SOILS NEWSLETTER

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Water Management &
Crop Nutrition Sub-Programme
of the Joint FAO/IAEA Division
of Nuclear Techniques in Food and
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Agriculture and Biotechnology
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A. TO OUR READERS

The need to produce sufficient food of acceptable quality in the context of an ever expanding human population has been recognised as a priority by several international conventions and agreements. Intensification, rather than expansion of agriculture into new areas, will be required if the goal of food security is to become a reality. Problems related to the sustainable production of food, fuel and fibre in both low-input and high-input agricultural systems are now widely recognised. The over-exploitation of the natural resource base has led to serious declines in soil fertility through loss of organic matter, nutrient mining and soil erosion. The overuse of external inputs of water and manufactured fertilisers has resulted in salinization and pollution of ground and surface waters. Nuclear science has a significant role to play in support of research into the development of more sustainable farming systems.

The FAO/IAEA Symposia on the use of isotopes and other nuclear-based techniques in studies of nutrient and water dynamics in the soil-plant-atmosphere system have become a recurrent event held every 4-6 years. They provide an international forum for a comprehensive review of the present state-of-the-art and recent advances made in this specific field, as well as a basis for delineation of further research and development required. The next International Symposium on *Nuclear Techniques in Integrated Plant Nutrient, Water and Soil Management* will be held at the Vienna International Centre during the week of 16 - 20 October 2000.

The Symposium will cover a wide range of isotope and nuclear-based techniques and their application in soil, water and nutrient management and related environmental disciplines. Therefore, the participation of soil, crop and environmental scientists, in addition to isotope specialists, is desirable to discuss and exchange views on recent advances in interdisciplinary and multidisciplinary approaches to addressing problems in sustainable agricultural production. Contributions should preferably have a new research-based development component or deal with significant refinement of isotope and other nuclear-based methods and / or open new fields of application to investigate / assess the impact of management strategies on sustainable crop production and environmental stewardship. The application of natural abundance or enriched isotope techniques to trace nutrient, water and gaseous fluxes in the soil-plant atmosphere continuum are particularly relevant. The application of isotopic methods to select plant genotypes for tolerance to stress factors and to understand the underlying physiological processes is also highly relevant.

It is expected that the Symposium will stimulate the international exchange of information and ideas that will lead to improved technologies for following key soil processes as well as the more efficient use of both scarce water and expensive nutrient sources. The Symposium will consist of seven sessions devoted to specific themes. Further details of the Symposium including themes, participation, financial assistance, submission of papers / posters, deadlines, publication, accommodation, visas, secretariat and channels of communication are provided under **Future Events** in this Newsletter.

I look forward to your active participation in this important event.

With best wishes for the Christmas season and the new millennium.

Phillip M. Chalk
Head, Soil and Water Management & Crop Nutrition Section

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C. FUTURE EVENTS

RESEARCH CO-ORDINATION MEETINGS (RCMs) OF FAO/IAEA CO-ORDINATED RESEARCH PROJECTS (CRPs)

⇒ **Second RCM of CRP on "Management of Nutrients and Water in Rainfed Arid and Semi-arid Areas for Increasing Crop Production" (D1.20.06), Tunis, Tunisia, 6 - 10 March 2000**

Thirteen contract holders and 5 agreement holders are expected to participate in this RCM. Pierre Moutonnet is the Project Officer, and will serve as the Scientific Secretary for the meeting. Mohamad Mechergui, Institut National Agronomique de Tunisie, Tunis, Tunisia, is the local organiser. The participants will present the major results and conclusions of their research covering the period from 1998-2000. General conclusions and recommendations will be formulated and guidelines updated accordingly. Data sets for running the plant growth simulation models of DSSAT and APSIM are expected to be collected by Ms. Lee Heng (Soil Science Unit, Seibersdorf Laboratories).

⇒ **First RCM of CRP on "Development of Management Practices for Sustainable Crop Production Systems on Tropical Acid Soils Through the Use of Nuclear and Related Techniques" (D1.50.06), Vienna, Austria, 5 - 9 June 2000**

This new CRP was approved in March 1999 for a duration of five years (1999-2004). The CRP will address sustainable agricultural production of tropical acid soils along three main lines of investigation: (i) utilisation of acid-tolerant and P-efficient plant genotypes, (ii) identification of acid soil infertility factors, and (iii) developing improved soil management and conservation practices. The overall objective is to develop integrated soil, water and nutrient management practices to increase and sustain the productivity of tropical acid soils. The focus of this project will be the acid soils of the savannah ecosystem in the humid and sub-humid tropics of Africa and Latin America. The project will be implemented through 1999 with researchers having an active involvement in existing networks in tropical acid soils and experience in multi-disciplinary approaches. Seven research contracts have been awarded and four agreement holders recruited. The overall work plan of the CRP and finalising experimental guidelines as recommended by the Consultants' Meeting will be finalized at the first RCM. Felipe Zapata is the Project Officer and will serve as Scientific Secretary for the meeting.

CONSULTANTS MEETINGS

⇒ **FAO/IAEA Consultants Meeting on "Fertigation Studies: State of the Art Review and Contribution of Nuclear Techniques to Agricultural Research", Vienna, Austria, April 2000**

A group of five international specialists on fertigation will be invited to present their on-going work in the Mediterranean and other regions, and provide state-of-the-art reviews of potentials and problems for the expansion of fertigation technologies. Mr. Pierre Moutonnet will review past and present Agency activities in fertigation through the TC Programme, including work with the soil moisture neutron probe and ^{15}N labelled fertilizers. In particular, the experts will be asked to consider issues of water management and the application of both macro- (particularly phosphorus) and micro-nutrients. They will also consider issues of sustainability, particularly accelerated soil acidification in some situations due to fertigation.

The Consultants will make recommendations to the Agency in regard to its future research programme in water and nutrient management through localised irrigation in arid and semi-arid areas, including the role of nuclear techniques.

⇒ **FAO/IAEA Consultants Meeting on "The Use of Nuclear Techniques for Developing Integrated Soil, Water and Nutrient Management Practices for Sustained Cereal Production in the Rice/Wheat System of Asia", Vienna, Austria, May 2000**

A group of five internationally-recognised Consultants with expertise in soil fertility and cropping systems will review on-going work in the rice-wheat system of Asia, which includes principally Bangladesh, China, India, Nepal and Pakistan. The Consultants will address the issue of sustainability under intensive cereal production with attendant high nutrient removal in grain and crop residues, and high water and fertiliser inputs with the associated risk of environmental pollution. They will have an active research or extension programme in the rice-wheat system and will preferably have strong links with the existing Rice-Wheat Consortium involving NARS, International Agricultural Research Centres and Advanced Research Institutes. It is anticipated that both CIMMYT and IRRI will be represented at the meeting. The Consultants will make recommendations to the Agency in regards to its future research involvement through a CRP, particularly in regard to overall water, carbon and nitrogen budgets in rice/wheat cropping systems which may include a grain legume phase and variable crop residue/water management treatments. The recommendations will include the role of nuclear techniques in the proposed project.

TECHNICAL CO-OPERATION PROJECTS (TCPs)

⇒ **FAO/IAEA Regional TCP for West Asia on "Fertigation for Improved Water Use Efficiency and Crop Yield" (RAW/5/007)**

This project was initiated in 1999 for a period of two years. Iran, Jordan, Lebanon, Saudi Arabia, Syria, United Arab Emirates and Yemen are the participating Member States. This project represents an antecedent project (RAW/5/002) which was implemented as Phase I during the period 1995-1998. Pierre Moutonnet is the Technical Officer.

- **Group Training, May 2000**

A 2-week event will be organised in the Region. The venue could be Lebanon or Syria.

- **Annual Co-ordination Meeting, Vienna, Austria, November 2000**

A 2-day meeting followed by a 3-day workshop on the utilisation of P-fertilisers in fertigation is proposed.

⇒ **FAO/IAEA Regional TCP for East Asia and the Pacific on "Nuclear Techniques for the Promotion of Agroforestry Systems" (RAS/5/029)**

This Regional TCP was initiated in 1995 involving Bangladesh, China, Indonesia, Malaysia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam. It is in the second phase of implementation, with Gamini Keerthisinghe as the Technical Officer.

- **Final Project Evaluation Meeting, Manila, Philippines, 3 - 7 July 2000**

The main purpose of this meeting will be to evaluate the results achieved in this project in accordance with the project objectives. The counterparts will present reports describing the major achievements of the project and steps taken to disseminate the new information generated from this project to the end-users. The presentations of the participants will be critically evaluated and discussions will be held to assess the impact and outputs of the project. Ms. Crispina Rosales, Philippine Nuclear Research Institute, Manila, will be the local organiser of the meeting.

⇒ **FAO/IAEA Regional TCP for Latin America on "Plant Nutrition, Soil and Water Management" (RLA/5/036), ARCAL XXII**

This regional project was initiated at the end of 1996 with 8 participating countries: Argentina, Brazil, Chile, Cuba, Guatemala, Mexico, Uruguay and Venezuela. The project is in the second phase of implementation and will be completed in the year 2000.

