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One way of dealing with water scarcity is the use of a low-cost drip irrigation system currently being used in Sierra Leone to target irrigation water to the main plant rooting zone, therefore minimizing water evaporation.

To Our Readers

The Soil and Water Management & Crop Nutrition (SWMCN) subprogramme is currently engaged in six Coordinated Research Projects (CRPs) including crop water use efficiency, soil conservation measures, conservation agriculture, selection and evaluation of crop genotypes tolerant to abiotic stresses (such as drought and soils with low nitrogen and phosphorus status) and integrated water-nutrient management in a range of agroecosystems. Following the recommendation at the Consultants Meeting organized in June 2006 as announced in our July 2006 Soils Newsletter on Assessing the Impact of Irrigation Management Technologies on Water Use Efficiency and Crop Water Productivity Using Isotopic and Nuclear Techniques, a new CRP on Managing Irrigation Water to Enhance Crop Productivity Under Water-limiting Conditions: A Role for Isotopic Techniques (D1.20.09) will be initiated later this year. Planning is currently under way for the implementation of this CRP and its

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first Research Coordination Meeting (RCM) which will be held at IAEA Headquarters from 26 to 30 November 2007. This CRP, which focuses on the impacts of irrigation water within the plant rooting zone and the CRP that is managed by the Isotope Hydrology Section which focuses on impacts of irrigation water below the plant rooting zone (*Quantification of hydrological fluxes in irrigated lands using isotopes for improved water use efficiency*) will provide comprehensive information on the impacts of irrigation water on water resources. Such combined activities will create a synergy of skills and resources to address the increasing worldwide concern amongst Member States on issues relating to agricultural water use and conservation and the consequent changes in soil-plant-water-nutrient management practices at both the farm and catchment scale on water resources. The SWMCN subprogramme will particularly contribute its expertise and experience in the field of plant-soil-water interactions and the use of isotopic and nuclear techniques to elucidate the influence of water management practices and soil moisture conservation measures at a range of scales on such interactions. This will assist in the development of farm management tools and land use strategies to enhance crop productivity and water use efficiency.

The SWMCN subprogramme currently provides technical support to 48 national and two regional Technical Cooperation Projects (TCPs), covering a range of issues that are important to Member States including soil fertility and crop nutrition management, combating land degradation and soil erosion, soil conservation measures and water-nutrient management for sustainable crop production and environmental protection. Both Regional TCPs, one in Asia and the other in Africa have provided valuable information on sustainable land use and management strategies for controlling soil erosion and improving soil and water quality in Asia and combating desertification in the Sahel. In Asia, the emerging regional emphasis is on agro-pollution of soil and water resources, while the efficient use of water under water limiting conditions through drip irrigation and fertigation is an important issue for the green revolution in the African region.

Ms. Lee Heng, a former staff member (1998-2005), has now rejoined the SWMCN subprogramme and will be based in the SWMCN Section as a Technical Officer to provide technical support to both CRPs and TCPs. A second Technical Officer position, which has been vacant in the SWMCN Section for over one year, will be filled later this year. This will greatly help the SWMCN Section, which has been understaffed for a considerable length of time, to address many interesting challenges in Member States on sustainable land and water management for crop productivity and environmental sustainability. I take great pride in sharing with you two success stories from counterparts in Turkey and Yemen, which have been submitted for publication in this edition of the Newsletter. A ‘success story’ from the Rice-Wheat CRP (D1.50.07) was also included. Such successes are examples of dedication and commitment from our counterparts and the Member States involved, as well as the SWMC team members. I also appreciate the support of ex-staff members, who have dedicated their time and effort to assist the SWMCN subprogramme in its implementation of activities and commitments.

I wish you and your family good health, happiness and every success. I look forward to receiving further success stories and welcome any feature article or suggestions that you may wish to contribute. Your inputs are vital to the success of the Soils Newsletters in bringing relevant information to you all.

Long Nguyen

Staff

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Staff News

Ms. Lee Heng, a former staff member with the Soil Science Unit rejoined the SWMCN subprogramme on 1 June 2007 as a technical officer in the SWMCN Section after approximately one and a half years of separation from the IAEA and working as an FAO consultant in Rome. Lee will play a key role in the Section acting as a technical officer for both TCPs and CRPs relating to soil and water management.

Mr Felipe Zapata, a former staff member returned to the Section on 19 February 2007 as a Consultant on an eight-month contract. Felipe is acting as technical officer for 11 TCPs and two CRPs.

Mr. Emil Fulajtar, a consultant (7 March 2006 to 7 March 2007) has returned to his home city, Bratislava, where he is working as a research scientist at the Soil Science and Conservation Research Institute. We thank Emil for his input and wish him all the best for the future.

Ms. Rosario Leon de Müllner. After working for six months (June to December 2006) under the Temporary Assignment Programme (TAP) as a secretary for the Waste Technology Section, we are pleased to welcome Rosario back with the section as a secretary and a valuable team member in assisting with administrative tasks.

Mr. Christian Vornberg. After four months (1 September to 31 December 2006) as temporary secretarial assistant in the SWMCN Section during the period of Ms. Leon de Müllner's absence, Christian is now working as a secretary in the Food and Environmental Section, one of the five sections within the Joint Division. We thank Christian for his enthusiasm and inputs and wish him every success in the new position.

Mr. Phillip Chalk, former Section Head (August 1997 to August 2004), left the Section on 30 June 2007 after completing a ten-month contract as a consultant. Phil acted as a technical officer for seven TCPs and two CRPs and was also responsible for the technical editing of the Agroforestry IAEA-TECDOC. We thank Phil for his contribution to the SWMCN subprogramme. Phil will return to Melbourne to begin his retirement and we wish him and his family well for the future.

Ms. Elisabeth Swoboda is on six months leave from the SSU and is currently working at the IAEA Waste Technology Section in the Division of Nuclear Fuel Cycle and Waste Technology. We look forward to her return to the SSU where she will continue her administrative and secretarial duties.

Ms. Doris Gludovacz joined the SSU in September 2006 as a temporary staff, as mentioned in the December 2006 Newsletter. As of 1 May we welcome Doris as a full time staff member in the SSU.

Feature Articles

These articles are reproduced from the abstracts of the seminars given by scientists visiting the SWMCN Section during the past six months.

Water harvesting and better cropping systems for small farmers in watersheds of the East Indian Plateau

Professor Peter Cornish, University of Western Sydney, Australia

The East Indian Plateau comprises much of the state of Jharkhand and parts of adjoining West Bengal, Bihar and Orissa. The region is characterised by high but variable rainfall (1 100-1 600 mm, 80% June to September), frequent dry spells within the monsoon, little irrigation (so little non-monsoon cropping), high runoff and soil erosion, mono-cropped paddy lands, high Tribal population, and subsistence agriculture with most villagers achieving only ~60% food requirement from an average of 0.5 to 1.0 ha of cropland, spread in separate small fields across the land types of the watershed. Poverty and risk aversion coincide with a risky farming environment to limit investment in modern varieties, fertilizer and other inputs, so yields are low. There is significant opportunity to improve the livelihoods of poor villagers through watershed development that reduces the risks, and improves the returns from, investment in improved technology.

The general aim of the project is to provide a platform for extending watershed development into the higher-rainfall East Indian Plateau in a collaborative project between two Australian Universities, the Indian NGO PRADAN and the Indian Council for Agricultural Research. Objectives are to:

- understand small watershed hydrology/hydrogeology with respect to water harvesting;
- develop easy-to-use principles for design and implementation of water harvesting technology;
- evaluate downstream hydrologic impacts of water harvesting;
- introduce new, appropriate crop options, farming systems and agronomic practices (soil management, fertilizers) that will improve the efficiency of natural resource use;
- improve our understanding of the change process underpinning effective watershed development;
- build capacity within the NGO.

In this seminar, Peter Cornish provided further details on the constraints and opportunities faced by farmers in the region, outlined the conceptual basis for the approach being taken and provided some preliminary results.

Improving the management of water and nitrogen fertilizer for agricultural profitability, water quality and reduced nitrous oxide emissions

Associate Professor Deli Chen, University of Melbourne, Australia

Irrigation and fertilizer use have contributed to the success of food production in the North China Plain (NCP), which is an important grain production base for China. However, there has been growing concern about the environmental implications of the high levels of input use. A large collaborative research project, Water and Nitrogen Management to Increase Agricultural Production and Improve Environmental Quality, was therefore designed to investigate the efficiency and the environmental impact of traditional rates of nitrogen (N) and water use in wheat-maize production in NCP (400-600kg N/ha and 500-700mm for two crops of wheat-maize rotation) where soil types are alkaline and sandy in texture.

Comprehensive field measurements using the ^{15}N tracer were conducted to quantify essential water and N fluxes at one hectare plot at each of the three locations in the NCP, in Fenqiu, Luanchang and Quzhou counties. A spatially referenced and process based biophysical model, termed water and N management model (WNMM), was developed for the NCP. WNMM successfully simulated key water, carbon (C) and N dynamics, crop growth and the effects of agricultural management practices. The combination of field measurements and modelling showed excessive use of irrigation and N fertilizer. Up to 30% of applied irrigation water was lost as deep drainage (out of 1.75 m of root zoon. Ammonia (NH_3) volatilisation was the main pathway of N loss if urea was surface broadcast in this high pH soil (8.5), and up to 48% of applied urea (96 kg N/ha) was lost as NH_3 within two days after application to summer maize. Deep placement or broadcast followed by the immediate irrigation significantly reduced NH_3 volatilisation by 75%. Nitrate leaching ranged from 12 to 82 kg N/ha (3-16% applied N). Denitrification accounted for less that 10% of applied N, but about 50% of that was nitrous oxide (N_2O), a potent greenhouse gas.

