SOILS NEWSLETTER

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

This is the first newsletter of the 1999-2000 biennium, which is the time span on which the Agency bases its current Programme of Work and Budget (PWB). The PWB for the next biennium is formulated approximately 18 months in advance, and so the Sub-programme has already commenced planning for the IAEA 2001-2002 biennium. Of particular importance are concepts and planning for new Co-ordinated Research Projects (CRPs) to commence during the next biennium. In this process we are adhering to several recommendations made by the 1996 expert review of the Sub-programme. In the first instance, our strategy is to develop integrated soil, nutrient and water management practices for sustained crop production within defined agroecological zones or cropping systems. Secondly, our research strategy involves a modelling component in order that site- and season-specific results can be integrated and then extrapolated to other regions. Thirdly, we are attempting to link with existing research networks or consortia involving national and international agricultural research centres and other advanced research institutions. These partnerships are mutually beneficial because we provide funding for introducing nuclear-based and other relevant non-nuclear technologies to engender added value to the research effort, while taking advantage of existing experiments, expertise and established lines of communication. Furthermore, we promote the networks by convening research co-ordination meetings of all participating scientists every 18-24 months.

A large range of well-established and emerging nuclear-based technologies can be applied within the Sub-programme to provide unique information on nutrient and water fluxes in the soil-plant-atmosphere continuum. Foremost amongst these are tracer techniques based either on artificial enrichment or natural variations in isotopic composition between components or phases of the system. The past emphasis in the Sub-programme has been on the introduction of materials enriched in a stable or radioactive isotope of the element under study. Current legislation in several countries restricts the use of certain radioactive isotopes (unsealed sources) previously widely used in agricultural research, e.g. ^{14}C, ^{32}P. Therefore, wherever and whenever possible, stable isotopes (e.g. ^{13}C, ^{34}S) are being used as tracers. The Sub-programme has a policy of promoting the use of natural variations in stable isotope composition as tracers while maintaining its traditional use of ^{15}N and other isotopically-enriched materials. To this end, we have developed facilities at the Soil Science Unit, Seibersdorf, for ^{13}C analysis, and we are developing sample preparation procedures and mass spectrometer facilities for deuterium (D) and $\delta^{18}O$ analyses. This analytical capability is crucial to the success of ongoing and planned research activities in developing countries which are attempting to make full use of advanced nuclear-based techniques.

A new CRP will be implemented in the current biennium. A full description of this CRP (acid soils) is to be found in the present Newsletter. This CRP embodies the new research strategy described above. Another major activity to be undertaken during the present biennium is the convening of an International Symposium on *Nuclear Techniques for Developing Sustainable Soil, Water and Nutrient Management Practices*, to be held at HQ in Vienna during the week of 16 - 20 October 2000, precisely five years after the previous Symposium. Information is currently being prepared in both electronic and printed form for distribution to potential participants. We look forward to your active participation in this important event.

The Sub-programme has the mandate to provide the technical expertise required to implement projects in the area of technical co-operation. New projects initiated in the current biennium cover a range of priority areas within the Sub-programme, namely, efficient use of scarce water resources, efficient use of inorganic and organic fertiliser sources, biofertilisers, reclamation of degraded soils, evaluation of germplasm for tolerance to stress factors. Several of these TC projects are so-called "Model Projects". The established criteria for Model Projects are that they must (i) respond to a real need of the country, (ii) produce significant economic or social impact through the end user, (iii) reflect an indispensable role for nuclear technology with distinct advantages over other approaches, and (iv) demonstrate sustainability through strong government commitment. Proposals for new TC projects within the 2001-2002 biennium should be prepared and submitted before the end of this year. The TC Project Request Form (April 1999) together with instructions can be obtained from the Internet <http://www.iaea.or.at/worldatom/program/tc/tcprefsform.html> or from your National Atomic Energy Authority. The professional officers of the Sub-programme would be happy to provide advice on the formulation of TC projects. In some cases, Proposals for Research Contracts which cannot be funded from the Research Contracts Programme because they are not linked to an on-going activity, could qualify for support from the Technical Co-operation Programme.

You will recall that we solicited information in the last Newsletter to update our mailing list. The response to this request was excellent. However, it is a continuing and difficult task to maintain accurate records of addresses and affiliations. It can only be done through your timely intervention. The introduction of a computer-based, Agency-wide Office Contacts Information System will in future help in this regard. Another difficulty we face is the lag time of several months between printing of the Newsletter and receipt at your address. For some, this problem can be overcome by accessing our web-site where the Newsletter is reproduced. We are in the process of updating this web-site and I urge you to make full use of it.

With my very best wishes.

Phillip M. Chalk
Head, Soil and Water Management
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B. STAFF

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3. Staff changes

Craig Atkins, University of Western Australia, left the Soil Science Unit in January 1999 after a 6-month sabbatical. He worked on an FAO Bulletin on biological nitrogen fixation and

on stable isotope tracing of water movement in soil-plant systems. He also advised the Sub-programme on Strategic Planning.

Robina Shaheen joined the Soil Science Unit in March 1999 as a Junior Professional Officer. Robina is on leave for one year from the Pakistan Atomic Energy Commission, Nuclear Institute for Agriculture and Biology, Faisalabad. She will be screening different crops for salt and drought tolerance using stable isotopes (D, ^{18}O, ^{13}C).

Seta Balian left the Section in June 1999 and **Lucia Kruzic** joined the Section at the same time as part of a Divisional rearrangement of secretarial staff.

A warm welcome is extended to Robina and Lucia, and our sincere thanks to Craig and Seta for their contributions to the work of the Sub-programme.

C. FUTURE 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 are expected to participate in this RCM. Gamini Keerthisinghe is the Project Officer, and will serve as the Scientific Secretary for the meeting. Ismaili Mohammed, Université Moulay Ismail, Meknes, Morocco, is the local organiser. The participants will present the major results and conclusions of their research. The presented data will be fully discussed, and the implications for enhancing sustainable agricultural production examined.

