Forestry in the two countries execute the project with financial support from GEF (through its Implementing Agency, the UN Environment Programme, or UNEP) and from other donors. GEF provides $3 million for Phase I of the project (2008–2011) with the co-financing of approximately $6.7 million. The Agency contributes to PALM through TC projects TAD/5/002 (Assessment of Soil Erosion and Sedimentation for Land Use) and TAD2007005 (Development of Soil Conservation Strategies for Improved Soil Health in Tajikistan, 2009-2011) with a total indicative budget of over $0.5 million. PALM Phase II may be considered for another 4 years based on the Phase I results.

PALM's immediate objectives are (i) to address the link between poverty, vulnerability and land degradation at the community level, through the promotion of sustainable land management practices which contribute to improving the livelihoods and economic well-being of inhabitants and (ii) to mitigate the impact of land degradation on the structure and functional integrity of ecosystems by mainstreaming sustainable land management tools and practices from households, communities and local government, both at national and regional levels.

The above objectives will be achieved through a trans-boundary approach to improving the technological, institutional, policy and legislative environment required for enabling mountain communities to take primary responsibility for the sustainable management of their local ecosystem resources.

Mongolia for TC project MON5014

Technical Officer: Gudni Hardarson

Mr. Gudni Hardarson travelled to Ulanbaatar and Darkhan, Mongolia from 4 to 8 August 2008 for the implementation of Technical Cooperation Project (MON5014) on Application of Isotopes in Soil and Plant Studies which was conducted during 2005–2008. The main aim of the visit was to review the progress made on the implementation of the present project. Visits were made to the Ministry of Food and Agriculture and the Mongolian State University of Agriculture, Darkhan.

Mongolia has a land area of 1.56 million km^2, of which approximately only 1% is suitable for cultivation. Most agricultural soils are deficient in nutrients, especially nitrogen and phosphorus, and fertilizer application has significantly increased crop yields under Mongolian conditions. However, despite the potential for increasing yields and farm income by the use of fertilizers, farmers since 1990 for various reasons have not had the resources to make use of fertilizers.

Therefore crop production and in particular wheat production has declined from 800 000t/year in 1990 to a current yield of about 131 000 t/year. This has resulted in the need to import nearly 75% of the wheat requirement for the country. As a result of this difficult situation, the Plant Science Agricultural Research and Training Institute at Darkhan requested the IAEA's assistance in conducting studies which would investigate ways to increase crop production. In 2004 an IAEA TC project was formulated which aimed to measure and enhance biological nitrogen fixation by legumes and to maximize nitrogen fertilizer use efficiency by cereal crops. It was proposed that 15N isotope techniques should be used under Mongolian agricultural conditions.

The project implementation included capacity building, with six fellows being trained at the Soil Science Unit of the Seibersdorf Laboratory and two scientific visits of senior scientists to institutes in Indonesia and Canada. Furthermore the project included four expert missions and infrastructure improvement in the Plant Science Agricultural Research and Training Institute at Darkhan. The project has been successful in building human capacity and infrastructure in Mongolia, as well as collecting data on fertilizer use and biological nitrogen fixation by field crops.

(a)

(b)

Wheat and fababean being grown in experimental plots at the Darkhan Experimental Station for quantification of fertilizer use efficiency (a) and biological (b) nitrogen fixation, respectively.

A two-day round table discussion to mark the culmination of TC project SLO5002, Slovenia

Technical Officer: Joseph Adu-Gyamfi

The purpose of the two-day meeting (29 to 30 July 2008), which was held at the Vienna International Centre (VIC) was to highlight the main achievements of the project, to identify specific technical and project management issues to ensure a successful outcome for the TC project and to develop a roadmap for Slovenia to comply with the EU Water Framework Directive 2000/60/EC. The meeting was attended by the Counterparts from Slovenia, the two Technical Officers (TO) of the project, Mr. Joseph Adu-Gyamfi and Mr. Ian Ferris, the Project Management Officer (PMO) Ms. Marta Ferrari and the Section Head TC Europe (SH-TCEU), Mr. Oscar Acuña.

Highlights of some of the main achievements during the three-year period were:

- The establishment of a national network to monitor good agricultural practices at a catchment scale, focusing on nitrate and pesticide leaching to groundwater.
- Results from the three experimental pilot sites (vegetable, maize and hop growing areas) using soil water monitoring equipment and isotope tracers, indicated that applying mineral fertilizers by fertigation and covering 100% of potential evapotranspiration with irrigation caused the lowest nitrate concentration in soil water on average, thus presenting the lowest risk of groundwater contamination.
- Using soil, water and weather data, models were used to identify the dominant pathways and sources of pesticide contamination and a soil sensitivity map indicating vulnerable areas for pesticide leaching was produced.
- A continuous dialogue with the Ministry of Agriculture, the Ministry of Environment and the Chamber for Agriculture and Forestry to adjust legislation concerning nitrate and pesticide pollution was established.
- In order to enhance the educational component and to effectively exchange the project outputs with farmers and extension officers, project outputs are communicated in special issue supplements to a weekly newspaper (*Farmer's Voice*).
- 'Champion' farmers and other stakeholders who can assist in the future 'scaling up/out' of project outputs were identified and established, and the compilation of guidelines for good agricultural practices relating to fertilisation and irrigation in the local language, financed by the Ministry of Agriculture is in progress.
- The capacity of project counterparts through training in the use of nuclear and related techniques in various fields related to the project objectives was enhanced.

(a) (b)

Monitoring nitrate and other soil pollutants using isotopic techniques in farmer-managed (a) vegetable and (b) maize fields to ensure compliance with the EU Water framework in Sneberje and Moškanjci, Slovenia

Global Forum on Agricultural Research (GFAR), Italy

Technical Officer: Long Nguyen

Long Nguyen attended a one-day Global Forum on Agricultural Research (GFAR)-Platform Meeting (21 July) and a three-day Technical Workshop (22 to 24 July) on Investing in Sustainable Crop Intensification: The Case for Improving Soil Health at the FAO Headquarters in Rome.

The GFAR-Platform Meeting comprised various stakeholders from the Consultative Group on International Agricultural Research Centres (CGIAR), the Non-CGIAR International Agricultural Research Centres (IARCs), National Agricultural Research Systems from North (Northern NARS) and South (Southern NARS), Farmers' Organizations (FOs), Non-Governmental Organizations (NGOs), the Private Sector, and Donors and Development Agencies. The meeting discussed various issues relating to soil health, land productivity and conservation agriculture.