Based on WNMM and farmer surveys, an agricultural decision support tool (ADST) was developed for optimum irrigation and fertilizer use. The ADST which incorporated geographical information system (GIS) facilitated the adoption of better management practices (BMPs), particularly in regard to fertilizer management. The project resulted in annual reductions in fertilizer use of around 20 to 23% and annual cost savings from reduced water pumping costs of A$10-A$45 per ha while maintaining current yield. For an average sized farm, input costs fell by 12-18%, equivalent to an increase in income of A$50-A$109 per year. The net benefits attributed to the project were estimated at A$216 million, based on the impact assessment.

The seminar also outlined the new development in studying the dynamics of water and N: new technologies for measuring NH_3 and greenhouse gases emission from managed land sources, such as open path laser and (Fourier Transform Infrared (FTIR) spectrometer; new development of WNMM in simulating N_2O emissions and incorporating a resource economical component for evaluating the policy options for sustainable water and N fertilizer management.

Soil and land management under climate change

Professor Winfried Blum, University of Natural Resources and Applied Life Sciences (BOKU), Vienna, Austria

The seminar briefly focused 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 was then discussed and its possible impact on civilization. In order to understand the current state of civilization, a short introduction into the historical development of the relationship nature – human society was given, explaining the development of land use on a world wide level and the growth of world population during the last 10 000 years. This allows defining the current state of human civilization in a physical, social, economic, environmental and cultural context.

Based on this, different scenarios of climate change, especially referring to changes in precipitation and annual mean temperatures were given, thus explaining what climate change means for the provision of surface and groundwater 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, explaining that world-wide food trading and food disposal is based on food production on those 12% of the land surface with the best soil quality. The world food resources are produced by about 25% of the world population.

Different scenarios regarding the sensitivity of agro-ecosystems to global climate change were 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 of the chemistry of the atmosphere was 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 on the trade of agricultural and other commodities.

In summary, the seminar demonstrated that

- through climate change, the provision of goods and services for civilization will change tremendously;
- the impact of these changes will be very different for specific world regions and predominantly negative for countries in development;
- adverse impacts are expected mainly regarding:
  - 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;
- possible causes of climate change derive from world views on the relationship between humans and nature, wrong economic and social theories and the increasing globalization of decisions regarding the production and marketing of agricultural-biological commodities, without considering regional-local ecological, social and economic conditions;
- 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, by establishing new economic rules and steering operations.

Cherenkov Counting

Professor Michael F. L'Annunziata, The Montague Group, California, USA

The speaker discussed the historic discovery of Cherenkov radiation and the principles, and applications of Cherenkov counting to 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. The speaker also described 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 32P, 36Cl, 86Rb (tracer for K) by Cherenkov counting, and the measurement of 90Y activity by Cherenkov counting applied in the radiopharmaceutical sciences was discussed. In the environmental sciences, the application of Cherenkov counting to the analysis of ^{89}Sr + $^{90}Sr(^{90}Y)$ is another application that was included. The Cherenkov effect and the beta-particle (electron) threshold energies required for the Cherenkov effect was reviewed in light of various media used to measure radionuclide activity, including water, plastic, and glass where samples are analysed in aqueous solution or in the 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 were described.

Emphasis was directed to the advantages of Cherenkov counting over conventional liquid scintillation counting particularly with respect to the application of this technique in IAEA Technical Cooperation Projects and Coordinated Research Programs in developing Member States.

Some advantages of Cherenkov counting of samples in aqueous solution that were discussed are (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 cases of the short-lived radionuclides, such as ^{32}P, the reuse of counting vials after Cherenkov counting and allowing 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.

Success Stories

DRIP IRRIGATION AND FERTIGATION

TURKEY

Mr. Basri Halitligil, Turkish Science and Technology Research Authority (TSTRA), Turkish Atomic Energy Authority (TAEA)

During the past 16 years, the SWMCN subprogramme has successfully implemented FAO/IAEA funded TCPs in Turkey in improving water and nitrogen management in the Cappadocia region (Niğde-Nevsehir Region) where it accounts for more than one third of Turkey's potato production (1.2 million tons). There are approximately 2 000 farmers in this nearly 30 000 hectare region and the soils in this Region are mainly light-textured, composed of sandy, loamy sand and or silt loam. Prior to the studies being conducted, sprinkler irrigation systems were implented for potato growing since 1960s and before the sprinkler irrigation came into use, the basin irrigation system was popular.

The TCPs projects were carried out with the support of the Turkish Atomic Energy Authority-Ankara Nuclear Research Center in Agriculture and Animal Sciences, Ankara (TAEA-ANRCAAS) as the main counterpart and the following organizations as in-country partners:

- (i) Turkish Science and Technology Research Authority (TSTRA). (ii) Ministry of Agriculture, Niğde Potato Research Institute (MA-NPRI).
- Ankara University, Agricultural Faculty, Soil Science Department, Ankara, Turkey (AUAFSSD).
- Soil and Fertilizer Research Institute (SFRI), Ankara, Turkey.

The TCPs (TUR5016 and TUR5020) with TAEA, TSTRA, MA-NPRI and AUAFSSD as in-country partners over the 1990 - 1993 and 1998 - 2002 periods demonstrated that a drip irrigation and fertigation system, which targeted both water and fertilizers at the plant-rooting zone, instead of sprinkler irrigation and broadcast application of fertilizers over a soil surface was found to reduce 40 to 50% of applied N and 60 to 65% of applied irrigation water without affecting the marketable tuber yield of approximately 35 000 to 36 000 kg per hectare.

Using N fertilizer labelled with stable ^{15}N isotope to track N movement in soil-plant systems and neutron probes to monitor available soil moisture content and provide technical information for irrigation scheduling, the Turkish counterparts have shown that sprinkler irrigation was not an efficient system to provide water for potatoes growing in the light-textured soils of the Cappadocia region. Approximately 65% of water applied was lost beyond the main rooting zone of 90 cm depth and this loss also caused an inefficient use of applied N fertilizer. To achieve a similar marketable tuber yield of 35 000 to 36 000 kg per hectare, 1400 to 1700 mm of irrigation water (14 to 17 tons of water per hectare with 100 mm of water per each irrigation) and fertilizer N at a rate of 1000 kg N/ha were required under sprinkler irrigation while only 600 mm irrigation water (12 irrigations at 50 mm of water per irrigation) and approximately 600 kg N/ha was required under drip irrigation and fertigation system, where no water and ^{15}N was found to move beyond the 90 cm soil depth.

Drip irrigation-fertigation system at Nigde Potato Research Institute for the Demonstration Experiment where potato crop was just planted

Although a conversion from conventional sprinkler irrigation system to drip irrigation-fertigation would cost farmers approximately $200 per hectare, 60 million dollar annual savings in terms of time, energy and labour inputs in irrigation and the cost associated with the reduction in fertilizer applications would be attained in the Region if all farmers adopt drip irrigation and fertigation instead of conventional sprinkler system. Not only such huge savings will be achieved, contamination of groundwaters with nitrate leaching can be avoided. These findings from TCPs have been communicated to the Turkish farming community by the Turkish main project counterparts (TAEA-ANRCAAS and MA-NPRI) through a 12 minute-interview with the Turkish Radio Television (TRT) on July 2000 at a field site on a farmer's property in the the Cappadocia Region.

The importance of drip irrigation-fertigation for potato growing in the Cappadocia Region was recognized by the Turkish Government with an Act passed by the General

Assembly on 14 November 2004 indicating that the Government can provide farmers in the Region with a loan of a low interest rate to allow them to switch to drip irrigation-fertigation. The interest in drip irrigation-fertigation in the Region has been remarkable after the announcement of this Act. The area under drip irrigation-fertigation had increased from 500 hectares in 2003 to 4000 hectares in 2006. Such increase suggests that within a next couple of years, drip irrigation and fertigation system will be the prevailing irrigation system in the Region.

Since the soils in the Region are light-textured with low soil organic matter content, the impacts of using vetch as green manure and alfalfa as a forage crop in improving soil organic matter content and hence soil structure and water and nutrient use efficiency is being investigated under another TC project (TUR5024) with TAEA, MA-NPRI and SFRI as in-country partners that has been initiated in 2005 and results are being expected to be available by the end of 2007.

The above results obtained from the Cappadocia Region can be extrapolated to the light textured soils of Central Anatolia-Bolu Region (mainly at the Northern Part of Ankara - around 3 000 hectares) and Agean Sea Region (nearly 5000 hectares) under nearly similar climatic conditions.

YEMEN

Mr. Abdulwahed A. Saif, Northern High Land Research Station-Sana'a, Agricultural Research & Extension Authority (AREA), Yemen

Mr. Abdulwahed A. Saif reported a similar success story with the use of drip irrigation-fertilization technology for potato production in Yemen. Three experiments conducted in farmers' fields at three locations in the Al-boun area of Amran Region of Yemen in 2006 have confirmed the preliminary results from the TCP (YEM5002) in showing that a drip irrigation-fertigation technology reduced both water and nitrogen fertilizer consumption by 50% while potato production increased by 11%, compared to the surface application of water and nitrogen fertilizers. Such success has encouraged farmers in the Region to adopt a drip irrigation-fertigation technology in upcoming seasons.

Field day-Farmers' interest in drip irrigation-fertigation technology

Drip irrigation-fertigation experiment in a farmer's field in the Al-boun area

Drip irrigation-fertigation set-up in a farmer's potato field in the Al-boun area

CRP ON NUTRIENT-WEATER INTERACTION ON RICE-WHEAT SYSTEMS

The CRP on Integrated Soil, Water and Nutrient Management for Rice Wheat Cropping Systems in Asia (D1.50.07) has generated interesting information on the use of resource conservation technologies (RCT) including no tillage, direct seeding and bed planting in rice-wheat systems in Asia.

Mr. J.K. Ladha of IRRI will present the paper on this topic for rice-wheat systems in south Asia (Bangladesh, India, Nepal and Pakistan) at the American Society of Agronomy, New Orleans, November 2007. The abstract of this paper is reproduced here for your information.