⇒ **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**

Twelve contract holders and 5 agreement holders or their representatives are expected to participate in the fourth RCM. Ms. Che Fauziah Ishak, Universiti Putra Malaysia, is the local organiser. The research carried out during the duration of the CRP (1995-1999) will be reviewed and discussed, and the achievements will be evaluated in accordance with the project objectives. Deadlines for the receipt of manuscripts for inclusion in a TECDOC and for the receipt of final reports have been set for 30 June and 31 July, respectively. Mr. Phillip Chalk is the Project Officer and will serve as the Scientific Secretary for the meeting.

⇒ **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 4 agreement holders of this CRP plus 10 participants of the sedimentation CRP co-ordinated by the Isotope Hydrology Section are expected to participate in this RCM. F. Zapata and E. García Agudo will serve as the Scientific Secretaries. Ignasi Queralt Mitjans, Institute of Earth Sciences, CSIC, Spain will be the local organiser. This RCM will be the final one for the sedimentation CRP. Therefore, each participant will make a presentation on the results achieved and conclusions drawn on the research conducted in the framework of the project. The meeting will synthesise the results of the presentations and formulate general conclusions and recommendations. It has also been agreed to publish the reports of the meeting in a special issue of the journal Acta Geologica Hispanica.

⇒ **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 4 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 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, April 2000**

A new CRP was approved in March this year for a duration of five years. This CRP will address the sustainable agricultural production of tropical acid soils along three main lines of investigation: (i) utilisation of acid-tolerant and P-efficient plant genotypes, (ii) addressing issues of acid soil infertility, 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 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. Recruitment for research contract and agreement holders is underway. It is expected that 10 contracts and 5 agreements will be awarded. The first co-ordination meeting is anticipated at IAEA Headquarters, April 2000 (exact dates to be determined later), for examining the overall work plan and finalising experimental guidelines as recommended earlier by the Consultants' Meeting. Felipe Zapata is the Project Officer and will serve as Scientific Secretary for the meeting.

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)**

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.

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

The main purpose of this seminar will be to discuss the extension activities of the project. All counterparts and their extension personnel are expected to participate at this seminar. They will be presenting 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 potential

socio-economic impact of the project. Lionel Gunaratne, Department of Export Agriculture, Matale, Sri Lanka, will be the local organiser of the seminar.

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

This regional project is in the second phase of implementation with 8 participating countries: Argentina, Brazil, Chile, Cuba, Guatemala, Mexico, Uruguay and Venezuela. Felipe Zapata is the Technical Officer. The activities initiated in the first phase are expected to be fully completed, and new initiatives such as the phosphate studies will be implemented to ensure the sustainability of the technological package being developed.

According to the Activity Plan of the project, the following three manuals are in an advanced stage of preparation and should all be published this year:

- N fertilisation of annual crops. Co-ordinator/editor: Dr. Segundo Urquiaga.
- Biological nitrogen fixation studies. Co-ordinator/editor: Dr. Juan José Peña Cabriales.
- Efficient use of water in agriculture. Co-ordinator/editor: Dr. T. Muraoka.

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 has been submitted to the IAEA and is being circulated among the Member States of the Latin American region for endorsement.

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

Participants will present a summarised report of the main results obtained in the field trials and conclusions and recommendations will be drawn from these results.

Following the workshop, the XIV Latin American Congress of Soil Science will be held in Temuco, Chile, 8 - 12 November 1999. The IAEA may provide some financial support to participants in order that they can present the results from the regional network of field trials and other aspects related to the implementation of the regional TC project, at the Congress.

- **Third Co-ordination Meeting, Oaxaca, Mexico, 24 - 28 January 2000**

During this meeting the Project Co-ordinators will discuss mechanisms to be adopted within each country for the transfer of results obtained in the first phase to farmers. The strategies to be considered: 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. This will be discussed in detail during the meeting.

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

This regional project was initiated in 1999 involving Iran, Jordan, Lebanon, Saudi Arabia, Syria, United Arab Emirates and Yemen. It follows on from a previous Regional TCP (RAW/5/002) in which scientists from the same countries (except Yemen) were introduced to

the principles and practice of fertigation. The current project will further promote the technology by conducting both "on-station" and "on-farm" trials. Pierre Moutonnet is the Technical Officer.

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

All country representatives will present 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-Chairmahi, will be the local organiser of the meeting.

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

- **In-country workshops**

Workshops will be held in Iran (June 1999), Syria and Pakistan (August 1999) and Tunisia and Morocco (November 1999). Team members from the counterpart institutions in these countries will present the results of their work done. The project management from the IAEA will also participate. Details of future activities will be delineated.

- **Second phase of the project**

While the first phase of the project ends in December 1999, the second 3-year phase will start on 1 January 2000. There is a possibility of including 2-3 additional countries in the project.

INTERNATIONAL SYMPOSIUM

⇒ **FAO/IAEA International Symposium on "Nuclear Techniques for Developing Sustainable Soil, Water and Nutrient Management Practices", Vienna, Austria, 16 - 20 October 2000**

Detailed planning for this major event in the Sub-programme calendar has commenced, and a call for contributions will be issued in the coming months. Limited financial support will be available to keynote speakers and participants from developing countries who make oral or poster presentations.