The three-day Technical Workshop (www.fao.org/ag/ca), jointly organized by the Tropical Agricultural Association (TAA-UK) and FAO, brought together approximately 100 participants from 40 countries, representing governments and inter-governmental institutions, the private sector, research organizations, farmers, land holders and NGOs. The Technical Workshop identified land degradation, soil nutrient depletion and water scarcity as the major concerns for sustainable agriculture in many parts of the world. Production systems such as conservation agriculture, which employs minimum tillage (minimum or no cultivation), cover crops, crop residues, diversification of cropping rotations and supplier sufficient nutrients for plant growth can enhance soil organic matter accumulation, stimulate earthworm and soil microbial activity, enhance soil aggregate stability, increase soil water holding capacity and ultimately soil quality and also land productivity, food security and environmental sustainability. On the other hand, practices that degrade soil physical-chemical-microbiological activity such as the use of heavy farm machinery on fragile soil structures, intensive soil cultivation without adequate return of crop residues, inadequate soil fertility amendment (nutrient mining) and inappropriate irrigation management practices can degrade soil health, its productive capacity and farmers' environments.

Some of the key research issues which arose at both the GFAR-Platform Meeting and the Technical Workshop are currently being addressed by the SWMCN Subprogramme. Specifically, the present five-year (2005-2009) CRP (D1.50.09) entitled 'Integrated soil, water and nutrient management in conservation agriculture', provides quantitative data on soil quality, soil nutrient and water availability, soil carbon sequestration, soil organic matter dynamics and greenhouse gas emissions under conservation agriculture. The increasing focus on soil management, as demonstrated by the two events outlined above, will provide opportunities to strengthen joint collaboration between the SWMCN Subprogramme, FAO and other national/international stakeholders in the overall effort to increase land productivity and mitigate land degradation and desertification in Member States.

Bangladesh for TC project BGD5026

Technical Officer: Joseph Adu-Gyamfi

The purpose of this visit (8 to 17 August 2008) was to assess progress in the soil water management component of the project and to discuss and make technical adjustments to the workplan for this TC project on 'Increasing agricultural production in the coastal area through improved crop, water and soil management' Besides the technical consultations with the Project Counterparts which resulted in identifying essential equipment, consumables, and nominations for fellowship training and scientific visits anticipated in 2009, the TO successfully organized a training course on the use of the carbon isotope discrimination technique and other nuclear techniques to select crops for greater water use efficiency in water limited and saline environments.

Soil and water management for increased rice production in the lowland coastal areas in Bangladesh

Soil-water-crop-livestock integration for enhanced food security in Bangladesh

Burkina Faso

Technical Officer: Long Nguyen

The purpose of this visit (11 to 19 October) was to discuss with Burkina Faso scientists, extension workers and FAO counterparts issues concerning land management and cropping rotation which affect fertiliser use efficiency, soil fertility, water use efficiency, water quality and land degradation. Mr. Long Nguyen visited experimental sites where field trials are being conducted to investigate the relative performance of conservation agriculture and conventional agriculture on crop yield. However, limited or no quantitative data has been obtained from these field sites to assess the impacts of soil cultivation practices and crop residue management on soil quality, soil fertility status, soil organic matter content and plant nutrient uptake. Isotopic techniques can help to provide this essential information. The synergy of expertise and resources between the SWMCN Subprogramme and FAO can provide a comprehensive solution and information on integrated soil-water-plant management practices which ensure sustainble agriculture in Burkina Faso and other parts of Western Africa, where soil nutrient mining and land degradation are currently the major issues.

China for TC project RAS5043

Technical Expert: Long Nguyen

This Regional Project entitled 'Sustainable Land use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality' has reached its final implementation stage and the final meeting will be held in mid-January 2009. The purpose of this travel (25 to 27 October) was to discuss the evaluation of soil quality in eroded landscapes and the use of isotopic and related techniques to measure soil carbon sequestration and soil moisture with Mr. Yong Li, a coordinator of this Regional Project. Administrative issues relating to a particular scientific visit, the organization of the January 2009 meeting, the production of a brochure of key project outcomes and the use of an expert to assist with the brochure production were discussed. Information has been conveyed to the Technical Officer, Mr. Gerd Dercon for subsequent implementation.

Sudan for TC project SUD5030

Technical Officer: Joseph Adu-Gyamfi

The purpose of this travel (22 to 29 November 2008) was to review the technical progress and to assist in preparing a supplementary workplan, including the Agency's inputs for 2008–2009. The TO paid a courtesy call to the Sudan Atomic Energy Commission, the UNDP and FAO Offices and travelled to the project sites, where experiments to evaluate crop plants with greater nitrogen and water use efficiency are being carried out. He also organized a training course on the use of N-15 and C-13 to select crops for greater water and nitrogen use efficiency in water and nitrogen limited environments.

FAO/IAEA Events

Asia-Pacific Regional Workshop on Improving Crop Water Productivity and Enhancing Plant Transpiration through the use of AquaCrop Modelling and Isotopic and Related Techniques, Beijing, China, 20 to 24 October

Technical Officers: Long Nguyen and Lee Heng

This Regional Workshop was organized jointly by the Institute of Environment and Sustainable Development in Agriculture (IEDA) of the Chinese Academy of Agricultural Sciences (CAAS) and the SWMCN Section of the Joint FAO/IAEA Division. Participants from China, Indonesia, Vietnam, India and external experts from the USA attended the Workshop. Isotopic and non-isotopic techniques for (i) improving crop water productivity and water use efficiency and (ii) determining

crop transpiration and soil evaporation were discussed. In addition, potential field sites and instruments required for providing soil and plant water data to support the CRP (D1. 20.09) on Managing Irrigation Water to Enhance Crop Productivity under Water-Limiting Conditions: a Role for Isotopic Techniques (Please see Status of Coordinated Research Projects section) were also discussed for subsequent implementation at the second RCM which is planned for June–July 2009.

A field visit to the Hengshui Experimental Station also provided an opportunity for all participants from China, India, Indonesia and Vietnam to view the field experimental sites and soil/plant/water sampling to determine evaporation and transpiration.

