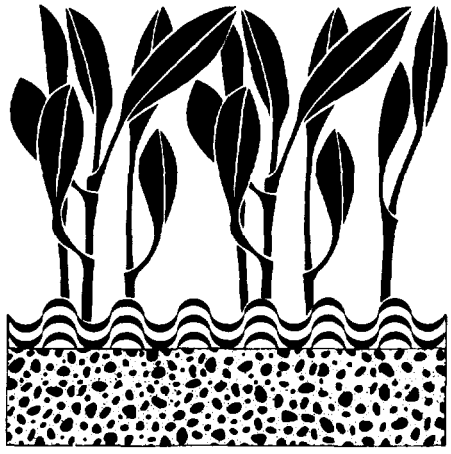

Soils Newsletter

JOINT FAO/IAEA DIVISION
OF NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE
AND FAO/IAEA AGRICULTURE AND
BIOTECHNOLOGY LABORATORY, SEIBERSDORF
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA

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TO OUR READERS

The first half of 1996 was a very busy period with many events of major significance for our Section.

A team of six agricultural scientists and research management specialists conducted an external review of the Joint FAO/IAEA Sub-programme D1 on Soil Fertility, Irrigation and Crop Production during the period 13-17 May 1996. This was the first external review of the Sub-Programme since activities of the Soils Section began 30 years ago. The was team headed by Dr. J. Nickel (USA), former Director General of the International Centre for Tropical Agriculture, and a scientist with remarkable professional and leadership capabilities. The other members were: Dr. J. Bouma (The Netherlands), Dr. D. Greenland (UK), Dr. F. Muchena (Kenya), Dr. J.A. Sagardoy (FAO, Rome) and Dr. P. Singleton (USA). The team reviewed a number of documents prepared by the Soils Section, provided to them one month in advance and received presentations by the Joint FAO/IAEA Division Director, Head of Soil and Water Management & Crop Nutrition Section and the staff of the Sub-programme D1 and the associated staff of Soil Science Unit of the FAO/IAEA Agriculture Laboratory, Seibersdorf. Following internal discussions with staff members, the team compiled a report which was presented to the staff of the Sub-programme.

The Review Team identified a number of issues that require more attention, and made a series of recommendations to facilitate their resolution. The Review Team strongly supports our **new emphasis in the future programmes on integration of soil, water and nutrient management activities within a cropping system context, using nuclear techniques**. This represent an important move from the prior approach on biological nitrogen fixation, and agreed that this approach be followed, taking into account some changes described in the text of the report. It should be noted that it was recommended that the Sub-programme should ensure that it maintains its position as the **leading centre of excellence in the use of nuclear techniques in soil, water and nutrient management**. The staff of the Soil and Water Management & Crop Nutrition Section and Soil Science Unit are prepared and ready to put all their efforts and capabilities to promote the use of nuclear and related techniques to increase and sustain crop production through improved nutrient and water management practices, for the benefit of the IAEA and FAO Member States.

Despite the enormous amount of work required in preparation for the external review many other activities were organized by the Soils Section in the first semester of 1996. The second Research Co-ordination Meeting (RCM) on "The use of nuclear techniques for optimizing fertilizer application under irrigated wheat to increase the efficient use of fertilizer and consequently reduce environmental pollution", was held in El-Batan, CIMMYT, Mexico from 4th to 8th March, with P. Moutonnet as scientific secretary.

From February to April 1996, expert missions were organized in Egypt, Iran, Iraq, Morocco, Myanmar, Pakistan, Syria and Tunisia, to study the potential use of saline groundwater to irrigate salt tolerant plants (halophytes) grown on salt-affected soils. Such soils are not currently part of an agriculture ecosystem and are considered as a wasteland. Following the above-mentioned missions, a Consultants Meeting organized by IAEA's Technical Co-operation Department and Soil and Water Management & Crop Nutrition Section of the Joint FAO/IAEA Division, was held in Vienna from 20-24 May in order to finalize the formulation of an inter-regional project on the above subject.