D. PAST EVENTS

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

⇒ **First RCM of CRP on "The Use of Nuclear Techniques for Developing Integrated Nutrient and Water Management Practices for Agroforestry Systems" (D1.20.07), Vienna, Austria, 19 - 23 April 1999**

This new CRP was approved in 1998 for an estimated duration of seven years. Gamini Keerthisinghe is its Project Officer, and served as the Scientific Secretary for the meeting. Nine contract holders, 5 agreement holders and the staff of the Section and Soil Science Unit participated in this RCM. The main objective of this RCM was to discuss the overall work plan and to formulate guidelines for implementing the CRP. The main focus of this project will be on the nutrient and water benefits provided by trees in systems with production of crops. All participants made presentations of their research activities related to this CRP and discussions were held in establishing experimental protocols in accordance with the project objectives. It was recommended that national counterparts remain flexible in their selection of crops, trees, tree-crop configurations and management practices to ensure that local needs and conditions are well addressed. The main nuclear techniques involved are (i) ^{15}N injection techniques for direct labelling of trees, (ii) delta ^{13}C shift for investigating soil organic matter dynamics, and (iii) soil moisture neutron probe and delta ^{18}O to study the effects of trees on movement of water and availability to crops. The RCM was successful in achieving its objectives.

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)**

- **Regional Group Training on "Fertigation and the Use of Nuclear Techniques in Water and Nutrient Management", Amman, Jordan, 10 - 21 April 1999**

Dr. M. Omari (MEMR) acted as the Course Director and Prof. M.J. Mohammad Rusan (JUST-Irbid) as the Scientific Co-ordinator. Two IAEA staff members participated in the training: Ms. Lee Heng (Soil Science Unit, Seibersdorf) and P. Moutonnet (Technical Officer of this regional TCP). There were a total of 11 regular trainees from 5 countries of West Asia, plus 5 observers.

The programme of the course consisted of the following main subjects:

- Fertiliser and water use efficiency evaluation using nuclear techniques.
- Soil water measurement under fertigation.
- Localised-irrigation scheduling.
- Assessment of mineral nitrogen and potential losses through leaching.
- Soil water balance evaluation using neutron probes and a set of tensiometers.
- Practical exercises on field fertigation studies.

Out of 9 working days, 4 were spent at laboratories or in the field for practical exercises. The training was very much appreciated. An advanced course should be organised in the year 2000.

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

- **Regional Workshop on "Uso Eficiente del Nitrógeno y del Agua en base a los resultados obtenidos en la Red de Ensayos de Campo", Buenos Aires, Argentina, 22 - 26 March 1999**

This regional event was hosted by the National Atomic Energy Commission of Argentina (CNEA) and was held at the "Centro Atómico Ezeiza" (CAE) with the following objectives: (i) to assess progress in implementation of the regional network of field trials, (ii) to determine strategies for the appropriate utilisation of nuclear techniques, and (iii) to formulate recommendations on enhanced nitrogen and water use efficiency in cropping systems for producers.

The workshop was attended by 15 participants from 8 participating Member States (Argentina, Brazil, Chile, Cuba, Guatemala, Mexico, Uruguay and Venezuela). The local organiser was Nestor Barbaro. It was evident from the country presentations that significant progress has been made in implementing the network of the field trials in this regional project. There has also been substantial commitment from the participating Member States in terms of human and financial resources for implementing these trials. It is recommended that this commitment be continued.

Significant, although differential, progress has been made in the application of nuclear techniques, i.e. ^{15}N isotope techniques and neutron moisture meter in the conduct of the field trials. While efforts in most places are concentrated on the development of efficient fertiliser N management practices, the integration of water use efficiency studies are still in the development stage. Training of local staff directly involved in the project was recommended.

Mechanisms and modalities for transfer/extension of generated technologies to larger groups of farming communities and producers are very complex and variable between the countries. It was recommended that strategies specific to each country be identified and carefully evaluated by the Project Co-ordinators for further consideration.

- **Technical Manuals**

A manual on the use of neutron moisture probes and their application in agriculture has been prepared by O. Bacchi, K. Reichardt and M. Calvache. It is planned to have it published as a part of the IAEA Training Manual Series. Technical editing was done by D. Nielsen and G. Vachaud. Advanced versions of the manual in English, French and Spanish are under review for language and minor technical editing. The final versions will be published upon the approval of the IAEA Publications Committee.

The book on "Enhancement of Biological Nitrogen Fixation of Common Bean in Latin America" (F.A. Bliss and G. Hardarson, eds.) was published in 1993 by Kluwer Academic Publishers, Dordrecht, The Netherlands. This book reports the research results generated in the framework of a CRP carried out during the period 1986-1991 in Latin America with participating scientists from Brazil, Chile, Colombia, Guatemala, Mexico, Peru and the USA. It

contains valuable information on the use of the ^{15}N isotope technique for identifying superior legume genotypes and rhizobial strains as an alternative nutrient source in the production of a basic staple food in Latin America. It also shows how a network of scientists can work together to solve common problems of relevance to agricultural production in a region. Unfortunately the book is a priced publication and is available only in English, both conditions being a serious constraint for its dissemination in the Latin American region. Within the framework of this regional TC project it was decided to translate the book into Spanish and make it an unpriced publication for wide distribution in the region.

The Spanish version (J.J. Peña Cabriales and F. Zapata, eds.) is basically the translation of the English book but includes three additional chapters from the Mexican and Chilean participants which were not included in the English book. The manuscript has been submitted to the IAEA Publications Committee for approval.

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

- **Co-ordination Meeting**

A Co-ordination Meeting was held in Tunis, Tunisia from 26 - 28 November, 1998. The meeting was inaugurated by the Hon. Mr. Mongi Safra, State Secretary, Prime Minister's Office, in charge of Research in Science and Technology, and the chief guest at the concluding session was the Hon. Mr. Ameur Horchani, State Secretary for Agriculture and Water Resources.

The National Co-ordinators from six participating countries made detailed presentations on the progress of the project in their respective countries. The IAEA Project Manager, an IAEA isotope hydrology expert and an IAEA expert in soil science were present for evaluating the work and future guidance. After comments and discussions on the progress of work, future activities were discussed and guidelines provided to all participants.

It was noted with satisfaction that the progress in some of the countries was good. However, it was necessary for a couple of the participating countries to redouble their efforts in order to catch up with the others.