Participants at IEDA-IAEA Regional Workshop

Fourth RCM of the CRP on Selection for Greater Agronomic Water Use Efficiency in Wheat and Rice (D1.20.08)

Technical Officer: Lee Heng

The fourth and final RCM of this CRP was held from 3 to 7 November 2008 at IAEA Headquarters in Vienna. Thirteen participants including nine contract holders, two technical contractors, and one agreement holder attended this RCM. See Status of Coordinated Research Projects (CRPs) section for more detailed information on this CRP.

Participants at the final RCM

Non FAO/IAEA Events

EUROSOIL 2008, Soil-Society-Environment, 25 to 29 August 2008, University of Technology, Vienna, Austria

Gerd Dercon, Lionel Mabit and Peggy Macaigne

The 3rd International EUROSOIL Congress (http://www.ecsss.net/web/frontend/view.php) was organized in Vienna (Austria) by the National Soil Science Societies of Austria, Croatia, the Czech Republic, Hungary, Slovakia, Slovenia and Switzerland, under the umbrella of the European Confederation of Soil Science Societies (ECSSS). Approximately 1500 participants from 70 countries attended the Congress.

Three staff members of the SWMCN Subprogramme contributed papers to the Congress (please see the Publications section in this Soils Newsletter). The papers are related to findings and activities on soil erosion and agricultural water and nutrient use efficiencies.

5th International Conference on Land Degradation (5th ICLD), Bari, Italy, 18 to 22 September

Technical Officers: Gerd Dercon and Lionel Mabit

The 5th International Conference on Land Degradation entitled 'Moving ahead from assessments to actions: Could we win the struggle with land degradation?" was held in Bari, Italy. The conference was organized by the Mediterranean Agronomic Institute, which belongs to the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM), in collaboration with the International Union of Soil Sciences (IUSS), the Institute for Environment and Sustainability of the Joint Research Centre (European Commission) and the Italian Society of Soil Science (ISSS).

This conference is a major scientific event for the Research & Development community working on land degradation and conservation (http://www.iamb.it/5ICLD). The conference was attended by about 100 participants from 37 countries.

Mr. Gerd Dercon presented a collective keynote paper, entitled *Zero-tolerance on land degradation for sustainable intensification of agricultural production* co-authored by Mr. Long Nguyen (SWMCN, Section Head) and Mr. Felipe Zapata (SWMCN, Consultant). This paper reported on the application of isotopic and nuclear techniques to unravel processes and factors that affect land degradation including soil erosion and the decline in soil quality and their constituents (such as water and soil organic carbon), with its subsequent reduction in crop production. Projects associated with improving soil health and enhancing water use efficiency were also briefly presented and discussed.

Mr. Lionel Mabit presented an oral paper entitled *Test of ^{137}Cs and $^{210}Pb_{Ex}$ to assess erosion and sedimentation*

process: A case study in Austria, co-authored by Mr. Andreas Klik (University of Natural Resources and Applied Life Sciences, Vienna, Austria). The presentation also included an overview of the potential use of fallout radionuclides (FRNs) versus conventional methods to assess erosion.

On behalf of Mr. Yong Li (Institute of Agro-Environment and Sustainable Development, Chinese Academy for Agricultural Sciences), Mr. Long Nguyen (SWMCN, Section Head), Mr. Gerd Dercon and Mr. Lionel Mabit presented a poster paper on *Effectiveness of soil conservation measures in reducing soil erosion and improving soil quality in China, assessed by using fallout radionuclides* at the poster session.

Workshop group photo taken outside Soil Science Department, University of Tehran

Workshop on Use of Nuclear Techniques in Soil Science, Karaj, Islamic Republic of Iran, 7 to 9 October

Technical Officer: Lee Heng

The Workshop on Use of Nuclear Technology in Soil Science was jointly organized by the Nuclear Agricultural Research Group of Nuclear Science & Technology Research Institute (NSTRI) of the Atomic Energy Organization of Iran and the Soil Science Department of the University of Tehran at Karaj, Islamic Republic of Iran from 7 to 9 October. The workshop brought together over 30 post-graduate students and staff of the NSTRI and the Tehran University. Ms. Lee Heng participated in the Workshop and delivered the three following invited lectures (1) The role of IAEA in using nuclear and related techniques in soil and water management, (2) Use of nuclear techniques in agricultural water management, and (3) Nuclear and related techniques for soil moisture monitoring and crop water requirement.

The Workshop highlighted the interest of the Iranian scientific community in strengthening its research capabilities in the use of nuclear techniques to address land and water management issues for food security and the farmers' environment.

Visitors

The following scientists visited the Soil and Water Management & Crop Nutrition Section to explore the potential collaboration with the SWMCN Subprogramme in the use of isotopic and nuclear techniques to assess land degradation, land desertification, crop water productivity and nutrient and water use efficiency:

1. Prof. Georg Cadisch and Dr. Frank Rasche from the University of Hohenheim, Stuttgart, Germany (27 August): The expertise and working experience of Prof. Cadisch and his team in developing countries will be highly useful for the forthcoming CRP D1.20.11 (See New Coordinated Research Project).
2. Dr. Roland Poss, President of the French Soil Science Society (28 August): Dr. Poss has been involved in research relating to nutrient cycling, rehabilitation of degraded soils, soil acidification and agricultural water management in many countries such as the Côte d'Ivoire, Togo, Australia and Thailand. His experience and wide contacts with various French institutions working in developing countries (e.g. INRA, CNRS, CIRAD and IRD) will be valuable for the activities of the Soils subprogamme.
3. Drs. Emmanuel Frossard, Simone Nanzer and Astrid Oberson from the Group of Plant Nutrition, Institute of Plant Sciences, Swiss Federal Institute of Technology (ETH) Zurich, Switzerland) (29 August) are internationally-recognized for their expertise in soil phosphorus dynamics and plant nutrition. This is highly relevant to the activities of the Soils Subprogramme.

New Coordinated Research Projects (CRPs)

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

Technical Officers: Long Nguyen and Gerd Dercon

This CRP was approved in late October 2008. Scientists who are currently working in the area of soil erosion and land degradation using either fallout radionuclides (FRN) and/or compound specific stable isotopes (CSSI) to quantify soil erosion-deposition and identify critically-sourced areas of land degradation/eroded soils, are invited to participate in this new CRP.