Use of CERES model for evaluation of resource conservation technologies in rice-wheat system in south Asia.

Resource conservation technologies (RCTs) involving various tillage and seeding practices such as no tillage, direct-seeding and bed-planting have potential to improve the sustainability of the rice-wheat system. The impact of RCTs on yield and N dynamics in the rice-wheat system was evaluated in field trials conducted at Ludhiana and Modipuram, India, Meherpur, Bangladesh, Ranighat, Nepal, and Lahore, Pakistan for 3 years during 2002 to 2006. The RCTs gave similar wheat yield (3.3 – 3.7 Mg ha^{-1}) but reduced rice yield by 0.9 to 1.3 Mg ha^{-1} compared to the conventional practice.

The Crop Estimation through Resource and Environment Synthesis (CERES)-Rice and CERES-Wheat models, embedded in the Decision Support System for Agrotechnology Transfer (DSSAT) version 4.0 framework, were evaluated using the data from the above trials. Genotypic coefficients for rice and wheat cultivars used in these trials were derived in this study. The models simulated the phenology of rice and wheat crops satisfactorily in all the locations (R^2 between simulated and observed days to flowering and maturity for rice were 0.75* and 0.64*, and for wheat 0.84* and 0.88*, respectively). Predicted grain yield of rice in the puddled transplanting treatment agreed well with observed yields (R^2 = 0.69*) but there was poor prediction (R^2 = 0.36) when yields of direct-seeding and bed planting of rice were considered. Predicted grain yields of wheat, however, agreed well with observed yields in all the tillage and seeding practices (R^2 = 65*). There was good prediction (R^2 = 0.65*) of N uptake by wheat but prediction of rice N uptake was poor (R^2 = 0.07). The study suggested that wheat can be satisfactorily grown with various RCTs but for rice the RCTs need refinement to improve yield. The CERES model was able to capture the major effects of crop management with RCTs on rice and wheat yield but needs improvement for estimation of N uptake by rice.

Rice-wheat system in Nepal

Wheat crop in rice-wheat CRP in India

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	L. Nguyen
ALG5021	Optimising irrigation systems and surface water management	L. Nguyen
ALG5022	Nuclear techniques for sustainable use of saline groundwater and wastelands for plant production	L. Nguyen
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 costal area through improved crop, water and soil management	Q. Shu /J. Adu-Gyamfi
CMR5013	Use of nuclear techniques in soil, nutrient and water studies	P. Chalk
CMR5016	Development of N and P fertilizer management for Sustainable Intensification of agricultural production in Cameroon	P. Chalk
CHI5048	Integrated watershed management for the sustainability of agricultural lands	I. Ferris/ L. Mabit
CPR5015	Assessment of soil erosion and effectiveness of soil conservation	F. Zapata
ECU5022	Efficient use of nitrogen fertilizers in flower production	P. Chalk
ELS8009	Study of sedimentation in the reservoirs of four CEL hydroelectric power stations	T. Vitvar/F. Zapata
ERI5004	Improving crop productivity and combating desertification	P. Lagoda/J. Adu-Gyamfi
GHA5032	Enhancing production and use of cassava	P. Chalk/F. Zapata/
HAI5003	Enhancing crop productivity through the application of isotope nuclear techniques	P. Chalk
INS5035	Application of Nuclear Techniques for Screening and Improving Cash Crop Plants in Coastal Saline Lands	Q. Shu/F. Zapata
IVC5029	Improvement of yield in plantain and cassava through the use of legume cover crops	G. Hardarson
JAM5009	Development of soil fertility management	P. Chalk
KEN5023	Combating desertification using nuclear technology	P. Chalk
KEN5026	Isotope techniques for assessment of water and nitrogen use efficiency in cowpea/maize intercropping systems	J. Adu-Gyamfi
LIB5010	Establishing a Drip Irrigation-fertigation System Using Nuclear Techniques	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	F. Zapata
MAR5014	Management Practices for Increased Efficiency of Fertilizers and Improved Productivity of Saline Soils	P. Chalk/L. Nguyen
MAR5015	Investigating the N dynamics in the crop-soil system of a multiple cropping system to optimize fertilizer use	L. Nguyen

Project Number	Title	Technical Officer
MLI5021	Sustainable intensification and diversification of sorghum production systems in the southern zone of Mali, Phase I	P. Chalk
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	F. Zapata
NAM5008	Increasing crop productivity and resource use efficiency in the northern communal areas	P. Chalk/L. Nguyen
NER5012	Improvement of the productivity and sustainability of cowpea with finger millet	F. Zapata/M. Spencer
PHI5031	Assessment of erosion and sedimentation processes for effective formulation of soil conservation and water quality protection measures	F. Zapata
QAT5002	Developing Biosaline Agriculture in Salt-affected Areas in Qatar	P. Lagoda/L. Nguyen
RAF5048	Combating Desertification in the Sahel	F. Zapata
RAS5043	Sustainable land use and management strategies for controlling soil erosion and improving soil and water quality	F. Zapata
SAU5003	Improving Fertilization under Saline Conditions for Sustainable Crop Production	P. Lagoda/L. Nguyen
SEN5030	Integrated approach to develop sustainable agriculture in Senegal	F. Zapata/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. Nguyen/F. Zapata
SIL5008	Contribution of nitrogen fixing legumes to soil fertility in rice-based cropping systems	G. Hardarson
SIL8002	Improved Water Management Technologies in the Inland Valley Agro-Ecology	J. Adu-Gyamfi
SLO5002	Protecting groundwater and soil against pollutants using nuclear techniques	J. Adu-Gyamfi/ I. Ferris
SRL5038	Application of isotopes for soil erosion studies	F. Zapata
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	F. Zapata
TUR5024	Improving crop productivity through nuclear and related techniques	L. Nguyen
UGA5025	Integrated nutrient management for increased and sustainable crop production on small-holder farms	L. Nguyen
UGA5029	Developing soil conservation strategies	F. Zapata
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	F. Zapata
ZIM5011	Combating desertification in agricultural lands	P. Chalk

Forthcoming Events

FAO/IAEA Events

Interregional Training Course on Use of Nuclear and Related Techniques to Measure Storage, Flows and Balance of Water in Cropping Systems

1 to 25 October 2007, Seibersdorf, Austria

Course Coordinator: Joseph Adu-Gyamfi

The interregional training course will be organized jointly by the Soil and Water Management and Crop Nutrition (SWMCN) Section of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and the Soil Science Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory from 1 to 25 October 2007 at the Agency's Laboratories at Seibersdorf. Other information related to the Interregional Training Course is available from the IAEA or on the IAEA web pages: http://www-tc.iaea.org/tcweb/participation/astrainee/default.asp

Participation

The training course is open to 20 participants from FAO and IAEA Member States in all geographic regions. Over 60 applications from Member States have been received and the Selection Committee will select 20 for the Course. Preference will be given to qualified candidates from developing countries.

Purpose of the course

The objective of the course is to give scientists from developing countries a sound working knowledge of the use of nuclear and related techniques to improve crop water productivity and water use efficiency and conserve/protect water resources through better systems of delivery, monitoring and control of irrigation water, in combination with improved crop and soil management practices to minimise unproductive losses of water. The course aims to transfer to participants of Member States existing knowledge on strategies, approaches and nuclear and related techniques to tracking and quantifying water fluxes at different spatial and temporary scales within and beyond the plant root zone for improved water use efficiency and sustainable water use for agriculture.

Language

The language of instruction will be English.

Participants' qualifications

Participants must have at least a first university degree in agronomy/agriculture sciences, and should be specialized in the field of soil physics/water management and/or actively involved in FAO and/or IAEA projects on water management. Proficiency in English language is essential. Participants should be able to express themselves in English.

Description of the course

The four-week training course is designed to support an increasing focus within the Agency and its Member States on Water Management in Agriculture under Project E1.08 (Technologies and practices for efficient agricultural water use and conservation). This course will provide an overview of techniques and approaches relating to a new CRP on Managing Irrigation Water to Enhance Crop Productivity under Water-limiting Conditions: a Role for Isotopic Techniques. The inter-regional training will provide fellows/trainees with information on tracer techniques based on natural variations in the concentrations of stable isotopes of water (^{18}O, D) to monitor storage and flows of water and solutes through soils and crops. The soil moisture neutron probe and other related techniques for logging water storage within and below the root zone will be compared. Practical applications of novel irrigation techniques such as drip irrigation, deficit irrigation and partial root zone drying irrigation related to crop-water productivity will be covered. The problems associated with and the approaches to resolve water management in agriculture in Asia may differ from those in Africa, the Middle East, etc., but the fundamental techniques are universal. The training will provide an opportunity for:

- Trainees to share working experience and problem-solving approaches. A triangle learning and problem solving processes, involving trainers-trainees and trainee- trainee interactions.
- Future networking of research collaboration/training opportunities between institutes where trainees come from.
- Possible sharing of resources for planned activities to support Project E.1.08 research and technical activities. For example, China with its laboratory and training facilities can provide analytical assistance to other trainees in their future work via networks established as described above.
- Interpretation of data on crop-water productivity and water balance for various irrigation systems and water saving technologies will be covered. Broad coverage of techniques will be given through intensive classroom lectures, laboratory sessions, and greenhouse and field experiments.

Syllabus

The following is an outline of the content of the course:

1st week: Soil physical properties, evaporation and water use efficieny (i) Introductory lectures on land and water management for food and environmental security (ii) Soil physical and hydraulic properties and water movement (iii) Field use of neutron moisture gauges and other soil water measuring devices (iv) evapotranspiration and soil-water balance (v) Calculations and working exercise

2nd week: Crop-water responses, irrigation and water management (i) Crop response to water and water use efficiency. (ii) Crop water requirements. (iii) Irrigation planning and management (iv) Irrigation scheduling, (v) Challenges to improving water mananement within irrigation and drainage systems (vi) Case studies and practical exercises.