- **Group Activity**

Together the National Co-ordinators visited the counterpart institutions in three of the participating countries, viz. Pakistan, Tunisia and Morocco (one week in each country). They visited the demonstration sites, farmers' fields and laboratories, and held detailed discussions with the counterparts. The personal acquaintances made in connection with the work and the other staff in the co-operating institutions is proving to be of benefit to the Co-ordinators in their own work and is encouraging ECDC. The IAEA Project Manager, and an IAEA expert joined the group for one week which assisted with technical backstopping and a better appreciation of the needs of the co-operating institutions was gained.

CONSULTANTS' MEETING

⇒ **Consultants' Meeting on "The Use of Nuclear Techniques to Develop Management Practices for Increasing Crop Production and Soil Fertility in Acid Soils", Vienna, Austria, 1 - 3 March 1999**

A consultants' meeting was convened to review advances on the sustainable management of tropical acid soils and to provide recommendations on the formulation and implementation of a new CRP on acid soils. The meeting was attended by six consultants, with expertise in tropical acid soils, drawn from international agricultural research centres and universities, together with staff members of the Section and Soil Science Unit, Seibersdorf. The six international consultants were: R. Thomas (CIAT-Colombia), R. Lefroy (IBSRAM-Thailand), S.H. Chien (IFDC-USA), K. Sahrawat (WARDA-Côte d'Ivoire), W.J. Horst (Germany) and T. Bachmann (FAO-Rome, Italy). The proceedings of the meeting will be published as an IAEA TECDOC. The consultants' presentations reviewed advances in approaches for the sustainable intensification of agricultural productivity in tropical acid soils in Latin America, Africa and South East Asia, and formulated a series of recommendations for the implementation of a new CRP. Based on the consultants' recommendations, a new project document was prepared and submitted to the Nuclear Application Research Contracts Sub-Committee for approval. Upon request, the report of the meeting is available in the Section.

NON-FAO/IAEA MEETING

⇒ **Regional Workshop (IMPHOS) on "Plant Nutrient Management under Pressurised Irrigation Systems in the Mediterranean Region", Amman, Jordan, 25 - 27 April 1999**

The Joint FAO/IAEA Division participated in the Scientific Committee in charge of the organisation of the workshop. The workshop programme included three keynote addresses and 15 lectures which were delivered through four plenary sessions: (i) water management, (ii) nutrient management under pressurised irrigation systems, (iii) fertigation with P fertilisers, and (iv) environmental and economic issues. The proceedings of the workshop will be published by ICARDA. It will include a text written by P. Moutonnet on the "Role of the FAO/IAEA programme in fertigation studies in the Mediterranean region".

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). A work plan and the experimental guidelines were established at the first RCM which was held in Vienna from 19 - 23 April 1999.

⇒ **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). 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 third RCM is scheduled for 6 - 10 September 1999 in Rabat, Morocco.

⇒ **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 corresponding final report of the project was prepared and sent to the participants in February 1999. This report is available upon request to the Project Officer. The administrative procedures to terminate the project have started. Meanwhile corrected/new manuscripts from the participants have been received for inclusion in the final publication. Dr. Frank Sikora, University of Kentucky, USA, has undertaken the technical editing for the final publications. Participants have provided additional information on the minimum data set for validating the P sub-model. Ms. Lee Heng from the Soil Science Unit will attend a training workshop in IFDC, Muscle Shoals, Alabama, USA and thereafter she will initiate the validation work with the available information. According to the Co-operation Agreement with IMPHOS (The World Phosphate Institute), a working schedule has been prepared to compile the information on the standard characterisation of soils and phosphate rocks, and relate it to the response obtained in the field and greenhouse trials. Messieurs 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 sedimentation CRP will be terminated this year and the soil erosion CRP is expected to terminate in the first quarter of the year 2001. A recent assessment of the progress made in the sedimentation CRP (valid also for the soil erosion CRP) indicated that substantial progress has been made for developing standardised protocols for the Cs-137 technique, 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. Studies on the field application of the Cs-137 technique in soil erosion and sedimentation are underway world-wide in many diverse locations. Specific work is being conducted to provide appropriate guidelines for reference site selection.

The models developed by Walling and He for converting Cs-137 measurements to estimates of soil redistribution rates on cultivated and uncultivated soils (including software and instruction manual for model implementation) are being tested in combination with other methods. An updated version of the software which deals with the potential problems with the numerical procedures used in Balance Model 3 has been prepared, and will be made available to the participants in due course via the web-site.

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

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 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 17 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 4 agreement holders: F. Maraux (France), R.J.K. Myers (ICRISAT-India), A. Bationo (IFDC/ICRISAT-Niger) 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 envisaged 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

Participating in this CRP are 11 contract holders: C. Magnavacca (Argentina), S. Ahmed (Bangladesh), T. Jiang (China), R. El-Motaium (Egypt), V.V. Athalye (India), M. Mitrosuhardjo (Indonesia), F. Ishak (Malaysia), F. Azam (Pakistan), E. Mendez Ferreira (Portugal), M. Dumitru (Romania) and P. Chaiwanakupt (Thailand); 1 technical contract holder: H. Kirchmann (Sweden); and 5 agreement holders: F. Koch (Austria), H. Harms (Germany), K. Kumazawa (Japan), A.C. Chang (USA) and S. McGrath (UK). The third RCM was held from 22 - 26 June 1998 in Oeiras, Portugal. The report on this meeting is available on request from the Project Officer. This CRP was formally reviewed by the Research Contracts Committee in October 1998. A 1-year extension was approved. The final RCM will be held in Serdang, Malaysia from 20 - 24 September 1999.