Proposal forms for submitting as research contracts or agreements can de downloaded from the IAEA website at http://www-crp.iaea.org/html/forms.html. These forms must be countersigned by the Head of the institution and then submitted to the Head, Research Contracts Administration Section by post or by email (Official.Mail@iaea.org; Research.Contracts@iaea.org). Forms can be sent as attached file in both Word Document and pdf file.

The following information will help you to formulate your project proposal that will address the objectives of the CRP. If you have queries, please contact Mr. Long Nguyen at m.nguyen@iaea.org.

The main objective of the CRP is to develop integrated isotopic approaches to identify hot spot areas of land degradation in agricultural catchments for effective soil conservation measures (precision conservation). Specific research objectives are (i) to develop the combined use of FRN technique with conventional techniques and spatial analysis to establish soil redistribution patterns and rates over several temporal scales on an area-wide basis (catchment), (ii) to develop and validate protocols for the application of compound specific stable isotope (CSSI) techniques to identify and apportion the amount of source soils (land-degraded areas) from main land uses/management (cropland, grassland and forestland) in the catchment, (iii) to 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) to create the basis to develop decision support tools for implementing precision conservation and contributing to sustainable land management.

Some of the expected outputs from this CRP include:

1. Field validated use of FRN for establishing soil redistribution patterns and rates over several temporal scales on an area-wide basis (catchment).
2. Harmonized protocols for the application of CSSI techniques at the catchment scale in a range of environments and land use systems.
3. Modelling and other approaches for the integrated application of FRN and CSSI techniques to establish comprehensive soil redistribution studies in the catchment, including the identification of soil sources and hot spots diffuse pollution areas.
4. Better understanding of the land use/management impacts on soil redistribution and the location of hot spots diffuse pollution areas on an area-wide scale.
5. Enhanced capacity in Member States to conduct applied research on comprehensive soil redistribution studies with the aid of nuclear and related techniques.

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

Technical Officers: Lee Heng and Long Nguyen

This CRP was approved in August 2008 and its first RCM will be held at IAEA Headquarters in Vienna from 15 to 19 December 2008. There are seven contract holders (China, Estonia, Islamic Republic of Iran, Lesotho, Nigeria, Romania and Uganda) and two agreement holders (UK and USA). The objective of the CRP is to assess and enhance ecosystem services provided by wetlands, ponds and riparian zones for improving water storage and quality in agricultural catchments. Specific research objectives are (i) to determine the capacity of wetlands, ponds and riparian zones for water storage, (ii) to assess nutrient/pollutant attenuation capacity of wetlands, ponds and riparian zones, (iii) to better understand the link between water and nutrient dynamics in wetlands, ponds and riparian zones and biomass production, and (iv) to optimize the system of wetlands, ponds and riparian zones for improved water storage andquality in agricultural catchments.

Some of the expected outputs from this CRP include:

1. Available conceptual model of water flow paths for study sites.
2. Validation of water sources and flow paths in study sites by using isotopic techniques - and water level studies.
3. Water budget and water storage capacity of wetlands, riparian zones and ponds.
4. Identification of inputs and outputs of wetlands and ponds, and changes in concentration of contaminants across riparian zones and nutrient/pollutant mass balances.

5. An understanding of the critical internal biogeochemical processes in soil and water.
6. A range of best management options for maximizing water storage and improving water quality.
7. Guidelines for optimizing water conservation and attenuation capacity and internal structure of wetlands, ponds and riparian zones, and biomass production.
8. Research findings communicated to the wider scientific community for further transfer to farmers and stakeholders.

Status of Coordinated Research Projects (CRPs)

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

Technical Officer: Lee Heng

The fourth and final RCM of this CRP was held from 3 to 7 November 2008 at IAEA Headquarters in Vienna. Nine contract holders: M. Hafsi (Algeria), M. Mirza Islam (Bangladesh), X. Xu and J. Huang (China), S.C. Misra (India), M. Jlibene (Morocco), J. Akhter (Pakistan), A. Wahbi (Syrian Arab Republic), A. Al Hakimi (Yemen); two technical contractors: A. Condon (CSIRO-Australia), A. Ismail (IRRI-Philippines), and one agreement holder: P. Monneveux (GCP, CIMMYT-Mexico) attended this RCM. The objectives of that meeting were to (i) present and discuss results of work carried out in the entire course of the CRP, (ii) evaluate achievements of the project in accordance with project objectives and expected outputs and (iii) review manuscripts prepared for the production of IAEA's TECDOC publication.

Research conducted in the CRP has resulted in several significant achievements in both the wheat and rice studies. In the wheat post-anthesis drought stress environments, the CRP confirmed the hypothesis that selection for high grain-carbon isotope discrimination (CID) would give a grain yield advantage. For the pre-anthesis drought stress environments, the hypothesis for selection for low leaf CID which would give a grain yield advantage was refuted as this was not observed by the project participants (Pakistan, Yemen, India and NW China). When grain CID was measured, positive correlations were observed in the pre-anthesis drought stress environments with high air temperature during grain filling. A good correlation between grain ash and grain CID was observed, suggesting that grain ash can be used as a surrogate for CID.

In the rice saline environment, the CRP confirmed the hypothesis that selection for high CID would be positively associated with a greater tolerance to salinity. In the irrigated non-saline rice environments, the hypothesis tested here was that selection for high CID would be positively associated with greater yield in non-saline, irrigated conditions. For inbred rice, this hypothesis was not, as there was no correlation between CID and yield. However, for hybrids, preliminary data indicates a negative correlation between leaf CID and grain yield.

Some important outcomes of the CRP are outlined below:

1. In India, the counterpart received substantial government funding to promote the use of CID technology. These funds will allow purchase of an isotope-ratio mass spectrometer dedicated to use in wheat breeding and the appointment of an associated scientist.
2. In Pakistan, new high-yielding wheat varieties identified under the CRP have entered the national wide-scale testing program for potential release.
3. A large number of publications (peer-reviewed journals) have been produced from this project.

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

Technical Officer: Gerd Dercon

The fourth and final research coordination meeting (RCM) of this CRP was held in Vienna, Austria, in October 2007 with Felipe Zapata acting as scientific secretary. Current efforts are focused on finalizing the manuscripts for the production of an IAEA-TECDOC.