Two training courses, one Regional and one Inter-regional, were organized in the first semester of 1996. The Regional Course was held in Addis Ababa, Ethiopia, from 1 to 26 April and involved 20 scientists in the Africa region, and the Inter-regional Course held in Vienna, Austria from 28 May to 5 July and this involved 22 scientists from different parts of the world. Both courses, which focussed on the use of nuclear techniques in studies on soil-plant relationships, were very successful.

For the second half of 1996, various activities are planned. From 28 July to 1 August, the 2nd workshop of the IAEA Technical Co-operation Regional Project for Asia and the Pacific on "Nuclear techniques for the promotion of agroforestry systems" will be held in Faisalabad, Pakistan. C. van Kessel will be the Scientific Secretary and participants from Bangladesh, People's Republic of China, Indonesia, Malaysia, Myanmar, Pakistan, the Philippines, Sri Lanka, Thailand and Viet Nam are expected to attend the meeting.

The final RCM of the FAO/IAEA CRP entitled "Enhancing soil fertility and crop production by better management of *Rhizobium*", with G. Hardarson as the Scientific Secretary, will be held from 2 to 6 September in Vienna, Austria. Contractor Holders from Brazil, Egypt, Mexico, Pakistan, the Philippines and Romania, and Agreement Holders from Germany, The Netherlands, Switzerland and the U.K., will report on the results of this programme.

A Regional Training Course with 20 participants from Latin America will take place from 2 to 27 September in Mexico, with F. Zapata as the Technical Officer.

The second RCM of the FAO/IAEA CRP entitled "The use of irradiated sewage sludge to increase soil fertility and crop yields, and to preserve the environment" will be held in Cairo, Egypt from 14 to 18 September. Thirteen Research Contractor Holders from Argentina, Bangladesh, People's Republic of China, Egypt, India, Indonesia, Malaysia, Mexico, Pakistan, the Philippines, Portugal, Romania and Thailand, as well as 5 Agreement Holders from Austria, Germany, Japan, U.S.A. and U.K., are expected to attend the meeting. I will be the scientific secretary for this meeting.

Two other Research Coo-ordination Meetings are foreseen for the last quarter of the year: (a) Research Co-ordination Meeting on "The use of isotope techniques in studies on the management of organic matter and nutrient turnover for increased, sustainable agricultural production and environment preservation". Fifteen participants of which 12 are Research Contractor Holders and 3 Agreement Holders, will attend the meeting, with C. van Kessel as scientific secretary; (b) Research Co-ordination Meeting on "The assessment of soil erosion through the use of ^{137}Cs and related techniques as a basis for soil conservation, sustainable agriculture production and environmental protection" with 8 research contractors and 4 research agreements and F. Zapata as scientific secretary. Both RCMs will be held in Vienna, Austria, on 7-11 October and 11-15 November, respectively.

A FAO/IAEA Consultants Meeting on "The use of nuclear techniques in rainfed agriculture" will be organized in the last quarter of the year.

Three international conferences on biological nitrogen fixation sponsored by the Joint FAO/IAEA Division will be convened in the second semester of 1996: the 7th Conference of the African Association of Biological Nitrogen Fixation (AABNF), to be held in Côte d'Ivoire from 2 to 7 September; the 2nd European Nitrogen Fixation Conference, to be held in Poznan, Poland, from 8 to 13 September; and the 7th International Symposium on Nitrogen Fixation with Non-Legumes, to be held in Faisalabad, Pakistan, from 16 to 21 October. I will represent IAEA at the 7th Conference of AABNF in Côte d'Ivoire. G. Hardarson will participate in the 7th International Symposium in Pakistan.

Among the recommendation made by the External Review Team was the possibility of linking our programme on isotope measurements of nutrient and water cycling with those of CG Systems and NARS which conduct studies on cropping system research. For this reason, we plan to organize a five-day meeting in Vienna during late November/early December to explore collaborative possibilities.