3rd week: Tracking and quantifying water fluxes at different spatial and temporal scales within and beyond the root zone (i) Use of nuclear/isotopic techniques to measure storage, flows and balance of water in cropping systems (ii) Processes affecting isotope ratios (Photosysnthesis, evaporation and respiration (iii)Tracer approaches for portioning evapotranspiration (ET) based measurements of the isotopic composition of atmospheric water vapour (iv) Oxygen isotope composition of soil water: Methodologies for quantifying soil evaporation losses and transpiration efficiencies in cropping systems (v) Field evaluation of isotopic procedures for determining sources and fluxes of water in plants and soil (vi) Research approaches, methodologies and practical measurements of ^{18}O and D.

4th week: Field Training, Excursion and Evaluation (i) Changes in physio-chemical and isotopic composition of water at Seibersdorf as influenced by cropping and land use practices (ii) A field excursion to Boku University Experimental Station at Groß-Enzersdorf (iii) Presentation of individual research proposals. (iv) Closing ceremony

Fourth and Final Research Coordination Meeting of the Coordinated Research Project (CRP) on Assess the Effectiveness of Soil Conservation techniques for sustainable watershed management and crop production using fallout radionuclides (D1.50.08)

15 to 19 October 2007, Vienna, Austria

Scientific Secretary: Felipe Zapata

The final Research Coordination Meeting of this CRP will be held at IAEA Headquarters, Vienna, Austria. It is anticipated that all the chief scientific investigators (contractors and agreement holders) will attend the meeting.

The objective of the meeting will be: i) to present and discuss the results of the research carried out in the course of the CRP, ii) to evaluate achievements of the project in accordance with the project objectives and expected outputs and c) to review the manuscripts prepared for the production of the IAEA-TECDOC publication.

The meeting participants will be requested to present an overview of their results and these presentations will be critically evaluated in line with the expected outputs and specific objectives of the project.

A circular has been sent to all participants informing them about the meeting. Further information about administrative arrangements will follow. A full manuscript will be required from each participant for subsequent publication in the IAEA's IAEA-TECDOC series.

First Research Coordination Meeting (RCM) of the Coordinated Research Project (CRP) on Managing Irrigation Water to Enhance Crop Productivity Under Water-Limiting Conditions: a Role for Isotopic Techniques, (D1.20.09)

26 to 30 November 2007, Vienna, Austria

Scientific Secretaries: Lee Heng and Long Nguyen

Planning is under way for the first RCM of this CRP to be held at IAEA Headquarters. Detailed information on this CRP is listed under the 'New Coordinated Research Project' Section. You are invited to have a look at this information and we would welcome any feedback and suggestions. It is expected that the proposals submitted in response to the Call for Submissions (deadline for submissions closed on 31 June 2007) will be selected by July after consideration of their relevance to the overall CRP objectives. The main purpose of the RCM will be to examine the experimental design and workplan of these proposed projects and to establish standardized methodologies and protocols to be used by all the participants in accordance with the workplan and objectives of the CRP.

Consultants Meeting on Use of Isotopes and Nuclear Techniques in Assessing Impacts of Land Use Activities on Soil Loss as Sediment Runoff

4th quarter 2007, Vienna, Austria

Scientific Secretary: To be announced

A Consultants Meeting (CM) is planned to address the following two issues:

- To review recent advances in the use of both nuclear and conventional techniques to investigate the mobilization, transfer, storage and sources of sediment and to assess sediment budgets as influenced by land use activities.
- To identify key research areas and formulate a new CRP to develop integrated approaches for assessing

impacts of land use activities and soil loss as sediment runoff.

Second Research Coordination Meeting (RCM) of the Coordinated Research Project (CRP) on Selection and Evaluation of Food Crop Genotypes Tolerant to Low Nitrogen and Phosphorus Soils Through the Use of Isotopic and Nuclear-related Techniques (D1.50.10)

1st quarter 2008, location to be announced

Scientific Secretaries: Joseph Adu-Gyamfi and Phillip Chalk

Planning is under way for the second RCM to be held during March or April 2008. Expressions of interest to host the meeting have been obtained from contract holders in Mexico and China. A final decision will be made soon on the dates and location of the RCM. The main objective of the 2nd RCM will be to present and evaluate the results obtained since the 1st RCM, and to review workplans (including standardization of protocols) and progress towards reaching the overall and specific objectives of the CRP.

Third Research Coordination Meeting (RCM) of the Coordinated Research Project (CRP) on Integrated Soil, Water and Nutrient Management for Conservation Agriculture (D1.50.09)

25 to 29 February 2008, Ankara, Turkey

Scientific Secretary: To be announced

First of all the mid-term progress review of the project and its extension will need to be approved by the IAEA.

The local organizer of this meeting is Dr. Mahmut Basri Halitligil.

It is expected that eight contract holders, two technical contractors and one agreement holder will attend the meeting. The main objective of the 3rd RCM will be to present and evaluate the results obtained since the 2nd RCM and to review work plans and progress towards reaching the overall and specific objectives of the CRP.

Non-FAO/IAEA Events 2007

- International Symposium on Organic Matter Dynamics in Agro-ecosystems, 16 to 19 July 2007, Poitiers, France. http://www.inra.fr/Symposium_OMD_2007

- 10th International Symposium on River Sedimentation, 1 to 4 August 2007, Moscow, Russian Federation. http://isrs10.hydro-msu.ru/en/

- Pedometrics 2007, 27 to 30 August 2007, Tübingen, Germany. http://www.pedometrics.de

- International Symposium CIEC Mineral versus Organic Fertilization, Conflict or Synergism? 16 to 19 September 2007, Ghent, Belgium. http://www.soilman.ugent.be/ciec/

- The Second International Symposium on Soil Water Measurement Using Capacitance, Impedance and Time Domain Transmission, 28 October to 2 November 2007, Beltsville, Maryland, USA. http://www.paltin.com/symposiums/symposium_2007.htm

- ASA-CSSA-SSSA International Annual Meeting, 4 to 8 November 2007, Louisiana, New Orleans, USA. http://www.acsmeetings.org/

- International Meeting Soil and Wetland Ecotoxicology, 26 to 27 November 2007, Barcelona, Spain. http://www.ub.edu/sowetox/

Past Events

FAO/IAEA Events

Mid-term Progress Review Meeting of the FAO/IAEA Regional Technical Cooperation Project for Asia (RCA) 'Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality' (RAS/5/043)

22 to 25 January 2007, Beijing, China

Project Officer: Felipe Zapata

The Mid-term Progress Review Meeting of the regional TC project RAS/5/043 on Sustainable Land Use and Management Strategies for Controlling Soil Erosion and Improving Soil and Water Quality was held from 22 to 25 January 2007 in Beijing, China. Local organizer of the meeting was Prof. Yong Li from the Institute of Agricultural Environment and Sustainable Development, Chinese Academy of Agricultural Sciences. IAEA Technical Officer was Mr. Emil Fulajtar. Dr. Claude Bernard, currently with the Ministry of Agriculture, Fisheries and Food, Quebec, Canada and former TO of the project attended the meeting as invited expert.

The objectives of the meeting were: a) to assess the progress achieved to date in the implementation of the TCP, b) to review and make necessary adjustments to the national work plans and regional project work plan and c) to formulate conclusions and recommendations for further implementation of the project.

Representatives of eleven countries involved in the project (Australia, China, Indonesia, Malaysia, Mongolia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam) attended the meeting.

The objectives of the meeting were successfully achieved. The results presented by the participants showed that good progress has been made in implementing the experimental activities according to the work plan during biennium 2005/2006 and the achieved results meet the expectations.

Most participating countries have established basic national capacities for the application of fallout radionuclide methods (FRN) to measure soil erosion and have mainly gained experience in the use of ^{137}Cs technique. More expertise is needed in data interpretation, in particular selection and application of the conversion models. Other FRNs such as ^{210}Pb-excess and ^{7}Be-methods are utilized to a variable extent by some countries. In all cases specific problems and limitations were reported by the participating countries.

The Mid-term Progress Review of national work plans and the regional project work plan recommended that the provision of IAEA inputs is required for further implementation of the project during 2007/2008.

China as regional lead country in agriculture proposed the formulation of a new regional project on 'Agropolution of Soil and Water Resources'.

International Measurement Session on In-Situ Intercomparison Scenario (ISIS)

16 to 20 April 2007 Wiener Neustadt, Austria

Arsenio Toloza (SSU) and Lionel Mabit (SSU)

The staff of the Soil Science Unit and the Chemistry Unit (Mr. Marek Makarewicz, Mr. Gyula Kis-Benedek and Mr. Chuschiro Yonezawa) participated and partly implemented the 'In-Situ Intercomparison Scenario' (ISIS). The session on in-situ gamma spectrometry and dose rate measurement in emergency situation took place in the region of Wiener Neustadt, Lower Austria. It was organized by the Austrian Research Centre (ARC) Radiation Safety and Application-Seibersdorf, in cooperation with the IAEA and the Austrian NBC Defence School.

The in-situ gamma spectroscopy provided a practical way to characterize the gamma radioactivity and dose rate from the soil and to calculate the dispersed radionuclide in or on the soil at nuclear facility decommissioning and restoration sites and surrounding areas. This technique is an efficient tool to provide rapid and spatially representative estimates of environmental radioactivity. More than 180 international experts (60 teams) from 30 nations and two international organizations participated in the ISIS. Every team presented their own facility and equipment by giving the other teams the possibility to exchange experience and share new technology.