The Activity Plan of the project calls for the preparation of four technical manuals:

- N fertilisation of annual crops. Co-ordinator: Dr. Segundo Urquiaga.
- Neutron and gamma probes: Their use in Agronomy. Co-ordinator: Dr. Osny Bacchi.
- Biological nitrogen fixation studies. Co-ordinator: Dr. Juan José Peña Cabriales.
- Efficient use of water in agriculture. Co-ordinator: Dr. T. Muraoka.

The first two manuals are in the final stage of preparation and are expected to be published this year. The other two are in an advanced stage of preparation and will be ready for printing by March 2000.

Following a recommendation adopted in the Second Co-ordination Meeting, the Chilean Project Co-ordinator elaborated a proposal for a new regional project for the 2001-2002 biennium. The proposal was initially rejected by the ARCAL national co-ordinators at the XVI ARCAL Technical Co-ordination Meeting held in Santiago, Chile, 24 - 28 May 1999. A modified proposal has been re-submitted for reconsideration after the IAEA General Conference held in September 1999.

- **Third Co-ordination Meeting, Oaxaca, Mexico, 20 - 24 March 2000**

During the regional workshop in Santiago, Chile, 4 - 6 November 1999, the participants assessed the progress made in the implementation of the field trials and made projections for their completion in the year 2000. They requested a postponement of the date of the next co-ordination meeting from January to March 2000, when all the information of the field trials will be completed.

During this meeting the Project Co-ordinators will evaluate the results achieved in accordance with the project objectives. The reports will highlight the achievements/outputs obtained in the field trials. The participants will propose mechanisms to be adopted within each country for the transfer of results to the farmers. The strategies to be considered (e.g. demonstration trials in farmers' fields, workshops for scientists and extension service personnel, field days for farmers, extension leaflets/bulletins, press releases to daily newspapers, other audio-visual communication media, etc.) will be discussed in detail during the meeting to ensure outreach of the project. Dr. Juan José Peña-Cabriales, "Centro de Investigaciones y Estudios Avanzados del Instituto Politécnico Nacional", Irapuato Unit, Mexico, will be the local organiser.

⇒ **Interregional Model Project on "Sustainable Utilisation of Saline Groundwater and Wastelands for Plant Production" (INT/5/144)**

The first 3-year phase of the 6-year project will be completed in December 1999. The first phase envisaged a small-scale demonstration that high salinity groundwater in arid areas could be utilised to grow economically-useful plants. This activity will continue in the second phase but there will in future be an emphasis on the transfer of this demonstrated technology to the end-users on larger areas to establish the extent of its sustainability and economic and environmental benefits. It is possible to include two or three additional countries in the project beside the seven (Morocco, Tunisia, Egypt, Syria, Iran, Pakistan and Myanmar) participating now. Jordan has also been included in the project.

- **Group Activity, Islamabad, Pakistan, April 2000**

The National Co-ordinators will make a detailed presentation of the results of the activities in the participating countries, and the outputs will be assessed and reviewed for developing specific work plans to attain the objectives of the second phase of the project. Remaining within the framework of the overall objectives, each country will develop work plans to suit the local socio-economic conditions.

- **Group Training, Damascus, Syria, May 2000**

A 2-week group training will be held on the use of nuclear and related techniques in the management of saline irrigation. Two nominees from each of the participating countries will be trained.

INTERNATIONAL SYMPOSIUM

⇒ **FAO/IAEA International Symposium on "Nuclear Techniques in Integrated Plant Nutrient, Water and Soil Management", Vienna, Austria, 16 - 20 October 2000**

- **Main Themes of the Symposium**

To achieve an efficient scientific interaction, the Symposium will consist of sessions devoted to specific themes. Prospective participants are invited to submit a paper on one of the following topics (see Section 5 below), and to take an active part in the discussion during each session:

(a) Soil organic matter dynamics and nutrient cycling.

(b) Evaluation and management of natural and manufactured nutrient sources.

(c) Soil water management and conservation.

(d) Assessment of soil erosion and sedimentation.

(e) Plant tolerance to environmental stress factors.

(f) Environmental and pollution studies.

(g) Recent advances in isotope analytical methodologies and related instrumentation.

- **Participation**

All persons wishing to participate in the meeting are requested to complete a Participation Form (see attached Form "A") and send it as soon as possible to the competent official authority (Ministry of Foreign Affairs, Ministry of Agriculture, national FAO committee or national atomic energy authority) for subsequent transmission to the IAEA. A participant will be accepted only if the Participation Form is transmitted through the government of a Member State of the sponsoring Organizations or by an organization invited to participate.

Participants whose designations have been received by the IAEA will be notified directly two to three months before the meeting.

- **Expenditure**

As a general rule, the IAEA does not pay the cost of attendance, i.e. travel and living expenses, of participants. However, limited funds are available to help meet the cost of attendance of selected specialists from **developing countries with low economic resources**. Generally, not more than one grant will be awarded to any one country.

If governments wish to apply for a grant on behalf of one of their specialists, they should address specific requests to the International Atomic Energy Agency to this effect. Governments should ensure that applications for grants:

(a) be submitted by **19 May 2000**.

(b) be accompanied by a duly completed and signed Grant Application Form (as attached).

Applications which do not comply with the conditions mentioned under (a) and (b) cannot be considered.

The grants awarded will be in the form of lump sums usually covering only part of the cost of attendance.

No registration fee is charged to participants.

- **Papers**

All papers - apart from invited review papers - must present **original** work; they should not have been published elsewhere.

Deadline for submission

(a) A completed **Form for Submission of a Paper** (Form "B"), together with the Participation Form (Form "A") and two copies of an **extended synopsis** of 800 words (i.e. two A4 format pages of single spaced typing or the equivalent, including any tables or diagrams and a few pertinent references) must be sent (in English) to the competent official authority for transmission to the IAEA by **19 May 2000** (see Section 12 below).

The synopsis should give enough information on the contents of the proposed paper to enable the selection committee to evaluate it. Introductory and general matters should not be included. The synopsis - if accepted - will be reproduced in unedited form in the Book of Extended Synopses; therefore, the original must be submitted as camera-ready copy. The general style and presentation should be as in the attached sample.

(b) If changes or corrections to an extended synopsis become necessary, a revised version may be sent to the IAEA by **1 September 2000** for inclusion in the book of extended synopses.

Authors are urged to strictly observe the above deadline(s) as otherwise publication of their paper cannot be guaranteed.

Paper/poster acceptance

In order to provide ample time for discussion, the number of papers that can be accepted for oral presentation is limited. If the number of relevant and high quality papers submitted for selection exceeds the acceptable number, poster sessions may be arranged.

Authors will be informed whether their papers have been accepted for presentation at a regular session or as a poster on the basis of the extended synopsis. *The sponsoring Organizations, however, reserve the right to refuse the presentation or publication of any paper that does not meet the expectations based on the information given in the extended synopsis.*

Further details concerning the written and oral presentation at the meeting will be sent to all authors in due course.

- **Proceedings**

The proceedings of the meeting will be published in camera-ready (unedited) form as a CD ROM by the IAEA as soon as possible after the meeting. All participants will receive a free copy of the CD ROM.

- **Working Language**

The working language of the meeting will be English**.** All communications, synopses, abstracts and papers must be sent to the Conference Secretariat in **English.**

- **Distribution of Documents**

A preliminary programme of the Symposium will be sent to participants before the meeting. The final programme, and the book of extended synopses will be distributed on registration.

- **Accommodation**

Detailed information on accommodation and other items will be sent to all designated participants well in advance of the meeting.

- **Visa**

Designated participants who require a visa to enter Austria should submit the necessary application to the nearest diplomatic or consular representative of Austria as soon as possible. Please note that Austria is a Schengen State and therefore persons who require a visa will have to apply for a "Schengen visa" at least 14 days before entry into Austria. In States where Austria has no diplomatic mission visas can be obtained from the consular authority of a Schengen Partner State representing Austria in the country in question. *[The Schengen States are as of September 1999; Austria, Belgium, France, Germany, Greece, Italy, Luxemburg, Netherlands, Portugal and Spain.]*

- **Secretariat**

The address of the Conference Secretariat is:

International Atomic Energy Agency
IAEA-SM-363
Vienna International Centre
P.O. Box 100
Wagramer Strasse 5
A-1400 Vienna
Austria

Telephone No.: (+43) - 1 - 2600 (0) plus extension
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Electronic mail: official.mail@iaea.org

The Scientific Secretary of the Symposium is Mr. P.M. Chalk, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture (telephone extension 21648 ; e-mail address: P.M.Chalk@iaea.org). Meeting organization is provided by Ms. K. Morrison, Conference Service Section, Division of Conference and Document Services (telephone extension 21317 and e-mail address: K.Morrison@iaea.org).