The overall objective of this CRP was to develop diagnostic tools for assessing soil erosion and sedimentation processes and effective soil conservation measures for sustainable watershed management. In this context, the participants developed fallout radionuclide methodologies with particular emphasis on the combined use of ^{137}Cs, $^{210}Pb_{exc}$ and ^{7}Be for measuring soil erosion and sedimentation over several spatial and temporal scales.

A wealth of valuable information on soil redistribution and effectiveness of soil conservation has been generated by the CRP in a wide range of environments. In total 143 scientific papers (peer-reviewed journals) were published by the CRP participants.

Eleven contract holders from Brazil, Chile, China (two), Morocco, Pakistan, Poland, Romania, the Russian Federation, Turkey and Vietnam, two technical contractors (Austria and the UK) and five agreement

holders (Australia, Canada, Japan, Switzerland and USA) participated in this CRP.

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

Technical Officer: Gerd Dercon

The overall objective of this CRP is to enhance the productivity and sustainability of farming systems through a better understanding of the principles and practice of conservation agriculture. This CRP has a total of ten participants comprising seven research contractors from Argentina, Brazil, India, Morocco, Pakistan, Turkey and Uzbekistan, two technical contractors (Australia and Chile) and one agreement holder (CIMMYT-Mexico). In addition one individual contractor (Mr. Bernard Vanlauwe) conducts research on the evaluation of carbon (C) and nitrogen (N) dynamics in long term trials in Sub-Saharan Africa focussing on tillage, residue management and crop rotational effects.

The CRP started in June 2005 with the third RCM being held in Ankara (Turkey) in April 2008.

The CRP is now entering its final phase with an established database on soil-water-plant interrelationships in conservation agriculture. This database will be expanded within the coming 12 months of the CRP and will provide valuable information on the impact of conservation agriculture on soil organic matter, resource use efficiency, agricultural productivity and environmental quality. The fourth and final RCM is scheduled to be held in October 2009 at the IAEA headquarters in Vienna.

Congratulations to Dr. Milkha Aulakh, one of the research contract holders in this CRP for being elected to the position of Chairperson of Commission/Division 4.1 'Soil and the Environment' in the International Union of Soil Science, a global professional organization.

Selection and Evaluation of Food (Cereal and Legume) Crop Genotypes Tolerant to Low Nitrogen and Phosphorus Soils Through the Use of Isotopic and Nuclear-related Techniques (D1.50.10)

Technical Officers: Joseph Adu-Gyamfi and Gerd Dercon

The mid term review of this CRP was completed during the third quarter of 2008 after a second RCM in Morelia, Mexico from 21 to 25 April 2008. The review critically assessed progress achieved in line with the specific objectives of the CRP, identified gaps and made suggestions for the improvement of work plans.
The overall assessment indicated that most of the participants made progress during the first two years of the CRP in the area of evaluating rice, maize, common beans, cowpeas and soybean genotypes in the laboratory, greenhouse and field to identify root traits conferring P and N acquisition. The CRP has promoted the exchange of germplasm amongst the project partners and Member States (MS). With participants from 17 countries (Australia, Benin, Burkina Faso, Brazil, Cameroon, China, Cuba, France, Germany, Ghana, Kenya, Malaysia, Mexico, Mozambique, Nigeria, Sierra Leone and USA) covering a wide range of agro-ecological zones and farming systems where low and declining soil fertility constrains crop yields, the networked research and results obtained so far is of global relevance.

Technical adjustments to each individual workplan to help achieve the overall objective of the CRP included:

- Examination of nutrient acquisition by crop genotypes from different soil N and P pools as a criterion for the adaptation of crops to low N and P soils. Protocols for determining soil P pools (Fe-P, Ca-P and Al-P) using non-labelled and labelled phosphorus (32-P) will be used by project participants from China, Brazil, Cuba and Malaysia.
- Ensuring that all field studies include soil sampling at planting, anthesis and maturity to investigate the correlation between the agronomic (root characteristics and yield) component and soil nutrient status (total and available soil N and P) at different crop growth stages.
- Establishing the need for to standardize (i) experimental protocols to determine soil N and P pools, (ii) terminologies (N and P efficiencies) used, (iii) measurement units and (iv) the collection of quantitative data.

The third RCM is proposed for the first quarter of 2010 and will be held in either Mozambique or Austria.

Managing Irrigation Water to Enhance Crop Productivity under Water-Limiting Conditions: a Role for Isotopic Techniques (D1.20.09)

Technical Officers: Long Nguyen and Lee Heng

This CRP is now in its second year of implementation and the second RCM will be held in Beijing in June-July 2009. The evaluation of all the contract renewals has been completed and contract awards have been announced. Discussions are being held with our Chinese counterparts to finalize the field site which will be used as an experimental plot where all technologies relating to isotopic and related techniques will be deployed to enhance crop water productivity and water use efficiency. Thirteen participants consisting of nine research contractors (Burkina Faso, China (2), Malawi, Morocco, Pakistan, Turkey, Vietnam and Zambia), two technical contractors (USA) and two agreement holders (Austria and Spain), will attend the meeting.

Laboratory Activities

Crop water productivity and soil water isotopic signature

Peggy Macaigne, José Luis Arrillaga, Leopold Mayr and Norbert Jagoditsch

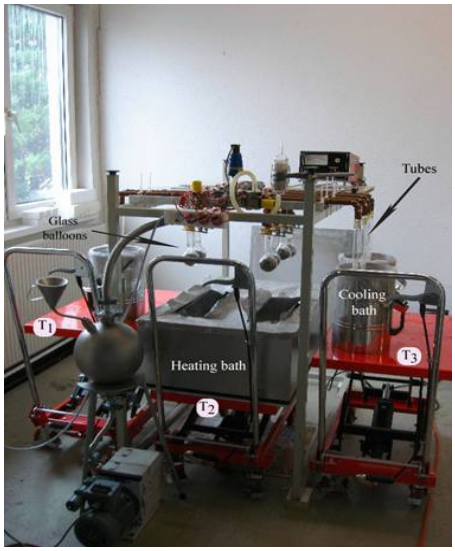
A pot experiment with the following three treatments has been conduced in a glasshouse at Seibersdorf (Picture 1): (i) cropped pots with maize and soil water at field capacity, (ii) cropped pots with maize and soil water below field capacity and (iii) bare pots and soil water below field capacity.