In-Situ Gamma detector measurement in Hohe Wand

IAEA equipment on display

The Soil Science Unit and Chemistry Unit team with the Member States experts

Final Evaluation Meeting of Regional Technical Cooperation Project on Combating Desertification in the Sahel (RAF/5/048)

23 to 25 April, 2007, Dakar, Senegal

Technical officer: Phillip Chalk

The IAEA Project Management Officer (PMO, Mr. A. Mahjoub) and the IAEA Technical Officer (TO, Mr. P. Chalk) attended the meeting, which was held at the Hacienda Hotel, together with the six national co-ordinators from the participating countries (Burkina Faso, Kenya, Mali, Niger, Senegal, United Republic of Tanzania). The local organizer was Mr. M. Samba Ndiaye (ISRA, Senegal). Two of the previous national coordinators (Mr. Mamadou Khouma, UNOPS, Senegal and Dr. Vincent Bado, ADRAO, Senegal) attended the meeting as invited experts. In addition, four staff members from ISRA, Senegal, participated in the meeting. The meeting proceeded according to plan with each national coordinator presenting the final Country Report. The outputs and outcomes achieved by each participant were evaluated against the expected achievements. A brochure outlining the major contributions of the project towards combating desertification has been prepared by the participants for publication by the IAEA. Conclusions and Recommendations were formulated by the participants drawing on the experience gained during the six-year period of RAF5048 (2001 to 2006). The participants prepared a Concept Note for a new regional TCP for the cycle 2009 to 2011. The Project final report document, including the Meeting Agenda, the List of Participants (full particulars), the Country reports and PowerPoint presentations, the evaluation of Project Outputs and Outcomes and the Conclusions and Recommendations, has been prepared by the TO and will be posted on the SWMCN website.

International Conference on Environmental Radioactivity: From Measurements and Assessments to Regulation

23 to 27 April 2007, IAEA Headquarters, Vienna, Austria

Lionel Mabit (SSU)

The objective of the International Conference on Environmental Radioactivity (http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=145) was to foster information exchange between professionals working in the broad range of disciplines associated with environmental radioactivity from sampling design to regulation. The conference provided a forum to review current methodologies, and to discuss future trends and developments, and evaluated their practical implications for compliance. During five days, around hundred oral presentations and more than hundred posters papers were presented.

In collaboration with Emil Fulajtar (Previous staff member of the SWMCN), Lionel Mabit presented a contribution entitled 'The use of ^{137}Cs to assess soil erosion and sedimentation processes: advantages and limitations'. This paper provided an overview of the activities of the Joint FAO/IAEA Programme to improve this method and to transfer it to IAEA Member States.

The interest maintained by researchers in the use of fallout radionuclides (FRNs) (http://www.ars.usda.gov/Main/docs.htm?docid=15237) is demonstrated by the large number of publications on the subject (3821 publications by April 2007).

Third Research Coordination Meeting (RCM) of the FAO/IAEA Coordinated Research Project (CRP) on Selection for Greater Agronomic Water-Use Efficiency in Wheat and Rice Using Carbon Isotope Discrimination (D1.20.08)

4 to 8 June 2007, Yinchuan, China

Scientific Secretary: Phillip Chalk

Eleven contract holders and one agreement holder attended the meeting which was held at the Apollo Hotel in Yinchuan. Mr. Xu Xing was the local organizer. Before the meeting each participant was requested to fill out Excel sheets on final work plans for 2005 and 2006 and projected work plans for 2007 and 2008, as well as a survey on phenotyping protocols. Each participant was allotted one hour, including discussion, to present the results of his project since the beginning of the CRP, but with emphasis on the period since the 2nd RCM. The achievements of each contract holder were evaluated against the projected outputs and the specific objectives of the CRP. The projected work plans for 2007 and 2008 were reviewed in light of the anticipated completion of the CRP early in 2009. An important item for general discussion concerned the description of environment that must be standardized in order to be able to integrate and extrapolate results across sites, seasons and regions. Conclusions and recommendations were formulated. The final meeting of the CRP will be held in Vienna in the first quarter of 2009. The report of the 3rd RCM has been prepared by the Scientific Secretary and will be posted on the SWMCN website.

NON FAO/IAEA Events

General Assembly of the European Geosciences Union

15 to 20 April 2007, Vienna, Austria

Lionel Mabit (SSU) and Arsenio Toloza (SSU)

In 2007, the Assembly of the European Geosciences Union (EGU) was held in Vienna. The meeting brought together several thousands of researchers from all around the world. A paper from the SWMCN subprogramme was presented under the programme group schedule Soil System Sciences during the Soil Erosion on Agricultural Land Session. L. Mabit, A. Toloza and our colleagues from the Department of Geography and Resource Management of the Chinese University of Hong Kong and the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (Canada) had one contribution entitled Soil Erosion Processes and Soil Quality Variability Evaluated using Fallout Radionuclides'.

This contribution highlighted that the assessment of the spatial soil redistribution and its relationship to soil organic carbon (SOC) content is a first step in the formulation of efficient natural resource management policies and implementation of appropriate soil conservation measures.

Status of Coordinated Research Projects (CRPs)

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

Technical Officer: Phillip Chalk

The final technical editing and formatting of the publication (IAEA-TECDOC) has been completed. The IAEA-TECDOC contains 15 manuscripts submitted by 13 of the 15 participants in the CRP.

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

Technical Officer: Phillip Chalk

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

The 1st RCM was held at IAEA Headquarters, Vienna (12 to 16 November 2001), the 2nd RCM was held in Meknes, Morocco, (21 to 25 November 2005) and the 3rd RCM was held in Yinchuan, China (4 to 8 June 2007). The reports of the RCMs are available at http://www-naweb.iaea.org/nafa/swmn/crp/d1_2008.html

Nine research contract holders from Algeria, Bangladesh, China (two), India, Morocco, Pakistan, the Syrian Arab Republic and Yemen, two technical contractors (CSIRO-Australia and IRRI-Philippines) and one agreement holder (CIMMYT, Mexico) are participating in the CRP. The mid-term review of the CRP was carried out in December 2006 and the extension of the CRP to five years was approved. Progress reports and requests for contract renewal for 2008 will be evaluated in December 2007. The final RCM is scheduled to be held in the 1st quarter 2009.

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

Technical Officer: Long Nguyen

Nine manuscripts from the participants (six contract holders, two technical contactors and one agreement holder) of this CRP are being technically edited by the Technical Officer, Mr. Long Nguyen and will be formatted by Ms. Eveline Kopejtka in September-October 2007 for IAEA-TECDOC publication.

Conservation Measures for Sustainable Watershed Management Using Fallout Radionuclides (D1.50.08)

Technical Officer: Felipe Zapata

The overall objective of this CRP is 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 are further developing 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.

Eleven contract holders from Brazil, Chile, China (two), Morocco, Pakistan, Poland, Romania, Russian Federation, Turkey and Vietnam, two technical contractors (Austria and UK) and five agreement holders (Australia, Canada, Japan, Switzerland and USA) are participating in this CRP.

The 1st, 2nd, and 3rd RCM were held in Vienna, March 2003, Istanbul, October 2004 and Vienna, March 2006 respectively. Reports from the RCMs are available at: http://www-naweb.iaea.org/nafa/swmn/crp/d1_5008.html

Good progress has been achieved in the implementation of the CRP. More specifically, the following achievements are being obtained in relation to expected outputs:

- Available standardised methodologies and guidelines for the application of fallout radionuclides for the assessment land uses and soil conservation measures: All the participants are working on this component. They have all developed an original research programme they are now implementing. The approaches used are variable, the scales ranging from plots to entire catchments. The progress reports produced by the participants describe their respective protocols.
- Reliable data on short-term erosion rates and soil redistribution patterns available, in the context of soil conservation measures: Very good quality data are already available, under so-called 'conventional' and conservation systems. Some comparisons between both types of system have already been made under some agro-ecosystems. It is expected to have complete data sets from the assessment of conservation systems by the final RCM.

- Effective soil erosion control practices identified and guidelines available: This element is related to the previous one. As more and more conservation systems are being assessed, the data necessary to fulfil this output will become available. The results obtained will provide information on the mechanism by which these conservation practices act: improved soil quality, reduced detachment rates, increased in-field deposition, etc.
- NARS personnel skills and physical capacities enhanced: As the CRP progresses, participants become more and more familiar with soil conservation practices and how to assess their efficiency from radionuclide measurements. Generally, the research teams involve staff with skills in soil science as well as in nuclear sciences.
- Publication of research results: The results obtained by the participants are being published in technical reports and/or peer-reviewed scientific journals. Presentations are being done in national and international scientific meetings. The reports of the first three RCMs included a list of publications related to the CRP.

The CRP is in its final stage. The 4th and final RCM is scheduled to be held from 15 to 19 October 2007 at the IAEA's Headquarters in Vienna.

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

Technical Officer: Felipe Zapata

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 should be achieved through the specific objective, which is to quantify the individual and interactive effects of conservation tillage practices, residue management, crop rotations, nutrient and water inputs to increase soil organic matter, resource use efficiency, agricultural productivity and environmental quality.

This CRP has a total of eleven participants comprising eight research contractors from Argentina, Brazil, India, Morocco, Pakistan, Turkey, Uganda, Uzbekistan, two technical contractors (Australia and Chile) and one agreement holder (TSBF-Kenya).

The 1st and 2nd RCMs were held in Vienna, Austria (June 2005) and Rabat, Morocco (September 2006). The RCM reports are available at http://www.iaea.org/programmes/nafa/d1/crp/d1-crp.html

The project has reached its mid-term. A review of the progress made to date by each participant and the project as a whole was carried out during the first quarter 2007. Substantial progress was made to identify the agro-ecosystems, the particular CA practices under study and the kind of studies performed by the participants using nuclear techniques. Also, several issues for improving the methodologies and collection of the data (standardization) generated were discussed and agreed to. Recommendations for future directions have been formulated in accordance with the objectives of the project to achieve the expected outputs. The mid-term report of the project will be submitted to the IAEA requesting the approval of its extension.

The 3rd RCM is scheduled to be held from 25-29 February 2008 in Ankara, Turkey. Local organizer of the meeting is Dr. Mahmut Basri Halitligil.