- **Channels of Communication**

The Participation Form and the Form for the Submission of a Paper, together with two copies of each synopsis, and, if applicable, the Grant Application Form, should be sent to the competent official authority (Ministry of Foreign Affairs, Ministry of Agriculture, national FAO committee, or national atomic energy authority) for transmission to the Conference Secretariat.

Subsequent correspondence on scientific matters should be sent to the Scientific Secretary and correspondence on administrative matters to the IAEA Conference Service Section.

Please see our website at: <www.iaea.org/worldatom/Meetings> for information on the above symposium as well as the forms for participation.

D. PAST EVENTS

RESEARCH CO-ORDINATION MEETINGS (RCMs) OF FAO/IAEA CO-ORDINATED RESEARCH PROJECTS (CRPs)

⇒ **Third RCM of CRP on "The Use of Isotope Techniques in Studies on the Management of Organic Matter and Nutrient Turnover for Increased, Sustainable Agricultural Production and Environmental Preservation" (D1.40.08), Rabat, Morocco, 6 - 10 September 1999**

Ten contract holders and 5 agreement holders participated in this RCM. Gamini Keerthisinghe, the Project Officer, served as the Scientific Secretary. Ismaili Mohammed, Université Moulay Ismail, Meknes was the local organiser. All participants presented results highlighting the major achievements of their research activities. Progress towards achieving project objectives was thoroughly reviewed and future plans were established. The report of the RCM is available from the Scientific Secretary upon request.

⇒ **Final RCM of CRP on "The Use of Irradiated Sewage Sludge to Increase Soil Fertility and Crop Yields and to Preserve the Environment" (D1.50.04), Serdang, Malaysia, 20 - 24 September 1999**

The RCM was held at the Mines Beach Resort Hotel, Serdang, Selangor, Malaysia. The local organiser was Dr. Che Fauziah Ishak assisted by Dr. Rosenani Abu Bakar, Dept. of Land Management (DLM), Universiti Putra Malaysia (UPM). Twelve Contract Holders, four Agreement Holders, one Consultant and the Scientific Secretary, Mr. P. Chalk, attended the RCM, which was officially opened by the Vice-Chancellor of UPM, Prof. Tan Sri Dr. Syed Jalaludin Syed Salim. A plenary paper on *The National Policy on Sewage Sludge Management in Malaysia* was given by Ir. Dr. Aminnudin Mohd Baki, Head, Engineering Design Section, Indah Water Konsortium Sdn. Bhd. A field visit was arranged by the local organizer to an oil palm processing factory where treatment facilities for mill effluent, techniques for sludge disposal and the use of empty fruit bunches as a plantation mulch were demonstrated.

A total of six Technical Sessions were held during which each participant gave a 45-minute presentation on the progress of his/her research work. Each Session was followed by 30 minutes of general discussion. The Technical Sessions were followed by a Session in which participants were divided into four working groups to review progress towards achieving CRP objectives, collate information and formulate conclusions. The conclusions were presented by the leaders of each working group in the final Session chaired by the Scientific Secretary. A report of the RCM is available from the Scientific Secretary upon request.

⇒ **Third RCM of CRP on "The Assessment of Soil Erosion Through the Use of Cesium-137 and Related Techniques as a Basis for Soil Conservation, Sustainable Production and Environmental Protection" (D1.50.05), Barcelona, Spain, 4 - 8 October 1999**

Twelve contract holders and 3 agreement holders of this CRP plus 10 participants of the Sedimentation CRP co-ordinated by the Isotope Hydrology Section participated in this RCM. F. Zapata and E. García Agudo served as the Scientific Secretaries. Dr. Ignasi Queralt

Mitjans, Institute of Earth Sciences "Jaume Almera", CSIC, Barcelona, Spain was the local organiser. This was the final RCM for the Sedimentation CRP. Each participant made a presentation of his/her research work and the results achieved. The overall implementation of both CRPs was reviewed, and in particular, the progress made in the application of the ^{137}Cs technique. A field trip was organized to the experimental catchment of the Vallcebre basin in the Llobregat upper valley, in the Pyrenees Ranges. Results obtained with conventional and the ^{137}Cs technique on soil erosion/sedimentation rates as well as practical problems encountered in their application were discussed *in situ*. During the final session the Scientific Secretaries made an overview of the activities in the Action Plan to be carried out by the participants to finalize the CRPs. Dr. Ignasi Queralt presented a schedule for the finalization of the special issue of the journal Acta Geologica Hispanica. After the peer review all papers should be ready for publication by mid-December 1999. The meeting synthesised the results of the presentations and formulated general conclusions and recommendations. A full report of the meeting is in preparation by the Scientific Secretaries.

Immediately after the RCM, A Consultants Meeting was convened by the Isotope Hydrology Section in the same location, 11 - 13 October 1999, to initiate the preparation of a handbook on "The use of ^{137}Cs and other fallout radionuclides in soil erosion and sedimentation studies". The meeting was attended by three consultants, the two scientific secretaries and Dr. Ignasi Queralt as the local organiser. The consultants were: D. Pennock (Canada), V. Golosov (Russia) and L. Basher (New Zealand). The panel outlined the content of the handbook, identified prospective contributors and formulated an Action Plan for its preparation. A full report will be prepared by Mr. E. García Agudo, the convenor of this meeting.

CONSULTANTS MEETING

⇒ **FAO/IAEA Consultants Meeting on "Identification of Supplementary Information Needed to Support Pesticide Registration Decisions in Tropical Countries", Vienna, Austria, 18 - 22 October 1999**

A meeting of four experts (from Australia, Austria and Sweden) in water movement, soils, pesticides, instrumentation, modelling and integrated pest management was convened at Headquarters. Ms. Lee Heng, Soil Science Unit, gave a presentation on water and solute transport and measurement techniques, and acted as joint Scientific Secretary for the meeting (with Mr. I. Ferris). The Consultants recommended that a CRP on the above subject be formulated. A website for the placement of soil water and pesticide data and modelling results was created.

TECHNICAL CO-OPERATION PROJECTS (TCPs)

⇒ **FAO/IAEA Regional TCP for East Asia and the Pacific on "Nuclear Techniques for the Promotion of Agroforestry Systems" (RAS/5/029)**

- **Regional Seminar on "Extension Aspects of Agroforestry Practices", Kandy, Sri Lanka, 28 June - 2 July 1999**

This seminar was held at the Hotel Thilanka, with Mr. L. Gunaratne, Department of Export Agriculture, Matale as the local organiser. Mr. A. Boehringer of the International Centre for Research in Agroforestry (ICRAF) served as a Consultant in the review of the project. The main purpose of this seminar was to discuss the extension activities of the project. The technical

officer, Mr. G. Keerthisinghe, and project co-ordinators and extension workers from Bangladesh, China, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam participated in this Seminar.

All participants presented reports describing the major achievements of the project and steps taken to disseminate the new information generated from this project to the end-users. A poster display was held to highlight the extension activities of each participating country. The presentations of the participants were critically evaluated and discussions were held to assess the potential socio-economic impact of the project and ways of improving the transfer of promising technologies to the end-users. The results obtained so far have clearly demonstrated the benefits of incorporating trees into cropping systems to improve and sustain soil fertility and increase crop yields. Recommendations were made for further improvement of the extension activities of the project.

⇒ **FAO/IAEA Regional TCP for Latin America on "Plant Nutrition, Soil and Water Management" ARCAL XXII (RLA/5/036)**

- **Regional Workshop on "Evaluation of the Dynamics of Nutrients and Water in Cropping Systems", Santiago, Chile, 4 - 6 November 1999**

This workshop was held at La Reina Nuclear Center, Chilean Nuclear Energy Commission (CCHEN), Santiago, Chile. Ms. Ines Pino, Head of the Agriculture Section, CCHEN, was the local organiser. Felipe Zapata, Technical Officer of the project conducted the workshop, which had as its objectives: a) to analyse the results gained in the field trials and evaluate its potential impact on the agricultural productivity in each participating country, and b) to recommend strategies for increasing the efficiency of water and nutrients in cropping systems on the basis of the results obtained. The project co-ordinators from seven countries (Argentina, Brazil, Chile, Cuba, Guatemala, Uruguay and Venezuela) plus four local staff members participated in this workshop.

All participants presented reports describing the major results obtained in the regional network of field trials. The presentations of the participants were critically evaluated and discussions were held on the future activities to complete the field trials and to assess the potential socio-economic impact of the project. The results obtained so far have clearly demonstrated the benefits of improving fertiliser N and water management in several cereal-based cropping systems. Participants prepared the logical framework of each subproject corresponding to the field trials. The strategies/approaches to be followed in the integrated studies of soil, water and nutrient management were developed through a case study. Specific conclusions were drawn for each participating country and general conclusions and recommendations were made on the overall implementation of the regional network of field trials in accordance with the objectives of the project. Future activities will focus on the transfer of the results to the end-users.