F. NEW CO-ORDINATED RESEARCH PROJECT

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

Background

As a result of the increasing world population, there is a need to increase food production. This can be achieved through intensification, diversification and specialisation of agricultural production systems in existing cultivated land or by expansion of the land under cultivation. Currently, about 40% of the potentially arable land resources are cultivated world-wide. The greatest potential for expanding agricultural land lies in the tropical rainforest and savannah regions dominated by acid, infertile soils. It should be noted however, that the cultivation of marginal lands and the lack of appropriate soil management and conservation practices on the better lands, have resulted in an accelerated rate of degradation of the natural resource base. Therefore, the required increased food production must be achieved without further degrading the resource base. Much of the required production will have to come from agroecologies that are capable of supporting more intensified production systems.

Acid soils, mostly Oxisols and Ultisols, cover 1.7 billion ha., approximately, 43% of the world's tropical land area; including 64% of tropical South America, 38% of tropical Asia and 27% of tropical Africa. The problem of soil acidity is likely to increase due to the use of legumes and ammonium-based nitrogenous fertilisers, removal of farm products and nitrate leaching.

The potentially most productive lands are concentrated in the savannah agroecosystem. The savannah area is located in the sub-humid tropical zone, and comprises a sizeable amount of the agricultural land in many countries of Africa and Latin America. In terms of agroclimatic conditions, the savannahs represent the most suited conditions for rainfed agriculture. In Africa the savannahs have historically produced all of the sorghum, millet, cowpea, much of the maize, yams and groundnuts, and more recently large amounts of cassava, soybean, cotton and upland rice.

In view of the above, several international agricultural research centres have focused their activities on identifying technologies suitable for the savannah regions. IFDC has carried out extensive research on fertiliser management on the acid savannah soils of Africa and Latin America. IITA, CIMMYT and CIAT have given special attention to the improvement of maize for savannah conditions. An EU-funded project to study mechanisms for tolerance of maize to Al and develop user-friendly sustainable technologies to mitigate soil acidity has been implemented. CIAT has also developed new agropastoral systems for the savannahs that can improve soil fertility and quality. ICRISAT has major programmes on sorghum, millet and groundnuts. IITA has also active programmes on soybean and cowpea and ICRAF has also studied the potential for agroforestry. WARDA is working extensively on rice production in inland valleys located through the savannahs. In addition, networks have been created to integrate national efforts into regional programmes and improve the flow of technology from the international agricultural research centres into the regions. As a result of all these efforts, many technologies are available for the savannahs. However, there are

significant gaps in the development and transfer of the technologies to the farmers. Consequently, agricultural production in the savannahs remains far below its potential.

There are several examples (maize, cassava and soybean) that illustrate the potential technological improvements that are available to stimulate food production within the moist savannahs on a sustainable basis. Similarly, there are improved technologies for other crops such as yams, cowpea, etc. albeit not of the magnitude of maize, upland rice, cassava and soybean. A key issue that has not been sufficiently addressed and that is lacking for the majority of the farmers in the savannahs is the improvement of resource management/conservation technologies that are vital for sustainable agricultural production.

In summary, bridging the gap between the potential and actual production of the savannahs is possible using improved technologies to intensify crop production while conserving the resource base. This can result in a major contribution to food security in Sub-Saharan Africa and Latin America.

The project will focus on three main lines of investigation:

- Utilising acid-tolerant and P-efficient genotypes.
- Addressing issues of acid soil infertility.
- Developing good management and conservation practices for acid savannah soils.

This division is arbitrary because these areas of research are closely interrelated. In most cases, combined approaches will be required. It is envisaged that the work will be implemented via an eco-regional approach, identifying specific benchmark areas as focal points for strategic research and development activities.

Several nuclear techniques that have the potential to quantify nutrient and water dynamics will be used. These include the soil moisture neutron probe for soil water studies and root activity, ^{15}N techniques for measuring N cycling (N recovery from organic residues and chemical fertilisers, biological nitrogen fixation, etc.) in soils, crops and water, ^{32}P techniques for evaluating soil P dynamics and the agronomic effectiveness of P fertilisers, in particular phosphate rock-derived products, ^{13}C for measuring decomposition rates of organic residues and identification of sources of organic matter in soil organic C pools, and ^{137}Cs for measuring soil erosion at the landscape level, etc.

The CRP will be conducted through the creation of a network of national agricultural research systems and international agricultural research centres. Synergies will be enhanced through appropriate linkage to existing networks on acid savannah soils. Close collaboration will be established with the AGL and AGP Divisions of FAO in Rome.

The improved technologies developed under this project should be transferred to the farmers, who are the beneficiaries of the project. To ensure direct transfer of the results and the expected impact from the outputs, several activities will be implemented to disseminate the information generated through the project. The results should be published in local and international journals. Whenever possible field trials should be carried out in farmers' fields and close links established with extension services. Also, database formation and validation of models should be considered.

Overall objective

To develop integrated soil, water and nutrient management (SWNM) practices to increase and sustain productivity of tropical acid soils.

Specific research objective

Improve agricultural production of tropical acid soils through the use of adapted plants, the amelioration of soil acidity and infertility and better soil, water, nutrient and crop management.

Expected outputs

Expected outputs from the CRP should include:

- acid-tolerant and P-efficient genotypes that have been screened and validated;
- data on carbon, nutrient and water dynamics that have been obtained using nuclear-based techniques;
- improved SWNM practices, with appropriate guidelines;
- a database of results from "on-station" and "on-farm" experiments;
- enhanced human skills and institutional capacities for "on-farm" and "on-station" research on integrated SWNM practices; and
- satisfactory communication of results.

Target topics

The target topics include:

- identification of adapted genotypes - the usefulness of adapted germplasm compared with susceptible lines in terms of P-efficiency and Al-tolerance;
- use of plant residues, green manures, rock-P and amendments such as lime to improve nutrient availability and to alleviate Al toxicity; and
- analysis of C, nutrient and water dynamics in different soil and crop management systems and the development of guidelines for improved soil, water and nutrient management.

Site/partner selection

The following criteria should be considered in the selection of sites and partners.