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 Phillip Chalk

The report of the 1st RCM held at IAEA Headquarters and Seibersdorf during the week of 16 to 20 October 2006 is being finalized and will be posted on the SWMCN website. Evaluation of the requests for contract renewals (June 2007 to June 2008) is in progress. Ten Research Contract holders from Burkina Faso, Brazil, Cameroon, China, Cuba, Ghana, Malaysia, Mexico, Mozambique and Sierra Leone, five Agreement Holders from Australia (UWA), Benin (WARDA), France (ENSA), Kenya (TSBF-CIAT), Nigeria (IITA) and two Technical Contractors from Germany (University of Hanover) and USA (University of Pennsylvania) are participating in the CRP. The 2nd RCM is planned for the first quarter of 2008.

New Coordinated Research Projects

1. TITLE OF THE CRP

Managing irrigation water to enhance crop productivity under water-limiting conditions: a role for isotopic techniques (D1.20.09)

2. PROPOSED DURATION: 5 years (2007-2011)

3. JUSTIFICATION

Food security and environmental sustainability depend on efficient use of scarce water in agriculture, particularly with the increasing competition for water to meet the needs of urban population, industries and tourisms. Since water is a transport agent of nutrients, agro-chemicals, farm slurries/wastes, and sediment from farm lands to receiving water bodies, improper land and water management practices at farm and catchment levels can potentially affect the quantity and quality of water resources that can be used not only for farming but also for downstream communities (Nguyen and Sukias, 2002; Hart et al., 2004; McDowell et al., 2004).

Currently on the average around 75-80% of worldwide fresh water resource is consumed by irrigated agriculture. This level of consumption by agriculture is not sustainable into the future because of the increasing competition for water from other sectors and the variation in rainfall patterns and global warming as a result of climate changes. Approximately one-third of the population of developing countries live in regions where there is insufficient water supplies to meet the expected needs for agricultural, domestic, industrial and environmental purposes in the year 2025 (Seckler et al., 1998). Thus improving water management in agriculture is crucial for increased global food security and alleviating rural poverty. This will require the development and testing of novel water management practices and soil moisture conservation measures at farm and catchment levels as well an increase in crop water productivity (Kijne et al. 2002; Pereira et al. 2002; Turner, 2004).

Improving water use efficiency in agriculture can be achieved by:

- An increase in crop water productivity (i.e. an increase in marketable crop yield per unit of water transpired) through the use of novel irrigation technologies.
- A decrease in water outflows (e.g. evaporation and deep drainage) from the soil-plant continuum other than crop stomata transpiration and an increase in soil water storage within the plant rooting zone through better soil and water management and conservation practices at farm and catchment levels.

Novel irrigation technologies include:

- Drip irrigation, which targets water applied to the plant rooting zone and minimizes unnecessary field losses via evaporation, deep drainage and surface runoff.
- Deficit irrigation, which involves less water supplied to the crop than would be needed for achieving maximum crop yield production. Because of the usually curvilinear shape of the crop-water production function (i.e. the relationship between crop yield and water received by the crop), maximum crop water productivity would be achieved at a water supply that is lower than needed for maximum yield. It has been reported that in Mediterranean climates, deficit irrigation with a water application of 40-70% less than needed for maximum yield resulted in a loss of wheat grain production of only 13% (Zhang and Oweis, 1999).
- Partial root zone drying irrigation in which irrigation water is applied alternatively to furrows or drip lines on either side of row crops (Kirda et al. 1999).

The benefits of novel irrigation technologies in minimizing water wastage are greater when combined with the following soil-plant-water management practices:

- Crop scheduling to take advantage of periods with low evaporation.
- Synchronizing water application with crop demand to avoid over-irrigation.
- Appropriate plant spacing and orientation.
- Optimum nutrient management and the use of high value crops to provide high economic returns per unit of water applied. Integrated soil fertility-water management is critical in determining plant growth, agricultural output and nutrient-water use efficiency. The interaction between water and nutrient is such that the potential benefit of applied nutrients to crop productivity depends on water availability, whereas the effect of water on crop growth and optimum yield production is also determined by the soil fertility status. This interaction is often ignored in economic (cost-benefit) analyses of irrigation and fertilizer applications (Drechsel et al., 2004). It is only through the combined evaluation of the effects of nutrients and water that the actual value of the added nutrients and irrigation water can be measured and the relative benefits and costs of various land and water management options can be assessed.

Environmental aspect:

Determination of water fluxes at different spatial and temporal scales within and beyond the plant rooting zone remains a formidable challenge because of interactions between water sources from rainfall, irrigation and subsurface water on plant uptake, evaporation, transpiration and transport of water inputs (rainfall or irrigation) into receiving water bodies. To date, the potential to increase the water productivity of crops by maximising the transpired fraction and minimising soil surface losses have not been adequately examined.

The involvement of the Agency in the CRP is justified because:

- nuclear/isotopic techniques for tracking and quantifying water fluxes through plant and soil surfaces are essential for successful implementation of the project.
- without the use of isotopic techniques, processes and pathways of water within the soil-plant continuum and the efficiencies of different crops in their productive use of water remain uncertain.
- the outputs of the CRP will contribute to the strategic objectives of the FAO's Department of Agriculture and, in particular, the development of conceptual models of crop water productivity.
- the research objectives and expected project outputs are highly relevant to a number of Member States with a need to develop strategic plans for the management of irrigation in water-limited environments.

4. OBJECTIVES

4.1. Overall Objective

To improve the water productivity (production per unit of water input) of crops under water-limiting conditions.

4.2. Specific Research Objectives

4.2.1. Quantify, and develop means to manage soil evaporative losses to maximise the beneficial use of water - the transpirational component of evapotranspiration.

4.2.2. Quantify, and develop means to improve the amount of biomass produced per unit of transpiration.

4.2.3. Devise irrigation and related management techniques to enhance the yield component of biomass production (Harvest Index).

5. EXPECTED OUTPUTS

5.1. Field validation of isotopic techniques for quantifying evaporation and transpiration in crop ecosystems.

5.2. Comparative datasets of evaporation components from different crops and regions.

5.3. Improved estimates of TE (dry matter production per unit of transpiration) of a range of crop species and in different environments.

5.4. Better strategies to improve the crop production per unit of water used.

5.5. New information (valuable for plant improvement programmes) on the mechanistic basis of the regulation of crop yield in water-limited environments.

5.6. Data inputs for pilot-testing and validation of FAO water productivity model.

5.7. Enhanced capacity of NARS to conduct applied research on crop water productivity with the aid of isotopic, nuclear and related techniques.

5.8. Research findings communicated to the wider scientific community for further transfer to the farmers, which will be the end-users and beneficiaries.

6. WORK PLAN

6.1. Tasks

6.1.1. In relation to specific objective 4.2.1.:

- Compare and evaluate underlying assumptions of isotope technique with other approaches (e.g. microlysemetry, sap flow, soil water balance using neutron probe, etc.) for quantifying soil evaporation and transpiration.
- Compare evaporation and transpiration fluxes over varying crop types and stages of canopy development, and soil surface wetness.
- Use the data collected to devise irrigation and related management strategies to minimize evaporation part of evapotranspiration, using FAO's AquaCrop or similar model for this purpose where appropriate.

6.1.2. In relation to specific objective 4.2.2.:

- At selected locations (MS) measure crop biomass and transpiration across a range of management strategies (nutrient levels, sowing rate and date and variety) for different crop species to calibrate existing transpiration efficiency (TE) predictions.
- Develop protocols to adjust for surface evaporation, saturation deficit and crop biomass components to refine TE calculations.
- Validate TE predictions for a range of species and management practices at MS locations.
- Devise and test management strategies at MS locations to improve crop production per unit of water.

6.1.3. In relation to specific objective 4.2.3.:

- Devise and test irrigation management strategies to a) avoid deficits at critical points in the plant's development that will impact adversely on yield-determining processes, and b) impose deficits when they will reduce shoot growth but not impact adversely on yield and may enhance harvest index (HI) and/or crop quality.
- Investigate the fundamental science behind different irrigation management strategies to manipulate shoot and root growth and root hydraulic properties to the benefit of HI and/or crop quality.
- Assess the suitability of various deficit irrigation techniques (PRD, RDI etc) to deliver strategies defined in 1 and 2 above.
- Use isotope signals in the soil-plant system to characterize depth and extent of nutrient, and water extraction and water source use by crops.

6.2. Sites & Partners Selection

6.2.1. Contract holders

National research systems (NARS) from Africa and Asia with active research programmes on water and irrigation management in crops with expertise and technical capacity to facilitate assessments of evapotranspiration and component fluxes, transpiration efficiency and harvest index.

6.2.2. Technical contracts

- Methods development for atmospheric water vapor sampling and isotopic analysis (D.G. Williams)
- Development of experimental protocols for measurement of crop biomass and transpiration efficiency (S. Azam-Ali)
- Data integration, modelling and testing of FAO Aquacrop model (T. Hsiao).
- Evapotranspiration and changes in water isotopic signatures as influenced by crop residues and carbon sequestration in no-till and conventional agriculture (P. Macaigne)

6.2.3. Agreement holders

Advanced research institutions with expertise in the use of isotopic and related techniques for quantifying crop water and carbon balance.

6.2.4. Locations

For all crops, target environments would include:

- Agroecosystems in which target crops are important for food security
- Agroecosystems in which water availability is a principal production constraint

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Laboratory Activities

Research

The use of geostatistics in environmental sciences to spatialise fallout radionuclides to assess soil erosion/sedimentation (Part 2 – A case study)

Lionel Mabit

In the December 2006 Newsletter we presented the concepts of the use of geostatistics in environmental sciences to spatialise fallout radionuclides (FRN) to assess soil erosion/sedimentation. In the following contribution the concept of geostatistics and interpolation is presented and applied to an original case study.

The objectives of this investigation were to determine the structure of spatial dependence of ^{137}Cs and soil movement, to map the baseline of both parameter and to establish a sediment budget using the information provided by the geostatistical approach.