⇒ **FAO/IAEA Regional TCP for West Asia on "Fertigation for Improved Water Use Efficiency and Crop Yield" (RAW/5/007)**

- **Annual Co-ordination Meeting, Dubai, United Arab Emirates, 20 - 24 November 1999**

All country representatives presented their work, mainly related to the transfer of promising fertigation practices to farmers. Dr. M.S. Al-Mehrezi, Ministry of Agriculture and

Fisheries, Ras Al-Khaimah, was the local organiser of the meeting. Mr. Mohammed Sager Al-Asam, Director of the Soil and Water Department, acted as Director of the meeting. Mr. A. Habjouqa, IAEA Project Officer, participated in the meeting. A field trip was organised to the Al-Hamraniyah Agricultural Research Station, Northern Agricultural Region, Ras Al-Khaimah, established in co-operation with the FAO in 1976.

⇒ **Interregional Model Project on "Sustainable Utilisation of Saline Groundwater and Wastelands for Plant Production" (INT/5/144)**

After a request from Jordan to join the project, the Project Manager, Mr. Mujtaba Naqvi, visited Jordan to assess the problems and to evaluate the suitability of the country to be part of the project that has very specific objectives. Jordan was found to be very relevant to the project. After visiting different institutions and field sites, it was agreed that the Natural Resources Authority and the Department of Agriculture will work together on two demonstration sites, one at Al Azraq and the other at Swaimieh near the Dead Sea; the former has pumped saline groundwater while the latter has a deep artesian well. A work plan for the country was developed and is operational now.

⇒ **FAO/IAEA Model Project on "Biofertilisers for Increased Legume Production" (BGD/5/017)**

Grain legumes such lentil, chickpea, groundnut, mungbean and soybean are an integral part of the daily diet in Bangladesh. In 1988, initial ^{15}N isotopic studies carried out by the Bangladesh Institute of Nuclear Agriculture (BINA) under the IAEA Research Contract Programme demonstrated that nitrogen fixation in these grain legumes can be substantially enhanced when inoculated with the appropriate *Rhizobium* strain. More importantly, the grain yield of the inoculated plants increased by 20-50%.

In 1995, the IAEA Department of Technical Co-operation implemented a Model Project in Bangladesh, with technical support from the Joint FAO/IAEA Division, to assist in establishing technologies for pilot-scale production of *Rhizobium* inoculants. The project was initially approved for the 1995-96 biennium and extended for 1997-98 with additional financial support from OPEC. The counterpart institutes are the Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh and the Department of Agricultural Extension (DAE), Dhaka. BINA is responsible for the construction and operation of the pilot plant for the Government of Bangladesh, the production and quality control of the Rhizobium inoculants, the research and development needed to service and further develop these production systems and the training of extension personnel within the Ministry of Agriculture. The second counterpart was included to create awareness among farmers and establish a market for the industry through field demonstration of these technologies.

Main outputs/achievements:

- Development of technology for *Rhizobium* inoculant production at the pilot scale. Equipment and fellowship support was provided by the Agency. Initial production of 400 kg/year increased to 1.5 ton/year in the 1997/98 season and currently the plant has the capacity to produce 15-20 ton/year.

- Introduction of a quality control system for inoculant production.
  This activity has been implemented with support provided by the Agency in terms of equipment, fellowship training and expert services.

- Construction and engineering work of pilot inoculant production plant.
  The combined efforts under this project and the pilot scale project of the Government of Bangladesh have led to the construction of a two-storied 550 m^2 biofertiliser building. Furnishing is underway and is expected to be completed by the end of 1999. Additional expert support and equipment was provided by the Agency.

- Promotional activities of biofertiliser technologies.
  This work was carried out under a subcontract funded by the Agency and it was successfully undertaken with the Department of Agricultural Extension (DAE) of the Ministry of Agriculture through several promotional activities such as country-wide demonstration trials, training sessions for extension personnel and progressive farmers, publication of a training manual on "Microbial fertilisers: Acquaintance and Application" (10,000 copies in the local Bengali language), production of slides, short films and other audio-visual media.

- A total of 7136 demonstration trials on rhizobial inoculation were laid down in farmers' fields in the pulse producing districts of the country and 3507 persons (extension personnel and progressive farmers) were trained on biofertiliser use (Table 1). The crop responses to inoculation in the demonstration farmers' fields were above 20% in terms of grain yield increase throughout four growing seasons (Table 2).

- Field research using ^{15}N to estimate nitrogen fixation.
  The ^{15}N-aided experiments were carried out to estimate the N fixation capabilities of the inoculated legume species and varieties at several locations. The amount of N fixed was mainly dependent on the legume cultivar utilised, particularly in the lentil and chickpea crops. Studies were also conducted to assess the effect of PK and micronutrient application on N fixation of grain legumes. The amount of N fixed was greatly affected by the rates and type of applied fertilisers, as seen for soybean at two locations (Table 3).

- Recruitment of additional staff for the Inoculant Production Plant.
  With the financial support of the pilot scale project of the Government of Bangladesh a total of 12 staff members have been recruited: 4 officers, 3 technicians and 5 other staff. The Agency is supporting the training of the new officers. A Biofertiliser Production/ Development Committee has been established to manage the site and operation of the pilot plant, and in general to plan current and future activities of the project.

- Involvement of private sector for further biofertiliser production.
  The Government of Bangladesh has given permission to BINA to sign an Agreement with a private entrepreneur (A.K. Khan & Co. Ltd.) for the commercial production of biofertilisers.

It is expected that the proper application of the biofertiliser technology in Bangladesh will contribute to increase legume production by 25% leading to estimated savings of about US $23 million on imported legumes and some US $6 million on commercial N fertilisers.

IAEA assistance has been instrumental in developing cost-effective technologies for the production and quality control of *Rhizobium* inoculants, the establishment of a biofertiliser industry and the transfer of the technology to the end-users at the farm level, thus contributing

to sustainable agricultural production while creating new employment opportunities and enhanced food security.

Table 1. Country-wide demonstration trials and training of extension personnel and farmers on biofertiliser use in Bangladesh.

Year	Districts	Demon-strations	Officers	Block Superv.	Farmers	Total
1995	20	1500	80	500		580
1996	26	1766	100	625		725
1997	33	1770	132	500	450	1082
1998	40	2100	160	360	600	1120
Total		**7136**	**472**	**1985**	**1050**	**3507**

Table 2. Yield increase due to biofertiliser use in demonstration trials in farmers' fields of Bangladesh, 1995-96 to 1998-99.

Crop	Without biofertilizer (kg/ha)	With biofertilizer (kg/ha)	% increase due to biofertilizer
1995-96			
Lentil	828	1105	33
Chickpea	1020	1387	36
Mungbean	460	550	20
Cowpea	897	1108	24
Groundnut	1658	2141	29
Soybean	1141	1599	40
1996-97			
Lentil	874	1092	25
Chickpea	1019	1257	23
Mungbean	815	1029	26
Cowpea	2128	2624	23
Groundnut	1494	1842	23
Soybean	970	1226	26
1997-98			
Lentil	831	1031	24
Chickpea	802	1012	26
Mungbean	807	981	22
Groundnut	1535	1812	18
Soybean	1105	1424	29
1998-99			
Lentil	819	1018	24
Chickpea	912	1360	49
Mungbean	699	900	29
Groundnut	1346	1655	23
Soybean	1006	1242	24

Table 3. Increase in the amount of N fixed (kg N ha^{-1}) in soybean (estimated using the ^{15}N isotope dilution technique) due to inoculation and fertiliser application at two locations in Bangladesh.

Location	Fertiliser treatment	Without inoculation	With inoculation	Average increase
Ishurdi	Control	21	112	91
	Mo2.5	25	108	83
	Mo5.0	32	116	84
	B2.5	25	116	91
	B5.0	17	124	107
	P60	24	97	73
	P60K40	32	125	93
	P60K40+CD5	30	132	102
Mymensingh	Control	13	75	62
	Mo2.5	22	104	82
	Mo5.0	23	92	69
	B2.5	21	82	61
	B5.0	21	81	60
	P60	24	80	56
	P60K40	28	108	80
	P60K40+CD5	26	118	92

Mo and B 2.5/5.0: 2.5 and 5 kg /ha
P60: 60 kg P_20_5/ha
K40: 40 kg K_20
CD5: Cow Dung at 5 ton/ha

NON-FAO/IAEA MEETINGS

⇒ **10th Nitrogen Workshop, The Royal Veterinary and Agricultural University, Copenhagen, Denmark, 23 - 26 August 1999**

Mr. P. Chalk, Section Head and Ms. R. Hood, Soil Science Unit, participated in the workshop which is a major scientific meeting held once every 18-24 months at a European venue. As a member of the Scientific Committee, Mr. Chalk was (i) involved in the development of the programme (ii) chairman of the first technical Session and (iii) referee for a paper selected for a special issue of *Plant and Soil*. Ms. Hood was invited to make an oral presentation on "*Estimating plant N uptake from organic residues using a new approach to the ^{15}N isotope dilution method*". Both IAEA participants took an active part in the thematic working group (TWG) discussions, with Mr. Chalk making short *impromptu* presentations on (i) the use of ^{15}N-based models to estimate legume symbiotic dependence (TWG 1, Biological N_2 fixation in low-input systems) and (ii) ^{15}N-based studies to identify real fertiliser-induced increases in soil nitrogen availability (TWG 10, Pool substitution - can we beat it?). A synopsis of the Workshop is given by Ms. Hood under **From Our Readers.**

The 11th Nitrogen Workshop is scheduled to be held in Reims, France in 2001.