I would like to inform the Soils Newsletter readers that our request to change the name of the Section, in order to appropriately reflect our new emphasis on the future activities, was approved by Mr. H. Blix, the IAEA Director General. As of the beginning of 1997 the new name of the Section will be: "Soil and Water Management & Crop Nutrition Section". This new name is also in agreement with the suggestion made by the External Review Team.

During the first semester of 1996 one of the grievous events in the history of our Section was the sudden demise of our dear Saliya Kumarasinghe. He passed away in the evening of June 17 at the Rudolfstiftung Hospital, leaving his family and friends in great shock. He was a competent colleague and good friend for many years and we mourn with his family deeply. We won't forget him.

This issue was compiled and edited by Dr. C. van Kessel and myself, with contribution from our colleagues in the Soils Section at the IAEA's Headquarters and the Soils Science Unit, FAO/IAEA Agriculture and Biotechnology Laboratory, in Seibersdorf. The manuscript was typed by Ms. Ruth Rossi.

We value very much the comments often received from our readers on the information disseminated through our Newsletter. I would like to express my gratitude for your continued interest and I am looking forward to receive your future contributions.

Christian Hera
Head
Soil and Water Management
& Crop Nutrition Section

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3. Staff Changes

In March 1996, **Dr. Felipe Zapata**, former Head of the Soil Science Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory at Seibersdorf, was transferred to the Soils Section of the Joint FAO/IAEA Division in Headquarters. During the past 15 years of tenure with the Laboratory Dr. Zapata was leading the research and development and training activities in support of the sub-programme D1 Soil Fertility, Irrigation and Crop Production. His efforts contributed substantially to the improvement of techniques and analytical capabilities for the application of both stable and radioisotopes in soil/plant research and are well known by the regular readers of this Soils Newsletter, IAEA fellows and training course participants. His main duties at the Section will be to act as Technical Officer of a number of IAEA Technical Co-operation Projects and Training Courses, and as Project Officer for the Phosphate CRP as well as the new CRP on the use of environmental radionuclides on soil erosion studies. This CRP will be run, in close co-ordination with another CRP on sedimentation run by the Isotope and Hydrology Section of the Division of Physical and Chemical Sciences. We are glad to welcome Felipe in the Section and wish him every success in his tenure.

After more than 6 years of activity with the Agency, **Dr. K. Olufemi Awonaike** has left the Soil Science Unit in Seibersdorf on June 30, 1996 for Nigeria, his native country. Femi got his Ph.D. (Microbiology) in 1980, then worked in Ibadan, Nigeria till 1990 when he accepted a position at the Agency. As a Soil Scientist he conducted research in support of two CRPs on "Measurement of nitrogen fixation in trees and management of agroforestry system" and "Optimizing the use of plant nutrients for sustainable agricultural practices and environmental protection". His professionalism, as well as his kindness, were greatly appreciated by the Soils Section/Unit staff members. We wish him and his family all the best for the future.

Ms. Helga Axmann retired from the Soil Science Unit in Seibersdorf on the 30th April 1996 after more than 33 years of service. Helga joined the IAEA on 1 October 1963 as a soil/plant analyst responsible for all analytical work associated with crop nutrition, plant breeding and the protein programme of the then Agriculture Section of the Seibersdorf Laboratory. Her arrival was at a time when isotope analytical methods were not well established. Soon, however, under her able leadership and initiative, she successfully developed a total N and ^{15}N analytical system combining a modified Dumas sample preparation technique with mass spectrometry. Further, she was also responsible for the development of the NOI series of emission spectrometers for ^{15}N analysis.

The contributions she has made over the past 30 years toward the successful implementation of the IAEA's Co-ordinated Research Programmes and the Technical Co-operation project are immeasurable. Many of these programmes would certainly not have achieved the high degree of success they reached if not for the dedicated services rendered by her through the Seibersdorf Laboratory and by way of technical advise to counterparts in the countries in which the programmes were implemented.

The training of scientists from Member States is another main activity of the IAEA Laboratories in Seibersdorf. Ms. Axmann has been instrumental in training well over one hundred fellows in the use and handling of isotopes especially ^{15}N, ^{32}P, ^{14}C, ^{35}S and ^{65}Zn in soil/plant studies. These scientists are now the corner stones of the agricultural development programmes in their own countries.