The magnitude of soil erosion in the Boyer River watershed – Quebec (Canada) – was investigated using ^{137}Cs measurements and a GIS oriented sampling strategy in 24 selected fields representing the main soil-slope and land use combinations encountered in the watershed (Mabit et al., 2007).

The 2.16 ha field under investigation is located in the South part of the Boyer River watershed. This study was a collaborative work between Laval University of Quebec (Canada) and the IAEA. Seven parallel transects were used for the sampling along the dominant slope. 42 samples with a total of 126 cores were collected.

The conversion of the areal activities of ^{137}Cs to soil movement (t ha^{-1} a^{-1}) was done using the Mass Balance Model 2 (MBM 2) (Walling et al., 2002). The parameters used in this conversion model are listed below; bulk density: 1136 kg m^{-3}, particle size factor: 1, sampling year: 2003, reference inventory: 2970 Bq m^{-2}, proportional factor: 0.8, relaxation depth: 4 kg m^{-2}, tillage depth: 340 kg m^{-2} (0.3 m x 1136 kg m^{-3}) and year of initial tillage: 1954.

The spatial distribution of ^{137}Cs and soil movement were analysed and described using geostatistics and variography concepts. Geostatistical and spatial correlation analyses were performed using the GS^{+} version 7 software. Afterwards, variogram models were established with the same dedicated software. The different variographic parameters and fitted models were then introduced in the GIS software Surfer 8.00.

- The mean value of the ^{137}Cs reference sites was estimated at 2970 ± 110 Bq m^{-2} with a coefficient of variation of 4 % (n = 9). The ^{137}Cs activity in the agricultural field varied from 531 to 4180 Bq m^{-2} with a mean value of 2034 ± 745 Bq m^{-2} (Mabit and Bernard, 2006).
- Experimental variograms for ^{137}Cs was fitted to theoretical models using the average semivariance for four distance values (11, 25, 41, 55 m) estimated from 36, 41, 131 and 100 pairs, respectively. The experimental variogram for soil movement, calculated from ^{137}Cs activities, were fitted using the average semivariance of five distance values (11, 32, 48, 71, 89 m) estimated from 42, 87, 158, 156, and 100 pairs, respectively. Data transformation was not required to stabilize the spatial variance. For all variograms, each group of pairs was representative and relevant, since it included more than 30 pairs of points. No anisotropy was found for any of the variables, suggesting that they vary similar in all directions and that the semivariance depended only on the distance between sampling points.
- Semivariograms were well structured. They showed a good autocorrelation and a small nugget effect with r^2 values over 0.87 and a nugget-to-sill ratio ≤0.8; the nugget-to-sill ratio defines the spatial dependence property.
- The semivariograms of ^{137}Cs and soil movement showed that the sampling strategy adopted was adequate, and adapted to reveal the spatial structures of the parameters under investigation (Mabit et al., 2006). The estimated soil movement rates for individual sampling points ranged from a loss of 62 t ha^{-1} a^{-1} to a deposition of 17 t ha^{-1} a^{-1}. Using the average bulk density of the samples collected, these values corresponded to a maximum removal rate of 5.5 mm a^{-1} (27 cm on the study periods 1954-2003) and a maximum deposition rate of 1.5 mm a^{1} (7.5 cm during the study periods 1954-2003).

After interpolation and taking into account the structure of the data, a complete soil movement budget was calculated for the whole field using contours maps of soil movement. The net loss from the field was estimated at 16.6 t ha^{-1} a^{-1} using ordinary Kriging. The gross erosion reached 16.7 t ha^{-1} a^{-1}. The sediment delivery ratio (SDR), corresponding to the ratio of the net output to the gross erosion rate, represents 99%. This high SDR reflects that the eroded area represents 98 % of the field surface and the deposition area only 2 %. A closer look at the erosion data showed that around 85% of the field had an erosion rate greater than 6 t ha^{-1} a^{-1}, the suggested soil loss tolerance level for most Canadian soils (Wall et al., 2002).

This study illustrated the advantage of the use of geostatistics to process data from FRN, to assess soil erosion/sedimentation processes and to establish sediment budget and SDR. The spatial structure of soil movement as estimated from ^{137}Cs data showed a significant autocorrelation and a reliable variogram. The spatialisation of soil movement distribution, and erosion risk assessment, can be improved through geostatistics and can be optimized through mapping and spatial modelling.

The spatialisation of soil movement in the landscape and the mapping of areas that are vulnerable to soil degradation is a first step forwards an efficient resource management policy and to a targeted and successful implementation of conservation practices.

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Is the ^{13}C isotope discrimination technique to select in maize and rice tolerant to drought and salinity conditions affected by nutrient stress?

Joseph Adu-Gyamfi

The use of ^{13}C isotope discrimination (Δ) as a research tool to evaluate the impact of water stress on rice and maize and to estimate water use efficiency (WUE) is well understood. However, its application in the field to assess water stress in semi-arid environments may be hampered by factors other than water and salt stress such as low nutrient (N and P) availability in soils. In Vol 29, No.2 of the Soils Newsletter, the experimental procedures for the pot experiments was reported and that samples were being analysed. The preliminary results from the analyses showed that the Δ for maize and rice variety used is influenced by nutritional (N and P) stress. The experiment is currently being repeated to assess (i) the interactive effects of salinity, drought (14 days after sowing and at booting) and (ii) the effect of N and P levels on the Δ. The results, if confirmed, will have implications to using the ^{13}C isotope discrimination as a selection tool in nutrient stressed environments.

Pot experiments to investigate effects of soil nitrogen and phosphorus status on plant yield and carbon isotope discrimination

Root development of maize under different nitrogen and phosphorus availability in soils

Crop production practices on changes in isotopic composition of groundwater at Seibersdorf

Joseph Adu-Gyamfi

In collaboration with the Austrian Research Center, (ARC) the effect of crop production practices changes in physio-chemical and isotopic composition of groundwater at Seibersdorf is being investigated. Field experiments with two plots (i) cultivated with maize and cowpea and (ii) control with no crops were established.

Access tubes for routine moisture measurements using the neutron probe and tensiometers to extract soil water were installed in both plots. Soil water extracted was analysed for ^{18}O and ^{15}N. The changes in the isotopic composition of the water and the daily mean temperature of the groundwater is monitored by the ARC. The field experiment on the crop production practices is being repeated this year. Results are expected at the end of the year.

Field practical training - A fellow from Turkey conducts an experiment on the effect of crop production practices on isotopic composition of groundwater

Monitoring soil water status under drip irrigation system

Training

Name	Country	Area of Training	Period
Mr. Ochirbat BATKHISHIG (MON/06005, MON/5014)	Mongolia	Use of FRN to assess erosion and sedimentation rates at different scales.	1 to 30 Nov 2006
Ms. Saule KENZHEBAYEVA (KAZ/05024, RER/5/013)	Kazakhstan	The interactive effects of drought and salinity on ^{13}C isotope discrimination at varying soil phosphorus availability in wheat varieties from Kazakhstan. The fellowship is related to a TC project 'Evaluation of South Eastern Europe's Natural and Mutant Genetics (RER/5/013). Supervisors: Mr Joseph Adu-Gyamfi and Mr Jose Luis Arrillaga.	16 Apr to 16 Jul 2007
Mr. Zandraagombo DOVCHIN (MON/05010, MON5014)	Mongolia	The use of stable isotopes to evaluate cereals and legumes for their tolerance to water and nutrient stress. The training includes the development of a rapid screening technique for root traits (adventitious, basal and primary) of cereals and legumes contributing to enhanced P acquisition from low P soils. Supervisors: Mr Joseph Adu-Gyamfi and Mr Jose Luis Arrillaga.	16 Apr to 16 Jul 2007
Ms. Mazvita S. MURWIRA (ZIM/06012, ZIM5011)	Zimbabwe	The use of isotopic tracer technology to quantify biological nitrogen fixation including field experimentation using tracer technology. Supervisor: Mr Gudni Hardarson.	16 Apr to 16 Jul 2007
Ms. N'Drin Thérèse YAO (IVC/05001, IVC5029)	Côte d'Ivoire		2 May to 2 Jun 2007
Mr. David A. KAMARA (SIL/05007, SIL5008)	Sierra Leone		16 Apr to 16 Aug 2007

Scientific Visits

Name	Country	Subject Area	Period
Mr. David K. KILUSINGA	Angola	Use of isotopes in soil science	22 to 26 Jan 2007
Mr. Anthony O. ESILABA	Kenya	Use of isotopes in soil science	22 to 26 Jan 2007
Mr. David DHLIWAYO	Zimbabwe	Use of isotopes in soil science	22 to 26 Jan 2007

Visitors

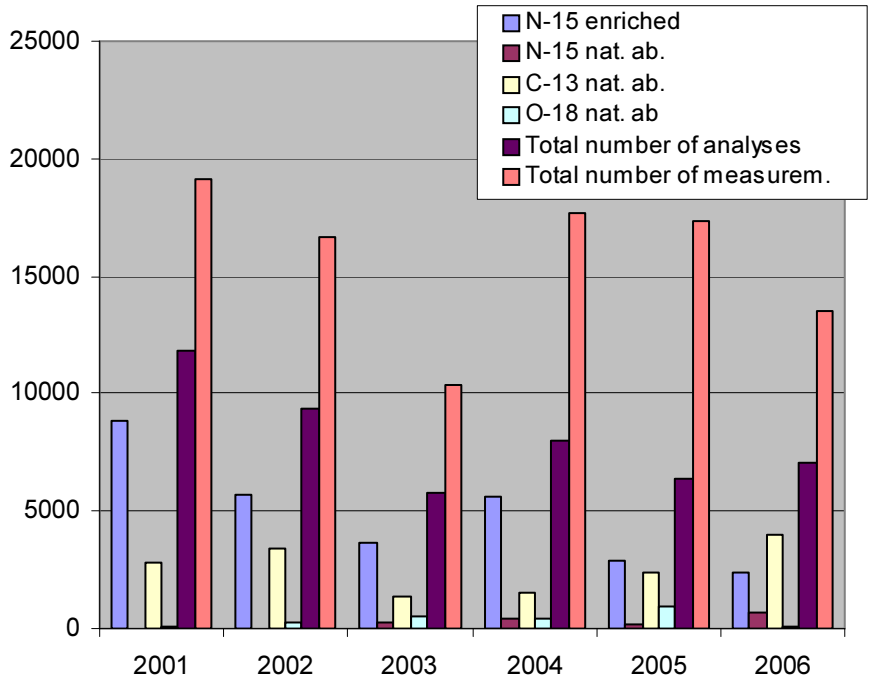
Prof. Tamas Lelley from the University of Natural Resources and Applied Life Sciences, (BOKU) visited the SSU to discuss research collaboration and to explore the potential for using carbon isotope discrimination (CID) as a selection tool for drought tolerance in RILs of wheat in a research being conducted by Prof. Lelley's PhD student from the Islamic Republic of Iran.