⇒ **Symposium on "Nuclear Techniques in Soil Fertility and Plant Nutrition Studies", 14th Latin American Congress of Soil Science, Pucón-Temuco, Chile, 10 November 1999**

A full day symposium was convened within Commission V (Soil Fertility and Plant Nutrition) of the 14th Latin American Congress of Soil Science. It consisted of Sessions V-3 and V-4. The convenors were Ms. Ines Pino, Chilean Nuclear Energy Commission and Mr. Felipe Zapata, Joint FAO/IAEA Division. A plenary paper on "*Development of integrated soil, water and nutrient management practices in cropping systems of Latin America by means of nuclear and related techniques*" was delivered by F. Zapata. This was followed by the oral presentation of twelve papers. The symposium was well attended. The papers described the work conducted under the IAEA Regional Technical Co-operation Project ARCAL XXII (RLA/5/036) in several countries and also from national TC and Co-ordinated Research Projects.

1. Influence of timing on fertiliser N efficiency by wheat (**S.C. Lopez et al.**, **Argentina**).
2. Recovery of ^{15}N labelled fertiliser by wheat and residual N in the soil under three management systems in an Ultisol, IX Region, Chile (**J.L. Rouanet et al., Chile**).
3. Evaluation of N cycling in a common bean-maize-common bean rotation using the isotopic method (**O. Muñiz et al.**, **Cuba**).
4. Recovery of labelled fertiliser N by maize under a conservation tillage system in the Central Plains of Venezuela (**Evelin Cabrera de Bisbal et al., Venezuela**).
5. Nitrogen use and efficiency in a rotation with and without incorporation of crop residues in a volcanic soil (**E. Zagal et al., Chile**).
6. N (^{15}N) uptake by strawberry in the Bajio region of Mexico (**A. Vera-Nuñez et al., Mexico**).
7. Efficiency of fertiliser N (^{15}N) application in peach trees (**A. Nario et al., Chile**).
8. Efficiency of fertiliser N (^{15}N) application on grapes var.Sultanina (I**. Pino et al., Chile**).
9. Efficiency of use of nitrogen fertilisers in maize and common bean in Guatemala (**M. Garcia, Guatemala**).
10. Efficiency of green manures (*Crotalaria* and *Mucuna*) applied alone or combined with urea as sources of N for rice (**T. Muraoka et al., Brazil**).
11. Evaluation of symbiotic nitrogen fixation in lupins (*Lupinus albus* and *Lupinus angustifolius*) in a Vilcun Andisol by means of isotopic techniques (**L. Barrientos et al., Chile**).
12. Management of fertiliser N in wheat cropped in volcanic soils (**I. Vidal et al., Chile).**

All of these presentations illustrated the application of the ^{15}N isotopic techniques under a variety of soil, crop and climatic conditions. It was demonstrated that the use of ^{15}N is a powerful tool to increase fertiliser N use efficiency by the crops and also the input of biological nitrogen fixation in grain legume and green manure crops, thus increasing crop productivity while protecting the environment.

The use of other isotopic (^{32}P, ^{137}Cs) and nuclear (neutron and gamma probes) techniques was presented in other Commissions.

The participants of the regional workshop held in Santiago, 4 - 6 November in the frame of the regional TC project ARCAL XXII received financial support from the IAEA Technical Co-operation Programme to attend the 14th Latin American Congress of Soil Science for presenting their work in this forum.

E. STATUS OF CO-ORDINATED RESEARCH PROJECTS

⇒ **Use of Nuclear Techniques for Developing Integrated Nutrient and Water Management Practices for Agroforestry Systems (D1.20.07)**
Project Officer: G. Keerthisinghe

Participating in this CRP are 9 contract holders: K. Aihou (Benin), B. Zhang (China), C. Ovalle Molina (Chile), C. Cervantes (Costa Rica), J.M. Ndufa (Kenya), Z. Rahman (Malaysia), S. Nissanka (Sri Lanka), P. Ebanyat (Uganda) and R. Chintu (Zambia); and 5 agreement holders: M. Adams (Australia), S. Recous (France), R. Buresh (ICRAF-Kenya), N. Sanginga (IITA-Nigeria) and M. Smith (UK). All contract holders have initiated field trials in accordance with the work plan and experimental guidelines established at the first RCM which was held in Vienna from 19 - 23 April 1999. The second RCM is tentatively scheduled for May 2001.

⇒ **Use of Isotope Techniques in Studies on the Management of Organic Matter and Nutrient Turnover for Increased, Sustainable Agricultural Production and Environmental Preservation (D1.40.08)**
Project Officer: G. Keerthisinghe

This CRP is in the second phase of operations, with 10 contract holders: S.M. Rahman (Bangladesh), K. Reichardt (Brazil), E. Zagal (Chile), J.Y. Wang (China), M.S.A. Safwat (Egypt), R. Abu Bakar (Malaysia), M. Ismaili (Morocco), J.Z. Castellanos (Mexico), R. Sangakkara (Sri Lanka) and Phan thi Cong (Viet Nam); and 5 agreement holders: D.F. Herridge (Australia), R. Merckx (Belgium), O.P. Rupela (ICRISAT-India), C. van Kessel (USA) and D.S. Powlson (UK). The progress of the project was evaluated at the third RCM which was held in Rabat, Morocco from 6 - 10 September 1999. All contract holders have field studies under way to determine the role of residue management practices in crop production and soil fertility. A minimum data set will be collected from each experimental site for validation of models to obtain information for the development of effective residue management practices for a wide range of environments. The final RCM is scheduled for March 2001 in Kuala Lumpur, Malaysia.

⇒ **Use of Nuclear and Related Techniques for Evaluating the Agronomic Effectiveness of Phosphate Fertilisers, in Particular Rock Phosphates (D1.50.03)**
Project Officer: F. Zapata

The fourth and final RCM was held in Vienna, 16 - 20 November 1998. The final report of the project is available upon request to the Project Officer. The administrative procedures to terminate the project have been completed. Participating scientists have been very effective in developing manuscripts from the research work carried out in the CRP. By the end of June 1999, a total of 52 manuscripts (or 634 pages A-4 format) have been received from the participants for inclusion in the final publication. Twelve manuscripts have been selected for an external peer-reviewed publication in a scientific journal and the remaining 40 manuscripts will be included in the IAEA TECDOC of the CRP. Dr. Frank Sikora, University of Kentucky, USA is responsible for the technical editing of the manuscripts. Ms. Lee Heng, Soil Science Unit, Seibersdorf, is creating a database with the available information to test and validate the P submodel of DSSAT. Progress has been made in collecting information on the standard characterisation of soils and phosphate rocks as part of a report to IMPHOS, who provided extrabudgetary funding for the project. These data need to be related to the response

obtained in the field and greenhouse trials. Messrs. A. Benjelloun, J.C. Fardeau, D. Montange, Truong Binh and F. Zapata are involved in this task. If and when necessary, participants will be requested to provide additional information.

⇒ **Assessment of Soil Erosion Through the Use of Cesium-137 and Related Techniques as a Basis for Soil Conservation, Sustainable Production and Environmental Protection (D1.50.05)**
Project Officer: F. Zapata

This project is being implemented together with another project on sedimentation co-ordinated by the Isotope Hydrology Section, Division of Physical and Chemical Sciences (Project Officer: E. García Agudo).

The soil erosion CRP has currently 16 participants, of whom 11 are contract holders: A. Buján (Argentina), O. Bacchi (Brazil), A. Ellies (Chile), X. Zhang (China), L. Hua (China), S. Theocharopoulos (Greece), B. Damnati (Morocco), I. Ionita (Romania), V. Golosov (Russian Federation), E. Fulajtar (Slovakia) and H. Nemasasi (Zimbabwe); 1 is a technical contract holder: D.E. Walling (UK); and 4 are agreement holders: P. Wallbrink (Australia), D. Pennock (Canada), J.C. Ritchie (USA) and F. Penning de Vries (IBSRAM-Thailand).

The sedimentation CRP will be terminated in July 2000 and the soil erosion CRP is expected to terminate in May 2001. The importance of the final reports to be prepared by the participants was stressed by the Scientific Secretaries during the Third RCM in Barcelona. Particular attention should be given to the following points:

(a) The need to focus on ongoing work and not to undertake new studies.
(b) To complete the background information required on all sites.
(c) To describe and critically analyse the methodology used and the results gained on the basis of the literature and discussions at the RCM. The analysis should be made in the context of the objectives of the CRP.
(d) To include the agricultural and environmental implications of the work.