Because of Ms. Axmann's excellent contribution to the development of analytical capabilities, she has virtually became a household name amongst the many agricultural scientists in Universities and research institutes alike in developing countries. As a woman who has devoted her entire career and who has been clearly instrumental in developing and supporting one of IAEA's most important and successful programmes in the field of agriculture, she certainly merits our high recognition. We sincerely wish her all the best in her retirement and hope she will enjoy her hobbies and interests.

Dr. Saliya Kumarasinghe, born on 17 April 1944, passed away on 17 June 1996, after a brief illness. He was recruited in the Soils Section as Technical Officer in June 1989. He was about to leave IAEA and return to his country Sri Lanka when he had a cardiac arrest. We have lost a very dear friend

and colleague. He was not only a very good scientist, but a good man, very gentle, would always go out of his way to help people, never complained and was full of good humour. Saliya made as a great contribution to the Soils Section in both Co-ordinated Research Programmes and Technical Co-operation Projects. Saliya was a person who put all his efforts in what he did with outstanding results. He was also a very friendly and pleasant person. All of us are shocked and saddened by his passing. He is survived by his wife and 3 sons.

We paid our last respects to Saliya on Friday, 21 June 1996 at the Rudolfstiftung Hospital. On Saturday, 22 June, his remains were transferred to Colombo, Sri Lanka. Our deepest condolences to his family.

CO-ORDINATED RESEARCH PROGRAMMES

1. FAO/IAEA/OPEC CRP on The Use of Nuclear Techniques in the Management of Nitrogen Fixing Trees for Enhancing Soil Fertility and Soil Conservation (D1.40.05)

Project Officer: Chris van Kessel

The seventh year for this CRP is underway and the final Research Co-ordination Meeting is scheduled to be held mid-1997 in Vienna. During this final meeting all participants will be asked to present the major results and conclusions of their component of this Co-ordinated Research Programme. Currently, this programme consists of 8 Contract Holders: C. Ovalle-Molina (Chile), E.Y. Safo (Ghana), H. Shariffuddin (Malaysia), K. Malik (Pakistan), N. Mbaya (Zaire), M. Gueye (Senegal), M. de S. Liyanage (Sri Lanka), and M. Bekunda (Uganda). There are three Agreement Holders participating in this project: J.K. Ladha (IRRI-Philippines), N. Sanginga (IITA-Nigeria), and D. Baker (U.S.A.).

Currently, plant samples from Contract Holders are being analyzed in Seibersdorf and all participants will receive the data before the end of the summer of 1996.

2. The use of Nuclear Techniques for Optimizing Fertilizer Applications under Irrigated Wheat to Increase the Efficient Use of Fertilizers and Consequently Reduce Environmental Pollution (DI-40.07)

Project Officer: Pierre Moutonnet

This programme includes seventeen participants, of which five are Agreement Holders: R. Rennie (Canada), G. Vachaud (France), I. Ortiz-Monasterio (Mexico), W. Baethgen and J. Schepers (USA) and twelve Contract Holders: M.I. Khalil (Bangladesh), A.E. Boaretto (Brazil), I. Vidal (Chile), X. Wen (People's Republic of China), M.A.S. Abdel Monem (Egypt), M.S. Sachdev (India), X. Uvalle-Bueno (Mexico), J.M. Sanchez-Yanez (Mexico), M. Bazza (Morocco), C. Cioban (Romania), A. Arslan (Syria), Ç. Kirda (Turkey). The Consultants Meeting established the goals and objectives of this CRP initiated in co-operation with CIMMYT, Mexico, and IFDC, USA. The first RCM was held in Vienna in October 1994. Fertilizers labelled with ^{15}N and several technical documents to be used as a guideline were provided to the contractors. Atom % ^{15}N excess measurements of plant and soil samples have been made at the Seibersdorf Laboratory, Austria and in various developing countries. First results were discussed in detail during the second RCM held in El Batan CIMMYT Research Centre, near Mexico City, on 4-8 March, 1996. Further information is reported elsewhere in this issue.