The aim of this study is to investigate the relationship between water stable isotopic signatures in soil and those in different plant parts as influenced by soil moisture conditions.

This relationship will help our understanding of soil-plant-water interactions in order to enhance crop water productivity and water use efficiency.

Plant and soil samples have been taken at four stages of plant growth: (i) early stage, (ii) mid season, (iii) male flower stage and (iv) corn cob maturity stage. These samples (192 soil and 128 plant samples) will be extracted for water using a modified cryodistillation line and the extracted water will then be analysed for ^{18}O analyses. To extract water from these soil and plant samples for ^{18}O analyses, a modified cryodistillation line has been built and used (Picture 2). The purpose of the cryodistillation line, which is a well-known technique, is to extract water from plant and soil while preserving its ^{18}O and ^{2}H isotopic signature and avoiding any contamination with air humidity before spectrometer analysis. For this reason, distillation is performed in a close system under vacuum conditions.

Picture 1. Pot experiment, 12 weeks after planting (18 July 2008)



Picture 2. Cryodistillation line developed to process eight samples at the same time

Preliminary investigation using nuclear techniques to assess soil erosion in Slovenia

Lionel Mabit, Vesna Zupanc[(1)], Paul Martin (Physics, Chemistry and Instrumentation Laboratory, IAEA Laboratories Seibersdorf) and Arsenio Toloza

[(1)] *Centre for Agricultural Land Management and Agrohydrology, Department of Agronomy Biotechnical Faculty, University of Ljubljana, Slovenia) / Previous fellow with the Soil Science Unit*

Soil erosion in Slovenia has been studied since the mid 1950's but there is little quantitative data available. A review of literature (Mikoš 1996; Komac and Zorn 2005, 2007) indicates that soil erosion investigations have mostly been conducted using field observations and the following conventional tools:

1. Rainfall erosivity assessment;
2. Field measurement of visible erosion features and morphometric measurements;
3. Runoff erosion plots with and without rainfall simulation;
4. Erosion risk assessment using surface morphology combining GIS, DEM and radar photos;

5. Sediment loading measurements;
6. Empirical sediment transport models;
7. Satellite remote sensing approach in combination with other data to assess erosion and sedimentation processes.

The use of nuclear techniques especially Fallout Radionuclides (e.g. ^{137}Cs) can complement the information provided by the above approaches. To obtain quantitative estimates of soil erosion and deposition rates from radionuclide measurements, the first important step is to determine the baseline value of the area under investigation to which the ^{137}Cs contents in different parts of the agricultural fields will be compared.

This article presents the evaluation of the reference inventory of ^{137}Cs in an undisturbed Slovenian forest chosen as the reference site.

Description of the study site

The study site is located in Pomurje – the sole Slovenian macroregion in which agricultural landscape still prevails (Hladnik, 2005) – in Goričko, a hilly area close to the Hungarian and Austrian borders at the beginning of the Pannonian plains, East Slovenia (Figure 1). An undisturbed forest situated in Šalamenci (46°44'N, 16°7'E) was selected as reference site. This forest covers approximately 1.9 ha with a flat topography (slope < 2%) at an average elevation level of 242 meters.

Figure 1 and Picture 1. Location and aerial photography of the forested studied site and adjacent agricultural fields near Šalamenci in East Slovenia

Soil sampling, γ-laboratory measurements and preliminary results

In the forest, a homogenous area of 1200 m^2 was selected with reduced canopy and roots occurrence. This area was sampled using a 'Systematic grid sampling' on the basis of a rectangular grid (40 × 30 meters). The origin and direction for placement of the grid was selected by using an initial random point located within the forest. Soil samples were collected at each intersection of the grid lines ('grid nodes') using bulk density cylinder. A total of 20 sampling points have been collected at 4 different depth increments (0-10 cm, 10-20 cm, 20-30, 30-40 cm) for a total of 80 samples. Soil samples were oven-dried at 70°C for 48 hours, sieved through a 2mm mesh and homogenized. The fine material was analysed for ^{137}Cs activity content by γ-spectrometry using the gamma detector of the Soil Science Unit (relative efficiency of 115% at 1.33 MeV) calibrated with a sealed radioactive source FG 607 from Amersham. Each soil sample for ^{137}Cs determination was counted for a period of 50 000s to reach an acceptable detection limit. Table 1 summarizes the ^{137}Cs minimum detectable activity and error measurement per each soil depth increment.

Table 1. ^{137}Cs Minimum Detectable Activity (MDA) and error measurement per soil increment

Soil increments (in cm)	MDA (in Bq)	Error measurement at 2 σ (in %)
0-10	0.26	2.6 ± 1.2*
10-20	0.16	6.5 ± 3.3*
20-30	0.13	26 ± 14*
30-40	0.13	46 ± 24*

* ± *Standard Deviation (SD)*

A high level of ^{137}Cs was detected in the first 0-10 cm soil increment while the activity of the ^{137}Cs measured in 20-30 cm layer and particularly the 30-40 cm layer was close to or under the detection limit of the detector (Tables 1 and 2). This ^{137}Cs distribution is typical of an undisturbed soil with 84% of the total soil profile ^{137}Cs inventory in the 0–10 cm increment (Table 2).

With a maximum areal activity of 11302 Bq m^{-2} and a maximum mass activity of 147 Bq kg^{-1} in the first 10 cm (Table 2), the values are very high in comwhen compared with our previous investigation in Mistelbach, Austria where the base line level of caesium was 1954 Bq m^{-2}. This is attributed to an additional Chernobyl contribution. The residual activity from the historic ^{137}Cs fallout at the Šalamenci site reached 7315 ± 1255 Bq m^{-2} (mean ±95% confidence interval) with a coefficient of variation (CV) of 34%, which is within the reported CV range (19–47%) for forested reference sites.

This estimated ^{137}Cs base level will be used in future investigations in Slovenia to assess the soil redistribution in neighbouring agricultural fields, including sedimentation and erosion rates.