A mid-term review of the soil erosion CRP was made in August/September 1999 and the continuation of the CRP beyond three years (until 2001) was approved. Significant progress has been made towards a harmonised application of the ^{137}Cs techniques by the CRPs participants, and increased human and institutional capacities for soil erosion and sedimentation studies have been established. Similarly, most of the participating scientists have presented their results in scientific meetings and published them in scientific and technical journals. The work of the participants has greatly broadened the range of environments in which the technique has been successfully applied, and a considerable amount of data on erosion and sedimentation rates has been generated for these areas. In view of the above, it has also been recognised that the production of a handbook on the technique would be desirable to further enhance this progress. After the Consultants Meeting on this topic, the preparation of the handbook is being co-ordinated by both scientific secretaries as one of the main outputs of the CRPs.

The testing of the calibration models for calculating soil loss or gain has only been possible in a few studies. Further work to test these models is required although the participants recognised that opportunities are limited. In this regard, an updated (revised) version of the software Csmodel1.exe for the calibration models developed by Walling and He is available at the following website: ftp://ftp.iaea.org/dist/gnip/ripc_ihs/csmodel/.

The work "Bibliography of publications of Cs-137 studies related to erosion and sediment deposition" by Jerry C. and Carole A. Ritchie is available on the Internet. The location is <http://hydrolab.arsusda.gov/cesium137bib.htm>. It can be viewed with an Acrobat Reader. Corrections/additions, etc. are most welcome. Please send them to J. Ritchie at <jritchie@hydrolab.arsusda.gov> for incorporation into the next version, which will be updated periodically.

⇒ **The Use of Nuclear and Related Techniques in the Management of Nutrients and Water in Rainfed Arid and Semi-arid Areas for Increasing Crop Production (D1.20.06)**
Project Officer: P. Moutonnet

This project has presently 18 participants, 13 of whom are contract holders: D.R. Prieto (Argentina), G.X. Cai (China), M.S. Sachdev (India), V.R. Maparla (India), M.J.M. Rusan (Jordan), I.V. Sijali (Kenya), K. El Mejahed (Morocco), I. Mahaman (Niger), M.M. Iqbal (Pakistan), M. Sene (Sénégal), N.E.D. Sharabi (Syria), M. Mechergui (Tunisia) and T. Sithole (Zimbabwe); and 5 agreement holders: F. Maraux (France), R.J.K. Myers (ICRISAT-India), A. Bationo (IFDC/ICRISAT-Niger), S. Asseng (CSIRO-Australia) and J. Ryan (ICARDA-Syria). The first RCM was held in Vienna, 6 - 10 July 1998. The research programme was discussed and the guidelines established for the next cropping seasons. The first field experiments are being implemented during the 1998/1999 agricultural season. The second RCM is scheduled for 6 - 10 March 2000 in Tunis, Tunisia.

⇒ **Use of Irradiated Sewage Sludge to Increase Soil Fertility and Crop Yields and to Preserve the Environment (D1.50.04)**
Project Officer: P.M. Chalk

The fourth and final RCM was held in Malaysia 20 - 24 September 1999. The Project Officer has prepared a report of the RCM for distribution to participants. All contract Holders prepared final project reports prior to the RCM, and a majority have prepared manuscripts for inclusion in an IAEA TECDOC. However, some contracts holders have to complete analysis of samples, interpretation of data, formulation of conclusions and preparation of final drafts of manuscripts. The Project Officer will edit manuscripts and prepare the TECDOC, which will include conclusions and guidelines for the irradiation of sewage sludge and its disposal on agricultural land. Participants are encouraged to prepare manuscripts for publication in scientific journals. The Project Officer will prepare a CRP evaluation sheet 12 months after completion of the project.

F. LABORATORY ACTIVITIES

RESEARCH

⇒ **Estimating plant N uptake from organic residues using a new approach to ^{15}N isotope dilution**

Research Co-ordinator: Ms. R. Hood

Preliminary experiments were conducted to determine the efficacy of the ^{15}N isotope dilution approach for estimating crop nitrogen (N) uptake from organic residues. It was apparent from these studies that simultaneous application of residues and fertiliser gave erroneous results. Therefore an alternative method to measure N release from organic residues indirectly was required (Hood *et al.*, 1999, Plant Soil. 208, 259-270.). Pool substitution, as described by Powlson and Barraclough (1993, *In* Nitrogen Isotope Techniques. Eds Knowles and Blackburn. pp. 209-242. Academic Press, Inc.) was identified as the possible cause of this discrepancy between the direct (i.e. ^{15}N-labelled residues) and indirect techniques. In a Consultants meeting convened in 1997 (See Soils Newsletter, Dec., 1997) with Drs. Roel Merckx, Erik Steen Jensen, and David Powlson, it was hypothesised that by pre-labelling the soil with ^{15}N, some of the problems associated with pool substitution could be overcome, which would allow the development of a new indirect method.

In this method the soil is pre-labelled by adding an inorganic N fertiliser with a carbon source and allowing the soil to stabilise prior to application of the residues. Experiments were established using a cross-labelling design that allowed the soil pre-labelling approach to be tested against the direct method. Results from greenhouse experiments were encouraging (Hood *et al.*, in press) and thus field experiments were initiated.

^{15}N-labelled or non-labelled fertiliser nitrogen and carbon in the form of finely ground straw were added to plots of Seibersdorf clay loam in October 1997. In May 1998, 24:1 and 12:1 C:N ratio plots received 150 kg N ha^{-1} in the form of labelled or unlabelled common bean (*Phaseolus vulgaris* L.) or soybean (*Glycine max* L. Merr.) residues. Control plots received no residues. Plots were sown with ryegrass (*Lolium perenne* L.), demand irrigated and harvested in late September 1998. In the 12:1 C:N ratio plots N derived from common bean residues (Ndfr) was 7 and 18 kg N ha^{-1} estimated using the direct or indirect methods, respectively. Ndfr from soybean residues was 8 and 9 kg N ha^{-1} from direct and indirect methods, respectively. In the 24:1 C:N ratio plots Ndfr from the common bean residues was 5 kg N ha^{-1} using the direct approach and 3 kg N ha^{-1} using the indirect approach. Ndfr from the soybean residue was 7 kg N ha^{-1} estimated using both the direct and indirect approaches. The results suggested that the technique was not achieving accurate estimates at very low N contributions, as shown in the common bean residue treatment. The technique may not be able to detect contributions of less than 10 kg N ha^{-1} from crop residues.

An alternative method of soil pre-labelling was therefore tested. Again a cross-labelling approach was adopted on Seibersdorf soil. Eight plots (10 x 4 m) that had been used to grow ^{15}N- and ^{14}N-labelled material and managed identically in the 1997 growing season were used. In May 1998, the plots received 150 kg N ha^{-1}, in the form of residues; controls received no residues. All plots were sown with maize (*Zea mays* L.), demand irrigated and harvested in early October. Average Ndfr across plots from the soybean residues was 31 kg N ha^{-1} estimated directly and 29 kg N ha^{-1} estimated indirectly. Ndfr from the common bean residue was 17 and 19 kg N ha^{-1} estimated directly and indirectly, respectively (Fig. 1).

A better parameter for comparison of the two techniques may be percentage Ndfr which is yield-independent. %Ndfr in the direct common bean plots was 11.5% vs. 13.5% in the indirect plots. Percentage Ndfr from soybean residues in the maize plants was significantly higher than the %Ndfr from common bean residues, but direct and indirect estimates were not significantly different ($P > 0.05$) (Fig. 2).

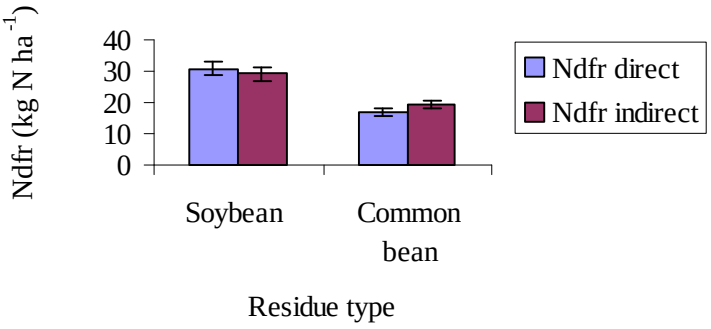

Figure 1. Ndfr calculated using the direct and indirect approach in the field . Error bars are plus and minus standard error.

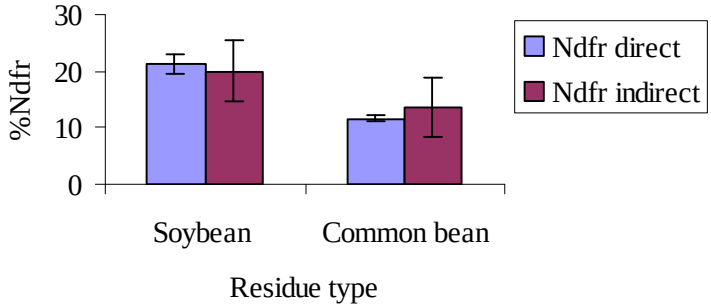

Figure 2. % Ndfr calculated using the direct and indirect approach in the field. Error bars are plus and minus standard error.