3. FAO/IAEA Co-ordinated Research Programme on Enhancing Soil Fertility and Crop Production by Better Management of *Rhizobium* (D1-40.06)

Project Officer: Gudni Hardarson

This CRP is now in its final year of implementation. The report of the programme is being written and edited by the Project Officer in collaboration with Professor W. Broughton, University of Geneva. The report, which will have as title: Molecular Biology in Soil Microbial Ecology, has 15 contributions and lists the results from the various contractors and agreement holders. The report will be published as a book in 1997.

The final Research Co-ordination Meeting of the above programme will be held during 2 - 6 September 1996 at the Vienna International Centre in Vienna. A report of the meeting will be published in the next issue of the Newsletter.

4. FAO/IAEA Co-ordinated Research Programme on The use of Nuclear and Related Techniques for Evaluating the Agronomic Effectiveness of Phosphate Fertilizers, in particular Rock Phosphates (D1.50.03)

Project Officer: Felipe Zapata

This CRP still has 2 more years to go, and at present time has 11 Contractors and 6 Agreement Holders. During the next phase of implementation, it is expected that the participants will conduct field experiments to gather information on the agronomic effectiveness of phosphate fertilizers. The third Research Co-ordination Meeting is planned for March 1997 at IAEA Headquarters, Vienna, Austria. The participants should prepare their progress reports in due time in order to be able to attend the meeting. Thanks to the generous support of the French Government the network of participating institutes is being enlarged and will include 6 additional Contract Holders from Eastern Europe. Following a co-operation agreement with the World Phosphate Institute (IMPHOS) arrangements have been made to proceed with the standard characterization of the soil samples of the benchmark sites at CIRAD, Montpellier.

5. FAO/IAEA Co-ordinated Research Programme on The Use of Irradiated Sewage Sludge to Increase Soil Fertility, and Crop Yields and to Preserve the Environment. (D1.50.04)

Project Officer: C. Hera

The second Research Co-ordination Meeting of this CRP on "The use of irradiated sewage sludge to increase soil fertility and crop productivity and reducing environmental pollution" will be held from 14 to 18 September 1996 in Cairo, Egypt. Eighteen Contractors and Agreement Holders from Argentina, Austria, Bangladesh, People's Republic of China, Egypt, Germany, India, Indonesia, Japan, Malaysia, Mexico, Pakistan, Philippines, Portugal, Romania, Thailand, United States of America and the United Kingdom, are expected to attend the RCM.

The purpose of this meeting is to review/discuss the on-going activities related to the use of irradiated sewage sludge, to present the reports with results from the first experiments and to prepare the workplans and experimental guidelines for the period 1996-1997.

Mr. Christian Hera will be the Scientific Secretary of the meeting and Ms. Rawia El-Motaium, will be the local organizer.

6. FAO/IAEA Co-ordinated Research Programme on The Use of Isotopes in Studies on Soil Organic Matter (D1-40.08).

Project Officer: Chris van Kessel

The first Research Co-ordination Meeting for this Co-ordinated Research Programme on soil organic matter and nutrient cycling, will be held from 7 to 11 October, 1996 in Vienna. An expected large number of applications were received and many good proposals could not be awarded or were put on hold for future considerations. Reasons for not be able to award a proposal was often based on geographical and budgetary considerations. As the Agency still receives new proposals to be considered for funding, we would like to ask our readers not to submit anymore proposals related to this CRP.

For this CRP 12 applicants were selected as Contract Holders: S.M. Rahman (Bangladesh), K. Reichardt (Brazil), E. Zagal (Chile), J.Y. Wang (People's Republic of China), S.K.A. Danso (Ghana), M.S.A. Safwat (Egypt), R.A. Bakar (Malaysia), J.Z. Castellanos (Mexico), D. Amara (Sierra Leone), R. Sangakkara (Sri Lanka), and N.N. Dang (Viet Nam). As of July, 1996, the following Agreement Holders have been selected: D.F. Herridge (Australia), R. Merckx (Belgium), and D.S. Powlson (United Kingdom).