Sites that are:

- representative of the main problems of acid soils, with potential for intensification and operating with existing farmer practices ("on-station" and "on-farm" studies);
- well characterised in terms of soil type, depth, water table and climatic data;
- presently have or that plan to have, existing cropping system experiments on productivity enhancement/natural resource conservation, e.g. should include combinations of crop rotations with ground covers and/or minimum or no tillage, improved fallows, forage or grain legumes; and
- related work on acid-tolerant germplasm enhancement.

National agricultural research system partners with:

- expertise in tropical acid soils and particularly savannah acid soils;
- some experience in nuclear-based techniques;
- preferably experience in interdisciplinary approaches (soils, agronomy, germplasm enhancement); and
- preferably a collaborator in an existing research network or participant in multi-institutional projects.

Isotope techniques for use in the target topics

- ^{15}N for root studies, nitrogen dynamics (N-fixation, N-transfer, N-fertiliser balance, N losses).
- ^{13}C for soil organic matter dynamics, root studies, drought stress, water use efficiency.
- ^{32}P for root studies, P dynamics (P-fixation, P-transformations, P-fertiliser recovery).
- Neutron probe, ^{18}O for water dynamics.

Research contracts

On the basis of technically sound proposals, research contracts with research institutions will be awarded for an initial period of one year. **The final deadline for such proposals is 31 August 1999 but applicants are encouraged to apply as soon as possible, preferably before 31 July 1999.** Contracts are renewable every year for up to five years, subject to satisfactory progress. Research contracts provide financial support (US $6,000 - 8,000 per year, with some input for equipment). The contracts follow an agreed work plan, and are awarded on a cost-sharing basis, i.e. the participating institution is expected to provide support to achieve the project objectives. It is anticipated that ten research contracts will be awarded under the proposed scheme.

For further information, please contact the Scientific Secretary, Dr. Felipe Zapata of the Soil and Water Management & Crop Nutrition Section, Joint FAO/IAEA Division.

Evaluation of proposals

It is essential that high scientific standards be maintained with respect to each contract/agreement. The selection of the institution will be absolutely dependent upon the ability of its staff to perform competent scientific research and the availability of adequate research facilities. The following major points will be considered when evaluating proposals:

- The relationship of the proposal to the approved CRP.
- The clear definition of the research objective and the potential value of the research to the topic under consideration.
- The scientific competence of the Chief Scientific Investigator.
- The scientific merit of the proposal, including the applicability of the experimental methods proposed.
- The desirability of any alterations to the proposed research activities.
- The availability at the institution of the necessary facilities, including equipment (except for items to be purchased in connection with the proposal), and their accessibility to the research team.

- The probable length of time required, at the level of expenditure indicated, to achieve meaningful results.
- The necessity, in relation to the given research goals, for each item of expenditure listed.
- The correctness of the amount shown for each necessary item of expenditure (as nearly as this can be determined).

Research agreements

Scientists of international repute in nutrient and water management in tropical acid soils will be invited to participate as research agreement holders. No financial remuneration will be involved, except for invitations to participate, expenses paid, in Research Co-ordination Meetings.

Research Co-ordination Meetings

The first Research Co-ordination Meeting is scheduled for April 2000 in Vienna, and every 18 months thereafter in locations to be determined later.

Submission of proposals

Research Contract Proposal forms can be obtained from the IAEA, National Atomic Energy Commissions and UNDP offices. They must be countersigned by the Head of the Institution and submitted to the IAEA (it is not necessary that they be routed through any other official channels).

Complementary support

The IAEA has a programme of support through national IAEA TCPs. These are concerned with aspects of soil and water management and crop nutrition (please refer to Section G. of this Newsletter). Through TCPs, additional support may be obtained for activities planned under individual research contracts, e.g. equipment, specialised training through IAEA fellowships and the provision of technical backstopping through visits by IAEA experts for periods of up to one month. Request forms for assistance under the IAEA Programme of Technical Co-operation can be obtained from the IAEA. Such support is available to IAEA Member States.

G. LABORATORY ACTIVITIES

Water and nutrient interactions

Ongoing work using stable isotopes (deuterium and ^{18}O) to trace water movement and plant-plant interactions has been extended to study the effect of salinity on plant water uptake. This has direct implications for plant growth in semi-arid and arid regions. Prof. Marianne Popp at the Institut für Pflanzenphysiologie, University of Vienna, will be providing salt-tolerant plants and collaborating in this study.

As part of the work on water management, a pit (1m x 8m x 1m deep) was constructed in the greenhouse to study hydraulic lift using stable isotopes. This pit will allow the set-up of a long column experiment to study the effectiveness of alfalfa and other deep-rooted plant species in hydraulically lifting water, and the improvement of water status of associated shallow-rooted plants.

Work on fertigation of N and P has been initiated at the laboratory. Fertigation is widely practised in the Mediterranean region, but its effect on soil as well as the environmental consequences of applying N and P together in solution has not received detailed study. In addition, a simple way for measuring available P in the soil which can be adopted in developing countries needs to be developed. This work is being done in support of a proposed future CRP on fertigation.

Modelling

A database of the results of the CRP on "Nuclear Techniques for Optimising N Fertiliser Application in Wheat under Irrigated Conditions" has been created. With all the results collated in this manner, it is possible to compare performance across countries. Large differences in grain yield and nitrogen use efficiency were observed. Synthesis of the results will appear as a chapter in a proposed TECDOC.

Nutrient availability from organic sources

Data from several field experiments to validate the soil pre-labelling method and to measure N release from organic residues were analysed and were in good agreement with the direct ^{15}N labelling technique. The robustness of the method is being further tested in the field with a variety of residue types such as sewage sludge, cattle manure, etc.

Experiments were conducted to test four diffusion techniques for preparation of ammonium and nitrate samples from soil extracts and tensionic cup samplers for ^{15}N analysis. Quantitative recoveries were achieved using a PTFE tape method. The method involves encapsulating an acidified disc in PTFE tape and floating it in the KCl solution with the appropriate catalyst. The method will be further tested and developed for use in future CRPs and inclusion in the revised manual of "Use of Nuclear Techniques in Studies of Soil-Plant Relationships".