These results demonstrate that using a previously labelled and cropped soil is a reliable method of pre-labelling soil for subsequent determination of plant N uptake from organic residues. The use of ^{15}N dilution in combination with this soil pre-labelling approach gives similar results to those obtained using direct ^{15}N estimates of Ndfr. This indirect technique is being further tested in the field with pig and poultry manure and sewage sludge. The technique is also being pilot tested in Malaysia and Kenya under the guidance of Drs. Zaharah Rahman and James Kmiri Ndufa, respectively.

⇒ **^{13}C Abundance in water soluble organic C**

Cost-free intern: Mr. K. McTiernan, Institute of Grassland and Environmental Research, UK

Research Collaborators: Ms. R. Hood, Mr. L. Mayr

Soluble organic carbon (WE-SOC) has been identified as having a major influence on nutrient cycling and gaseous losses in agricultural systems. By gaining a comprehensive understanding of the sources, sinks and turnover time of WE-SOC better predictions of nutrient losses can be made. Measurement of the ^{13}C abundance in the soluble carbon fraction was made by connecting the total organic carbon (TOC) analyser to the mass spectrometer. The operating principle of the TOC analyser is that the sample is purged with phosphoric acid to eliminate all inorganic carbon as CO_2, which is then vented to waste. A sub-sample is taken and a peroxide-UV oxidation breaks down all the organic carbon to CO_2, and this is measured using infra-red gas analysis. By connecting the detector outflow pipe to a cryogenic trap it was possible to condense the carbon dioxide and determine the $^{13}C/^{12}C$ ratios of the soluble organic carbon by mass spectrometry.

The experiments were completed and the results will be published in an international journal and presented at the British stable isotope mass spectrometers users group meeting (SIMSUG 2000). Initial results suggest that soil drainage has a major influence on WE-SOC residence time whereas a current crop has little or no influence.

⇒ **Evaluation of the Pi-strip technique under fertigation**

Research Co-ordinator: Ms. Lee Heng

Research Fellow: Mr Abderrazzak Bentassil, Morocco

An experiment was carried out during a 6-month fellowship training on isotopic techniques in water management, to evaluate the Pi-strip technique for the assessment of soil phosphate status under fertigation. Tomato plants were grown on two soils (a sand and the Seibersdorf soil) in large 50-litre pots in the glasshouse. Mono potassium phosphate and ^{15}N-labelled fertilizer were applied through drip irrigation (fertigation), and water and nutrients were monitored using TDR probes, mini-suction cups and Pi-strips, inserted at various depth and radial distances from the plants. The analysis of the results is currently underway.

⇒ **Comparison of soil moisture measuring techniques**

Research Co-ordinator: Ms. Lee Heng

Research Fellow: Mr Abderrazzak Bentassil, Morocco

A field experiment on the movement of ^{15}N-labelled fertilizer under a maize crop, in the presence and absence of both surface cover ("Leca" mulch) and sprinkler irrigation was carried out in June 1999. The isotopic signatures of soil water (D, ^{18}O) under the various treatments were also monitored. Three soil moisture measuring techniques were compared under the maize crop: neutron probes, TDR and a capacitance sensor. Tensiometers to monitor soil water potential and suction cups for the collection of soil solutions were also installed. Samples are presently being analysed.

TRAINING

⇒ **Fellows trained during 1999**

Ms. S.H. Syaukat, INS/98039, 5 months, organic residues
Mr. S. Rizal, INS/98040, 3 months, organic residues
Mr. B. Abidi, TUN/98025, 1 month, water use efficiency
Mr. M.A. Bentassil, MOR/98017, 6 months, water and fertiliser use efficiency
Mr. A.T.J. Koua, IVC/97008, 2 months, N and ^{15}N analyses by emission spectrometry
Ms. Z.B. Tumirin, MAL/99001, 2 months, N and ^{15}N analyses by emission spectrometry
Mr. L.B. Farahat, MOR/98012, 2 months, N and ^{15}N analyses by emission spectrometry
Mr. A.P. Lugoloobi, UGA/99023, 2 months, N and ^{15}N analyses by emission spectrometry

⇒ **Scientific Visitors received during 1999**

Mr. L. Badimbayi-Matu, ZAI/99001
Mr. T. Loewy, ARG/98052
Ms. M.A. Nario Mouat, CHI/99013
Mr. M. Janat, SYR/99035
Mr. N. Ibragimov, UZB/99020
Mr. S. Nurmatov, UZB/99021
Ms. A. N'Goran, IVC/99010

SUPPORTIVE SERVICES

⇒ **Elemental and isotope analyses**

9000 samples were analysed during the first ten months of 1999 for total N and ^{15}N as well as C and ^{13}C.

Source of samples	**N and ^{15}N**	**C and ^{13}C**
TCPs	530	
CRPs	4115	212
Research and training	1671	346
Quality assurance	1850	227
Total	**8166**	**785**

EXTERNAL QUALITY ASSURANCE

⇒ **Interregional Project on "Quality Assurance in Analytical/Diagnostic Laboratories" (INT/2/010)**
Co-ordinator: Ms. M. Aigner

The objective of this 3-year project (1997-1999) was to establish Quality Assurance Programmes for counterpart laboratories for ^{15}N measurements and to identify a network of IAEA-recognised regional laboratories to sustain the QA programme. Three rounds of proficiency testing exercises on total N and ^{15}N abundance analysis of plant materials were successfully conducted, Standard Operating procedures (SPOs) have been written by the

participants in English and Internal Reference Materials have been produced following the guidelines given in the QA-handbook[1] provided during the first workshop (Irapuato, Mexico, March 1998).

- **Second Co-ordination Workshop, Seibersdorf Laboratories, Austria, 6 - 12 September 1999**

Eleven participants from 4 regions concerned with ^{15}N analysis by OES were trained in the implementation of a basic quality system in analytical laboratories, i.e. method validation, assessment of instrument performance and the use of quality control (QC-) charts. Two days of practical demonstrations on QC-measures applied in the Kjeldahl total N analysis and OES ^{15}N analysis were performed. Two in-house experts on Quality Management (Mr. H. Aigner, Mr. A. Fagelj) presented lectures on the above topics. The participants had the opportunity for discussion in regional groups with representatives from the TC Department.

The current project will finish at the end of 1999. An extension of the project has been requested by the participants and a proposal for continuation of the project (phase II) is currently being elaborated by a working group formed during the workshop.

⇒ **Proficiency testing exercise on total N and ^{15}N analysis**
Co-ordinator: Ms. M. Aigner

The proficiency testing exercise ("**EQA99**") for 1999 on total N and ^{15}N analysis of plant materials included 15 participating laboratories from 5 regions. Results were submitted within the extended deadline and the evaluations were sent to participants in October 1999.

The next round ("**EQA2000**") is planned to start at the beginning of 2000. The analytical methods and instruments are chosen by the participants. Applications for participation in this cost-free service to Member States are welcome.

[1] "Quality Assurance Measures applied in total N and ^{15}N plant analysis" (M.Aigner, 1998)

G. PUBLICATIONS

⇒ **Printed**

- Arslan, A., Zapata, F. and Kumarasinghe, K.S. Carbon isotope discrimination as an indicator of water use efficiency of spring wheat as affected by salinity and gypsum addition. Commun. Soil Sci. Plant Anal. 30 (19 & 20), 2681-2693 (1999).
- Peña Cabriales, J.J. and Zapata F. (Eds.). 1999. "Aumento de la Fijación Biológica de Nitrógeno en el Frijol Común en América Latina". Spanish translation of the book "Enhancement of biological nitrogen fixation in common bean in Latin America", (Bliss, F.A. and Hardarson, G., Eds.). Kluwer Academic Publishers, Dordrecht, The Netherlands, 203 pp.
- Zapata F. and Chalk, P.M. 1999. Desarrollo de prácticas de manejo integrado del suelo, del agua y la nutrición de plantas en sistemas de cultivo en América Latina mediante el uso de técnicas nucleares y conexas. CD Rom. 14th Latin American Congress of Soil Science, Commission V: Soil Fertility and Plant Nutrition. Pucón, Temuco, Chile.

⇒ **In press**

- Chalk, P.M. Integrated effects of mineral nutrition on legume performance. Soil Biol. Biochem.
- Comparison of Soil Water Measurement Using the Neutron Scattering, Time Domain Reflectometry (TDR) and Capacitance Methods. Proceedings of a Consultants Meeting, Vienna, 23 - 25 November 1998. IAEA-TECDOC Series.