Analytical services

The Soil Science Unit continues to provide stable isotope analyses for CRPs, TCPs and for the other FAO/IAEA regular activities. The following table summarises the analytical services provided during 2006.

		CRP	TC	Seib	Contract	**Total**
Samples received		3 286	25	2 103	61	**5 475**
Requested analyses	^{15}N enriched	1 368	25	907	61	**2 361**
	^{15}N nat. ab.	276	0	425	0	**701**
	^{13}C nat. ab.	2 194	0	1 768	0	**3 962**
	^{18}O nat. ab.	0	0	60	0	**60**
	Total	**3 838**	**25**	**3 160**	**61**	**7 084**
Measurements carried out	^{15}N enriched	2 590	39	1 497	0	**4 126**
	^{15}N nat. ab.	487	37	747	0	**1 271**
	^{13}C nat. ab.	4 117	0	2 940	0	**7 057**
	^{18}O nat. ab.	0	0	29	1 016	**1 045**
	Total	**7 194**	**76**	**5 213**	**1 016**	**13 499**

There is a clear trend of increased requirement for natural abundance measurements of ^{13}C and ^{18}O in the last few years. ^{13}C and ^{18}O at natural abundance were mostly done in duplicates. Overall, the proportion of measurements for ^{15}N enriched, ^{15}N at natural abundance, ^{13}C at natural abundance and ^{18}O at natural abundance were: 30%, 9%, 52% and 8% respectively.



The annual proficiency test (PT) for the measurement of ^{15}N- and ^{13}C isotopic abundance and total N and C concentration in plant materials

The following is a summary of the annual proficiency test IAEA-SSU-2006-01 on the analysis of three different plant materials for the isotopic abundance of stable isotopes ^{15}N and ^{13}C as well as the total element concentration of nitrogen (N) and carbon (C).

This annual PT is organized and conducted by the SSU. It is free of charge and especially tailored to the needs of agricultural research laboratories in developing Member States working with stable isotopes.

Three plant materials with different ^{15}N- and ^{13}C isotopic abundances and N and C contents were distributed to the participating laboratories in April 2006. The plant test materials were produced by the SSU and the assigned values and associated uncertainties were determined by application of a primary method (Isotope Ratio Mass Spectrometry, IRMS) for ^{15}N- and ^{13}C isotopic abundance determination. Laboratories were requested to analyse the ^{15}N / total N- and/or the ^{13}C / total C- content in the three different plant samples. Additionally a questionnaire on the implemented quality system had to be completed. The deadline was set at the end of October 2006. Eighteen of the 23 laboratories originally registered reported to the IAEA.

Figure 1: Geographical distribution of the laboratories that reported analytical results

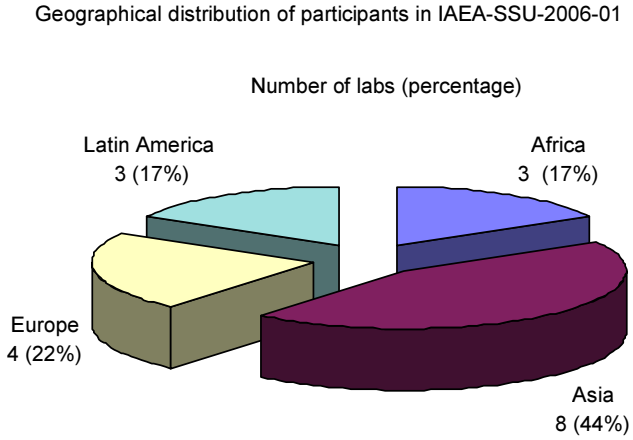


Table 1: Summary of applied methods and instrumentation listed per region (OES = optical emission spectrometry, IRMS = isotope ratio mass spectrometry).

		Applied methods:					
Region	Number of participants	^{15}N by OES	^{15}N by IRMS	N_{total} by Kjeldahl	N_{total} by dry comb.	^{13}C by IRMS	C_{total} by dry comb.
Africa	3	1	2	1	2	2	2
Asia	8	4	4	5	3	4	4
Europe	4	2	2	2	2	2	2
Latin America	3	3	-	3	-	-	-
TOTAL	18	10	8	11	7	8	8

The results were evaluated by statistical methods for assessing laboratory analytical performance by the 'z-score test'. The standard deviation for proficiency assessment was set at a value corresponding 'to the level of performance that the PT-organizer wishes the laboratories to be able to achieve'. Results received the status '*acceptable*', when the calculated z-score was smaller or equal to the value of ±2 **,** a '*warning*' was given, if the z-score was between ±2 and ±3, the results received the status '*not acceptable*', when the calculated z-score was exceeding the value of ±3. Participants were given a confidential code letter to assure anonymity and received a short report including the reference values of the three test samples and the 'z-scores' of all participants in December 2006. Certificates of participation are provided to all laboratories, a 'successful participation' is only stated to laboratories who showed proficiency in both, the isotope- *and* the total element concentration for one or both combined analyses. Individual assessments on sources of possible errors and proposed improvements of the applied methods were provided to each participant.

The combined analysis ^{15}N / total N was analysed correctly by 61 percent of the participating laboratories (Fig. 2). The number of laboratories also analyzing ^{13}C / total C increased from 5 to 8 compared to the previous year. As noted below the ^{13}C / total C results still indicate some analytical weakness in half (50%) the participating laboratories (Fig. 3).

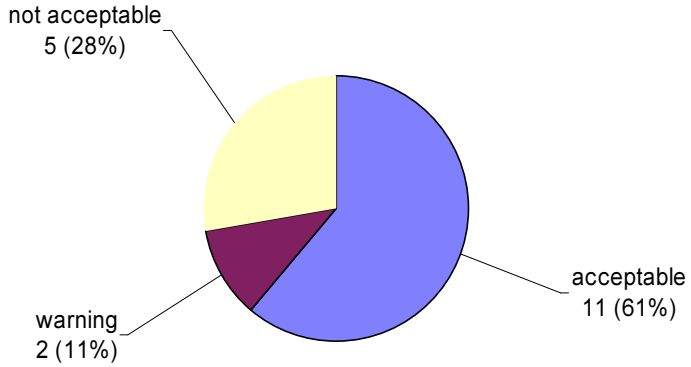


Figure 2. Overall performance on the combined analysis of ^{15}N / total N

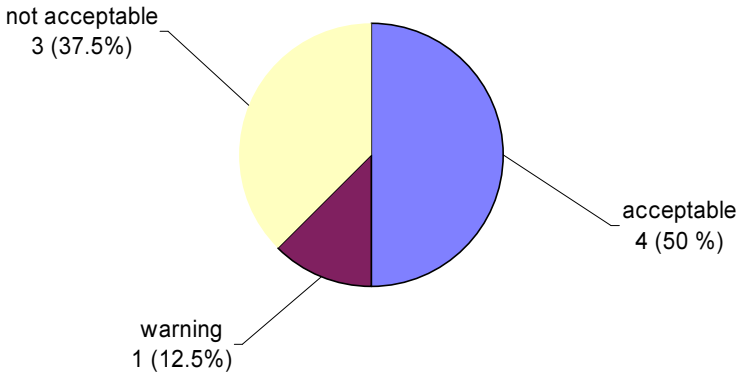


Figure 3. Overall performance on the combined analysis of ^{13}C / total C

The results of the PT demonstrate that initial appropriate steps towards quality assurance and quality control implementation had been taken by most participating laboratories.

Publications

An updated list of articles from SWMCN staff published in scientific journals and conference proceedings is available on our SWMN Section website at the URL http://www.iaea.org/programmes/nafa/d1/public/d1_pbl_1.html

Publications/Proceedings of Symposia and Seminars

IAEA Proceedings Series STI/PUB/1285. Management Practices for Improving Sustainable Crop Production in Tropical Acid Soils. Results of a Coordinated Research Project organized by the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture (2006). IAEA, Vienna, Austria.
This is a priced IAEA publication. Paper copies cost 55 Euros. Instructions for ordering can be found on the webpage http://www-pub.iaea.org/

Papers in Scientific Journals and Conference Proceedings

Fulajtar, E., **Mabit, L.,** Bernard, C. (2006). Assessing erosion-sedimentation processes and efficiency of soil conservation practices using radio-isotope techniques. In: Abstracts of the International Sediment Initiative Conference (ISIC). pp. 79-80 + CD-ROM. UNESCO Chair in Water Resources. 12-15 November 2006, Khartoum, Sudan.

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Websites

- Soil and Water Management and Crop Nutrition Section:
  http://www-naweb.iaea.org/nafa/swmn/index.html
- Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture:
  http://www-naweb.iaea.org/nafa/index.html
- FAO website: http://www.fao.org/waicent/FAOINFO/AGRICULT/Default.htm
- FAO/AGL (Land and Water Development Division):
  http://www.fao.org/ag/agl/default.stm

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