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Table 2. ^{137}Cs summary statistics per soil depth increments (number of samples per depth increment = 20)

	Depth interval 0-10 cm			Depth interval 10-20 cm			Depth interval 20-30 cm			Depth interval 30-40 cm		
	Bulk density	^{137}Cs content		Bulk density	^{137}Cs content		Bulk density	^{137}Cs content		Bulk density	^{137}Cs content	
	(kg m^{-3})	(Bq kg^{-1})	(Bq m^{-2})	(kg m^{-3})	(Bq kg^{-1})	(Bq m^{-2})	(kg m^{-3})	(Bq kg^{-1})	(Bq m^{-2})	(kg m^{-3})	(Bq kg^{-1})	(Bq m^{-2})
Mean	943	70.1	6127	1354	7.6	971.8	1436	1.0	145	1500	0.47	70.4
Standard Error	39	7.8	592	32	1.49	169.6	9.16	0.18	25.8	6.38	0.06	9.39
Median	941	61.5	5397	1348	5.80	754.3	1432	0.75	105	1498	0.37	55
SD	176	33	2514	143	6.3	719	41	0.78	109.68	28.5	0.27	39.85
SV	31101	1092	6.3E+06	20666	40.1	5.1E+05	1681	0.6	12030	814	0.1	1587
Kurtosis	0.9	0.2	-0.5	3.9	3.3	2.8	1.2	4.7	4.9	0.9	-0.16	-0.47
Skewness	0.1	0.7	0.5	0.6	2.0	1.9	0.5	2.0	2.0	-0.6	0.9	0.8
Minimum	557	22	2230	1050	2.6	369	1353	0.3	41	1426	0.1	20
Maximum	1352	147.5	11302	1776	24.7	2863	1539	3.4	489	1550	1.1	156
CV (in%)	18	47	41	11	84	74	3	76	75	2	58	56

SD = Standard Deviation; SV = Sample Variance; CV = Coefficient of Variation

Can efficient irrigation and nitrogen management practices contribute to nitrate reduction in groundwater under intensive farmer-managed vegetable fields in Slovenia Catchments?

Vesna Zupanc, Marina Pintar, Peter Korpar (Agronomy Department, Biotechnical Faculty, University of Ljubljana, Slovenia) and Joseph Adu-Gyamfi

The Challenge

Groundwater is a very important source of drinking water in Slovenia. However, the intensification of agriculture through the use of nitrogen (N) fertilizers and organic manure from livestock (pig farms) to enhance crop yields may be one of the causes of groundwater contamination through nitrate leaching. It is predicted that intensive vegetable production is the major cause of nitrate contamination in the Ljubljana aquifer which is the major source of drinking water in Ljubljana, Slovenia.

The Project

Slovenia aims to meet the EU Water Framework Directive (2000/60/EC) and national standards for good quality groundwater status by 2013 while maintaining an intensive agriculture production. A Technical Cooperation Project (TCP) SLO5002 was funded by IAEA to help improve the capabilities of the Slovenia Counterpart institutes to address nitrate (and also) pesticides in drinking water by establishing a monitoring system for soil water balance, and for pesticide and nitrate leaching from agricultural benchmark sites in Slovenia catchments. The objective of the study is to assess how different irrigation, nitrogen and cropping system management strategies could help reduce nitrate leaching while sustaining yields in a farmer-managed vegetable field using farmers' (one time fertilizer application before planting and irrigating shortly after planting) and improved practices (scheduled irrigation and fertilization) in a benchmark site in Sneberje, Slovenia. The project also aims to transfer knowledge to the stakeholders.

Nitrogen-15 fertilizer was used as a tracer to monitor N acquisition by plants and nitrate movement in the soil. Soil water was monitored using 2 capacitance probes (EnviroScan and the Time Domain Reflectometer). The IAEA provided experts, training, equipment, stable and radioactive tracers and consumables and the Government of Slovenia executed the Project.

Main findings

Preliminary results have shown that applying mineral fertilizers by fertigation and covering 100% of potential evapotranspiration with irrigation caused on average the lowest nitrate concentration in soil water, thus presenting the lowest risk of groundwater contamination. Nitrate concentrations in soil water monitored by suction cups were highest under the farmer's practice method in September–October 2006, following the crop rotation of iceberg lettuce in June and endive in August– September. Nitrate concentration in 50% irrigation plots was lower than that under the farmer's practice method but higher than under 100% irrigation and values ranged from 10 and 90 mg L^{-1}.

Both EnviroScan and the Time Domain Reflectometer were proved to be effective tools for monitoring soil pollutants (nitrate), although soil moisture data obtained using the TDR was more strongly correlated with values from gravimetric measurements than that of the EnvioScan. A methodology for nitrate leaching modelling on a catchment scale was established, and minimum input data sets (i.e. soil, water, weather data) for modelling of nitrate leaching were produced.

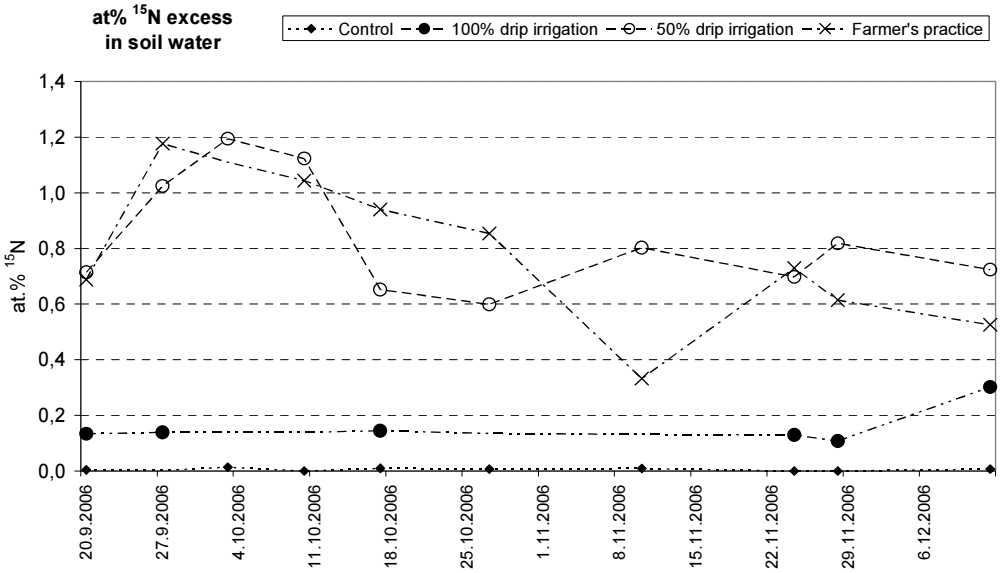

Figure 1 15N (at.% excess) in soil water collected with suction cups at 50 cm depth in 2006. Control (farmers' irrigation practices with no fertilization), Farmers' practice (farmers' irrigation practices with fertilization of 80 kg N, 50 kg P and 120 kg K ha^{-1} all applied at planting), 100% drip irrigation (100% water requirements + 50 kg P and 120 kg K ha^{-1} applied at planting but 80 kg N applied in 3 splits) and 50% drip irrigation (50% water requirements + 80 kg N, 50 kg P and 120 kg K ha^{-1} all applied at planting).