⇒ **In preparation**

- Bacchi, O., Reichardt, K. and Calvache, M. Neutron and Gamma Probes: Their Application in Agronomy. IAEA Training Course Series (English, French and Spanish versions).
- Garcia Agudo, E. and Zapata, F. Global soil inventories of ^{137}Cs: Standardization of field and laboratory measurements. Proceedings of the International Workshop on "Tracers in Global Circulation", ENRICH (European Network for Research in Global Change) Project, November 1999, Upsala, Sweden.
- Hood, R. The Use of Stable Isotopes in Soil Fertility Research. In: Soil Fertility and Crop Production. (Krishna, K.R. Ed). Springer Verlag, Heidelberg/New York.
- Urquiaga, S. and Zapata, F. "Manejo de la fertilización nitrogenada en cultivos anuales en América Latina" (In Spanish). IAEA Technical Manual Series.
- Zapata, F. and Garcia Agudo, E. Future prospects for the ^{137}Cs technique for estimating soil erosion and sedimentation rates. Acta Geologica Hispanica (special issue).
- Isotopic Methods in Soil Fertility and Water Management: A Manual. IAEA Training Course Series.
- Water Balance and Fertigation for Crop Improvement in West Asia. Results of a Technical Co-operation Project. IAEA-TECDOC Series.

- The Use of Nuclear Techniques for Optimizing Fertilizer Application Under Irrigated Wheat to Increase the Efficient Use of Nitrogen Fertilizer and Consequently Reduce Environmental Pollution. Results of a Co-ordinated Research Project. IAEA-TECDOC Series.
- The Use of Nuclear Techniques to Develop Management Practices for Increasing Crop Production and Soil Fertility in Acid Soils. Proceedings of a Consultants Meeting, Vienna, 1 - 3 March 1999. IAEA-TECDOC Series.
- The Use of Nuclear and Related Techniques for Evaluating the Agronomic Effectiveness of Phosphate Fertilisers, in Particular Rock Phosphate. Results of a Co-ordinated Research Project. IAEA-TECDOC Series.
- Evaluating the Agronomic Effectiveness of Phosphate Rocks Through the Use of Nuclear and Related Techniques. (Sikora, F.J. and Zapata, F. Eds.). Nutrient Cycling in Agroecosystems (special issue).
- Progress in the Worldwide Application of the ^{137}Cs Technique in Soil Erosion and Sedimentation Studies. (Queralt, I., Zapata, F. and Garcia Agudo, E. Eds.). Acta Geologica Hispanica (special issue).

H. FROM OUR READERS

⇒ 10th Nitrogen Workshop, The Royal Veterinary and Agricultural University, Copenhagen, Denmark, 23 - 26 August 1999

The workshop was organised into 4 technical sessions, each covering one day. The sessions were (i) Nitrogen cycling in low input agriculture (ii) Gaseous nitrogen exchange (iii) New methods for measuring and interpreting nitrogen cycling in terrestrial ecosystems (iv) Prospects for improving nitrogen use efficiency in high input agriculture. Each Session comprised an invited plenary lecture followed by 6 oral presentations. Poster presentations were also associated with each session, with 150 contributions in total. Five concurrent thematic working groups (TWG) were convened on each of two afternoons to review poster presentations and discuss emerging issues.

The meeting focused on the latest developments in nitrogen research. New methods were presented such as the use of radon isotopes for estimating diffusion for nitrogen gas studies and methods to measure ammonium compensation points in plants. Review papers covered the topics of N loss abatement, nitrogen mineralisation and N modelling.

The thematic working groups provided a forum to discuss issues in more detail. These included: (i) biological nitrogen fixation in low input systems, (ii) quality of organic material and N turnover, (iii) NH_3 and N_2O emission from animal manure, (iv) Soil factors affecting exchange of oxidised nitrogen compounds between soil and atmosphere, (v) optimisation of N use efficiency with respect to crop rotation, (vi) strategies of using catch crops for reducing N losses in relation to N nutrition of the following crop, (vii) measurement and modelling of NH_3 fluxes within European ecosystems, (viii) modelling of N cycling and losses, (ix) measurement of gross N fluxes in the soil, and (x) pool substitution: can we beat it?

There was general consensus that we are currently limited in our ability to manage N fertiliser efficiently as there is a fundamental lack of understanding in the areas of N mineralisation and immobilisation, and a paucity of data on N losses, below-ground N inputs from legumes and N inputs from manures and complex organic fertilisers.

A general theme of the conference was reduction of N losses from an environmental perspective. Various management strategies to reduce N losses in farming systems were highlighted:

- Animal and crop production should be kept in close harmony to allow for maximum N utilisation. It was emphasised that one of the problems with modern agriculture is that there has been an increasing shift to either animal units or crop units causing problems of waste management and decreasing soil organic matter.
- Fertiliser N recommendations should be set at 10% below maximal yield. This would probably not have a significant effect on yields but would reduce N losses substantially.
- Cover crops should be used to reduce N losses and reduce resultant acidification.
- Covering manure heaps or effluent ponds significantly reduced N losses. Covers could be straw, etc.
- Lowering total N input in fodder, and supplementation with specific amino acids, could reduce N losses from animal manure.

- Use of straw in housing of animals could significantly reduce N losses. Hosing of animal effluent from housing rather than scraping is better, and the longer the effluent is left to stand the greater the N loss from the material.
- Use of decision support systems to improve crop rotations may have a significant role to play.

It was stressed throughout the conference that research in soil science leads to knowledge-based changes in management, which in turn lead to increased food production and reduced environmental impact.

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⇒ **XXIXth Annual Meeting of ESN (European Society for New Methods in Agricultural Research) and of the working group soil to plant transfer of UIR in Wye, UK, 8 - 12 September 1999. Report of the Chairman of working group 3 (soil-plant relationships)**

The annual meeting was well attended, and of a total of 42 papers, 25 were presented orally and 17 as posters by scientists originating from 15 countries.

The first papers dealt with recent developments in terrestrial radioecology, addressing both agricultural and semi-natural environments (12 oral presentations, 2 posters). Mitchell (U.K.) reported on the present status of the fluxdatabase of UIR, which, due to its 17000 entries provides an excellent basis for applying or testing new model approaches. One paper was presented on the upward movement of mobile (Na, Cl) and less mobile (Cs) radionuclides in soil columns (Wadey/UK). Skarlou/Greece and Goncharova/Byelorussia highlighted important impact factors on soil-plant transfer of Cs and Sr such as soil pH and ageing of contaminants/hot particles. Two presentations (Kirchner/Germany, Konopleva/Russia) focused on successful approaches to describe plant uptake of Cs and Sr taking into account ion competition in soil. Klemt/Germany presented an interesting model to estimate Cs-transfer to roe deer and highlighted the importance of mushrooms in this respect. The important role of fungi for Cs-dynamics in forest soil was confirmed by the data of Nikolova/Bulgaria. Spiridonov/Russia presented a radioecological model describing Cs-dynamics in forest ecosystems. The FORESTLAND/FORTREE model is parameterised for both deciduous and coniferous forests. A set of three papers (Tkachenko/Ukraine, Goncharova/Byelorussia, Oncsik/Hungary) focused on countermeasures. It became evident that the effect of applications of macro- and micronutrients, clay minerals and zeolithes on radionuclide soil-plant transfer is highly site specific and needs consideration of soil properties. Two papers described the long-term impact of radionuclide contamination on the collective dose of the population (Kravets/Ukraine, Goncharova/Byelorussia).

The effect of soil and plant management on soil properties was addressed in several papers, including addition of soil conditioners on physical characteristics (Sheta/Libya), the impact of scots pine originating from different countries on soil microbial activity (Kieliszewska-Rokicka/Poland) and the consequences of slash and burn agriculture on soil fertility in Indonesia (Ketterings/USA). The impact of heavy metal contaminations of soil was addressed by various papers (Kovácz/Hungary, Shumik/Ukraine, Roxana/Romania, Bujtas/Hungary). The latter author presented an interesting approach using mobile heavy metal fractions to predict heavy metal plant uptake. The impact of P fertilisers on trace element uptake through alteration of soil pH was demonstrated by the paper of Osztoics/Hungary. Stanica/Romania presented interesting results on heavy metal contamination of apple trees with varying distances from a highway. N dynamics in the soil/plant system was again one of the main topics of this meeting. Gerzabek (Austria) evaluated the possibilities to use ^{15}N natural abundance to quantify N turnover from organic manures. Hejnak (Czech Republic) used ^{15}N applications to quantify the impact of soil pH on N utilisation. Another ten papers focused on the efficient use of N fertilisers or other macronutrients (Nankova/Bulgaria, Gökman/Turkey, Budoi/Romania) including the impact of cereal varieties and the description of models to optimise fertiliser applications.

One session focused on economical aspects of fertiliser application in Turkey. A series of four oral presentations and three posters elaborated both on specific questions related to crops grown in Tokat province (Akca/Turkey) and general topics of global input-output analysis in the fertiliser sector or the suitability of organic farming for less developed countries (Karkacier/Turkey, Esengün/Turkey, Kizilaslan/Turkey, Akcay/Turkey).

In summary, the meeting was characterised by interesting and relevant presentations and lively discussions in all sessions and an enjoyable environment provided by our host institution. The proceedings of the meeting will be published later this year.

The XXXth annual meeting of ESN will be held in Keszthely/Hungary from 26 - 30 August 1999 (information: Prof. A. Szabo, e-mail: H9623MED@ELLA.HU)

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