Work continued on developing simple methods to measure nutrient losses from soils for future incorporation into CRPs. The concept is to develop a package of low-cost technologies that can be used "on-farm" for comparing potential nutrient losses from different crop/livestock systems.

Training

- ***Fellows trained in 1998:***

Al-Chammaa, Mr. M.	SYR/97006	98/03/09 to 98/03/13
Ali, Mr. A.H.W.	IRQ/97006P	98/06/04 to 98/11/03
Beqqali, Mr. M.	MOR/98008P	98/06/15 to 98/09/14
Hussain, Mr. F.	PAK/98028R	98/06/18 to 98/09/17
Shaheen, Ms. R.	PAK/98026R	98/06/18 to 98/09/17

- ***Fellows trained in 1999:***

Abidi, Mr. B.	TUN/98025	99/03/01 to 99/05/31
Rizal, Mr. S.	INS/98040P	99/03/01 to 99/05/31
Syaukat, Ms. S.H.	INS/98039P	99/03/01 to 99/06/30
Bentassil, Mr. M.A.	MOR/98017P	99/03/01 to 99/08/31

In addition, a group fellowship on N and ^{15}N analyses is being planned for the second half of 1999.

Consultants

Cecilia Videla, a cost-free expert from the Universidad Nacional del Mar de la Plata, Argentina, completed training in the use of stable isotopes, sample preparation and theoretical and practical aspects of ^{15}N analysis.

José Ortiz, a cost-free intern from the University of Vienna, is developing simple methods to measure nutrient losses from soils. This is a collaborative venture with the Austrian Forestry Research Centre.

Ron Williams, Clemson University, USA, visited the Soil Science Unit during the period 14 - 18 December 1998 to demonstrate and test a prototype of a ^{15}N Plasma Spectroscope.

Supportive services

The Soil Science Unit analysed more than 14,000 samples for total N and ^{15}N, total P and ^{32}P, total C and ^{13}C, as well as ^{2}H and ^{18}O, during 1998. The following table summarises the number and type of analyses:

- ***Total N and ^{15}N analyses***

TCPs	1,080
CRPs	3,214
Research and training	4,269
Quality Assurance	5,789
Total	***14,352***

- ***Total P and ^{32}P analyses***

Research	700

- ***Total C and ^{13}C analyses***

  Research 114

- ***^{2}H and ^{18}O in collaboration with Hydrology Unit***

  Research 96

Contributions at meetings/workshops

- ***First Viennese Workshop on Stable Isotopes in Biological and Ecological Research, Vienna, Austria, 17 December 1998***

This workshop took place in the Biozentrum UZA1 of the University of Vienna under the auspices of the Plant Physiology Institute. There were 27 participants, including staff and students from the University of Vienna, the Agriculture University and the Forestry Institute, as well as from the FAO/IAEA Soil Science Unit at Seibersdorf. Presentations included:

Craig Atkins (FAO/IAEA, Seibersdorf). Outlined the use of D/H and $^{18}O/^{16}O$ isotope signatures to study the sources of water for plant growth. Preliminary studies with Lee Heng were reported. These involved isotope analysis of xylem water as well as rain, soil and ground water from field sites at Seibersdorf and at Carnuntum Petronell (in collaboration with the Forest Ecology Institute, Agricultural University, Vienna, and the IAEA Isotope Hydrology Unit).

Marianne Popp (Plant Physiology Institute, University of Vienna). Described the use of $^{13}C/^{12}C$ signatures to study the sources of organic C and the use of ^{15}N in studies of soil process in newly exposed areas of an alpine glacier. In these studies the excellent mass spectrometric analytical facilities available in the Chemical Plant Physiology group in the University of Vienna were used.

Wolfgang Wanek (Chemical Plant Physiology, University of Vienna). Outlined the utility of stable C isotope signatures in studying and selecting for water use efficiency.

Gudni Hardarson (FAO/IAEA, Seibersdorf). Described the use of ^{15}N dilution in providing the significant outcomes from 25 years of BNF research in the FAO/IAEA Soil and Water Management & Crop Nutrition Sub-programme. This presentation ranged from the use of isotope methodology for selecting superior legume cultivars and elite Rhizobia for use as inoculants to agronomic practices that have been shown to enhance BNF in the field.

Rebecca Hood (FAO/IAEA, Seibersdorf). Presented new information relating to the development of a method based on ^{15}N isotope dilution for estimating N availability and use from organic residues added to soils in both managed and natural ecosystems.

The workshop generated a lively discussion on both the limitations and utility of isotope tracer methodology. The value of utilising the natural abundance of isotopes in field studies was stressed. A number of avenues for the development of research collaboration were explored. It is planned that this workshop will continue to involve the staff of the Soil Science Unit and will be held at least twice a year in different venues.

- ***Stable Isotope Mass Spectrometry Users Group (SIMSUG) Annual Meeting, Institute of Grassland and Environmental Research, North Wyke, Devon, UK, 18 - 20 January 1999***

Rebecca Hood presented an oral paper on "Estimating plant N uptake from organic residues using a new approach to the ^{15}N isotope dilution method", and a poster on "The inorganic N story: Measurements from the pre-labelled soils used for estimating N release from organic residues".

- ***Workshop on "Application of Stable Isotope Techniques to Plant Physiology, Plant Water Uptake and Nutrient Cycling in Terrestrial Ecosystems", Centre for Legumes in Mediterranean Agriculture and the University of Western Australia, Perth, Australia, 6 - 15 February 1999***

Rebecca Hood gave an oral presentation on "Estimating plant N uptake from organic residues using a new approach to the ^{15}N isotope dilution method".