Fellows

Name	Country	Area of Training	Period
Ms Vesna Zupanc (SLO07019)	Slovenia	Water balance calculations and simulation of water flow related leaching, and data analyses and interpretation of soil water measurements from Snerberje experimental plot in Slovenia (part of the TC project SLO5002)	28 July to 27 September
Mr Negusse Abraha Russom (ERI08007)	Eritrea	Use of carbon isotope discrimination techniques to evaluate putative mutants of sorghum and millet at vary soil moisture and phosphorus availability. The training is jointly hosted by the Soil Science and the Plant Breeding Units (ERI5002)	11 August to 10 December
Mr Yueksel Mert (TUR08007)	Turkey	Stable isotope analyses by mass spectrometry and maintenance of mass spectrometer (RER0016)	6 October to 5 November

Scientific Visits

Name	Country	Area of Training	Period
Mr. Severin Arnoux (HAI08001V)	Haiti	Use of nuclear techniques in crop nutrition and water management (HAI5003)	13 to 17 October
Mr. Jean Jeune Pierre Karly (HAI08003V)	Haiti	Isotopic techniques in soil water, plant nutrition and soil fertility and erosion control (HAI5003)	1 to 5 December
Mr. Donald Joseph (HAI08004V)	Haiti	Isotopic techniques in plant nutrition, soil fertility, soil water management and erosion. (HAI5003)	1 to 5 December

Analytical services, January to October 2008

The Soil Science Unit provides stable isotope analyses for CRPs, TCPs, and for FAO/IAEA regular research and training activities. The following table is a summary of the analytical work provided during the period January through October 2008.

Samples measured:

	^{15}N *enriched*	^{15}N *nat. ab.*	^{13}C *nat. ab.*	^{18}O *nat. ab.*	*Total*
D1-2008	0	0	1420	0	1420
D1-5009	279	0	449	0	728
TC	66	0	00	0	66
Seibersdorf	686	783	1151	476	3096
Total	**1031**	**783**	**3020**	**476**	**5310**

Measurements carried out:

	^{15}N enriched	^{15}N nat. ab.	^{13}C nat. ab.	^{18}O nat. ab.	Total
D1-2008	0	0	2221	0	2221
D1-5009	471	0	763	0	1234
TC	112	0	0	0	112
Seibersdorf	1180	2098	2638	791	6711
Total	**1767**	**2098**	**5622**	**791**	**10278**

External Quality Assurance - Activities in 2008

Martina Aigner

The FAO/IAEA the Soil Science Unit has established a new collaboration with the University of Wageningen, The Netherlands, to organize regular Proficiency Tests (PT) on ^{15}N and ^{13}C in plant materials at the natural abundance level. The University has conducted this PT for several years (see PT-scheme *IPE* on their homepage, http://www.wepal.nl/website/about_wepal/Scope.htm).

The Wageningen Evaluating Programs for Analytical Laboratories organization (WEPAL) has been accredited for the organization of Interlaboratory Studies by the Dutch Accreditation Council RvA since 26 April 2000. The accreditation is based on the ILAC-requirements (Guidelines for the requirements for the competence of providers of proficiency testing schemes, ILAC-G13:2000). Accreditation covers the quality system of the organisation as well as all the parameters mentioned in the scope

It was agreed between the Soil Science Unit and the PT-organizer to include one ^{15}N-enriched plant material (range: 0.1 – 2.5% ^{15}N atom excess) per year into the IPE test sample set.

A bulk amount of uniformly ^{15}N-enriched plant material was produced by the FAO/IAEA Soil Science Unit and sent to WEPAL for milling, homogenization and bottling through the routine test sample production process for PTs. In February 2008 all participants in PTs previously organized by the Soil Science Unit were invited to participate in the WEPAL IPE programme. Participants were invited to conduct analyses of any determinants offered in the WEPAL IPE scheme including ^{15}N (enriched and/or natural abundance level), total N, Kjeldahl-N, ^{13}C and total C. The participation fee for one round of PT in 2008 (round IPE2008.2) was covered by the IAEA. 24 participants registered in the 'SSU PT scheme' in previous years were provided with the WEPAL test sample set IPE 2008.2 consisting of four test samples of 20g plant material each, one of which was ^{15}N-enriched, the other three were at the natural abundance level. Twelve laboratories reported results within the deadline. The Soil Science Unit also participated in this round of PT. All participants received the quarterly evaluation report 2008.2 (April–June 2008). For information, see http://www.wepal.nl/website/products/QuaterlyReport.htm.

The Soil Science Unit plans to produce a more detailed internal report with summary graphs for all IAEA-participants in the first quarter of 2009. For judgment of the participant's performance in ^{15}N- and ^{13}C atom abundance analysis the results will be compared with the data reported to WEPAL by the SSU. For stable isotope laboratories fulfilling the established requirements for ^{15}N and ^{13}C analysis of plant materials (see report IAEA/AL/165) a certificate of "successful participation" will be provided.

A new PT-round is planned for 2009.

Visitors

Mr. Ahmed Shames El dein Shabaan and Amin Aloo (PhD students), Dr. Elmar Stenitzer and Mr. Leopold Gassner from the Soil and Water Institute Petzenkirchen, Austria, visited the Laboratories in Seibersdorf on 4 September 2008 to discuss the potential use of the carbon isotope discrimination technique as a tool to select crop plants with greater agronomic water use efficiency.

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- Soil and Water Management and Crop Nutrition Section:
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