- ***International Training Program on "Computer Simulation of Crop Growth and Management Responses", International Fertilizer Development Center (IFDC), Muscle Shoals, Alabama, USA, 17 - 28 May 1999***

Lee Heng participated in this 2-week training programme. An additional two weeks were spent at IFDC to test and validate the soil P sub-model using data from the phosphate rock field trials carried out under the CRP "The Use of Nuclear and Related Techniques for Evaluating the Agronomic Effectiveness of Phosphate Fertilisers, in particular Rock Phosphate" (D1.50.03).

H. PUBLICATIONS

Printed

- The results of the FAO/IAEA CRP on "Molecular Biology" have been published as a special issue of Plant and Soil, Vol. 204 (1), 1998 and as a hardcover book entitled "Molecular Microbial Ecology of the Soil", Eds. Gudni Hardarson and William Broughton by Kluwer Academic Publishers, 1998. A limited number of copies are available upon request. These publications included the following papers/chapters:

  1. Role of legumes in sustainable cropping systems *by* D. Gareth Jones*.
  2. RNA based identification and detection systems for rhizobia and other bacteria *by* W. Ludwig, R. Amann, E. Martinez-Romero, W. Schonhuber, S. Bauer, A. Neef and K.-H. Schleifer.
  3. Rapid identification of *Rhizobium* strains by targeted PCR fingerprinting *by* X. Perret and W.J. Broughton.
  4. Use of marker genes in competition studies of *Rhizobium by* A. Sessitsch, G. Hardarson, W.M. de Vos and K.J. Wilson.
  5. Isolation of unique nucleic acid sequences from rhizobia by genomic substraction: application in microbial ecology and symbiotic gene analysis *by* J.E. Cooper, A.J. Bjourson, W. Streit and D. Werner.
  6. Potential of *Rhizobium* and *Bradyrhizobium* as plant growth promoting rhizobacteria with non-legumes: Effect on radishes (*Raphanus sativus* L.) *by* H. Antoun, C.J. Beauchamp, N. Goussard, R. Chabot and R. Lalande.
  7. Competition in Kenyan soils between *Rhizobium leguminosarum* biovar *phaseoli* strain Kim5 and *R. tropici* strain CIAT899 using the *gusA* marker gene *by* B. Anyango, K. Wilson and K. Giller.
  8. Effect of host plant origin on nodulin activities and nitrogen fixation in *Phaseolus vulgaris* L. *by* V.M. Ceccatto, J.E. Gomes, G.A. Sarries, D.H. Moon and S.M. Tsai.
  9. Symbiotic performance of some modified *Rhizobium etli* strains in assays with *Phaseolus vulgaris* beans that have high capacity to fix N_2 *by* E. Martinez-Romero, I. Hernandez-Lucas, J.J. Peña Cabriales and J.Z. Castellanos.
  10. Improvement of biological nitrogen fixation in Egyptian winter legume through better management of *Rhizobium by* H. Moawad, S.M.S. Badr El-Din and R.A. Abdel-Aziz.
  11. Analysis of *Phaseolus-Rhizobium* interaction in subsistence farming system *by* W.S. de Oliveira, L.W. Meinhardt, A. Sessitsch and S.M. Tsai.
  12. Contributions and limitations to symbiotic nitrogen fixation in common bean (*Phaseolus vulgaris* L.) in Romania *by* A. Popescu.
  13. Detection of *Bradyrhizobium* spp. and *B. japonicum* in Thailand by primer-based technology and direct DNA extraction *by* N. Teaumroong and N. Boonkerd.
  14. QTL-mapping of nodule number and common bacterial blight in *Phaseolus vulgaris* L. *by* S.M. Tsai, R.O. Nodari, D.H. Moon, L.E.A. Camargo, R. Vencovsky and P. Gepts.

*Note: Chapters 1, 16 and 17 were published in the hard-cover book only.

15. Nitrogen fixation and nodule occupancy by native strains of *Rhizobium* on different cultivars of common bean (*Phaseolus vulgaris* L.) *by* J. Vasquez-Arroyo, A. Sessitsch, E. Martinez-Romero and J.J. Peña Cabriales.
16. Use of rep-PCR to fingerprint the genomes of *Azospirillum* spp. *by* J.C. Mamaril and L.C. Trinidad*.
17. FAO/IAEA Co-ordinated Research Programme on enhancement of nitrogen fixation in leguminous crops *by* G. Hardarson and W.J. Broughton*.

- Karanja, N.K., Mwendwa, K.A. and Zapata F., 1999. Growth response of *Grevillea robusta* A. Cunn. seedlings to phosphorus fertilisation in acid soils from Kenya. Biotechnol. Agron. Soc. Environ. 3 (1): 57-64.
- Mwendwa, K.A., Karanja, N.K., Zapata, F. and Maingi, S.W., 1997/98. Evaluation of phosphorus uptake from Minjingu phosphate rock and growth of six agroforestry tree species on an acid soil from western Kenya. Int. J. Biol. Chem. Physics, 6/7:79-85.
- N'goran, K., Zapata, F. and Sanginga, N., 1998. Availability of N from Casuarina residues and inorganic N to maize using ^{15}N isotopic techniques. Biol. Fertil. Soils 28:95-100.
- Thomas, R. and Zapata F. "The use of nuclear techniques to develop management practices for increasing crop production and soil fertility in acid soils". Report of a Consultants' Meeting, Vienna, 1-3 March 1999. IAEA, Vienna (1999).

In press

- 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.

In preparation

- Peña Cabriales, J.J. and Zapata F. (Eds.). Aumento de la Fijación Biológica de Nitrógeno en el Frijol Común en América Latina. 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.
- Bacchi, O., Reichardt, K. and Calvache, M. The Use of Neutron Moisture Meters and their Application in Agriculture. Training Manual Series (English, French and Spanish versions).

Note: Chapters 1, 16 and 17 were published in the hard-cover book only.

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