7. FAO/IAEA Co-ordinated Research Programme on The Assessment of Soil Erosion through the Use of Cs-137 and Related Techniques as a Basis for Soil Conservation, Sustainable Production, and Environmental Protection (D1.50.05).

Project Officer: Felipe Zapata

The FAO/IAEA Consultants Meeting on the Use of Isotopes in Studies on Soil Erosion was held from 13 to 16 November 1995 in Vienna, Austria. This meeting provided an excellent forum to review the current status of the Cs-137 technique in soil erosion research and to discuss the potential applications of the technique in developing countries. The panel strongly recommended the implementation of this CRP on soil erosion in close co-ordination with the CRP on sedimentation being conducted by the Isotope Hydrology Section, IAEA, Vienna. Because of the need for innovative research designs, the consultants devoted considerable time to develop a standard sampling and analytical framework for the application of the Cs-137 technique in soil erosion studies. Aspects of vegetation cover associated with land use type and soil profile description as well as soil quality measurements were also given due consideration because of their implications on losses of soil productivity, soil conservation and environmental protection. Implementation of this CRP has already started and at present time there are 6 Contractors and 4 Agreement Holders. The first RCM will be held in November 1996 in Vienna, Austria.

FAO/IAEA TRAINING COURSES

Completed

1. IAEA/FAO Regional Training Course on the Use of Nuclear Techniques in Studies on Soil/Plant Relationships, 1 - 26 April 1966, Addis Ababa, Ethiopia.

Technical Officer: C. Hera
Course Director: G. Gebeyehu

The Regional Training Course on Soil/Plant Relationships was held in the Institute of Agricultural Research, Addis Ababa, Ethiopia for a duration of four weeks.

The objective of the course was to give scientists from Africa a sound working knowledge on the use of relevant nuclear techniques in studies of soil fertility, crop nutrition and water management.

The Course was very intensive and both lecturers/instructors and participants are to be commended for outstanding dedication and commitment. The Course was attended by 20 participants from 13 countries: Algeria (2): Ms. F. Bacha and Mr. F. Malaikia; Egypt (1): Mr. A.A.G. Abdalla; Ethiopia (4): Mr. S. Kidanu, Mr. H. Regasa, Mr. D. Negash and Mr. E. Bekele; Ghana (1): Mr. J. Adjetey; Kenya (2): Ms. L. Ireri and Mr. S. Kanyanjua; Mali (1): Ms. Z. Diarra; Niger (1): Mr. A.S. Kiari; Nigeria (1): Ms. M.A. Olasogba; Sierra Leone (2): Mr. C.A. Dixon and Ms. S. Lusenie; Tanzania (1): Mr. C.J. Lyamchai; Tunisia (1): Mr. M.F. Ben Hamouda; Zaire (1): Mr. K-N Mwange; Zambia (2): Mr. R. Myemba and Mr. S.D. Siatembo. There were 8 lecturers: three from Africa: Messrs. M. Bazza (Morocco), S.K.A. Danso (Ghana) and N. Sanginga (Nigeria), Mrs. Zaharah Abd. Rahman (Malaysia), two from Austria: H. Axmann and K. Buchtela; two from IAEA: C. Hera and S. Kumarasinghe.

The participants received training on various aspects of soil plant relationship, e.g., safe handling of radioisotopes and radioisotope assay techniques, instrumentation for stable and radiometric assay, use of stable and radioactive isotopes in soil fertility, plant nutrition and fertilizer studies, biological nitrogen fixation by grain legumes, pastures and agroforestry, water management, photosynthesis and crop productivity. The local capacity isotope laboratory established at the Holetta Experimental Station was of high standard and the local personnel were well trained.

2. FAO/IAEA Interregional Training Course on the Use of Nuclear Techniques in Studies of Soil/Plant Relationships with emphasis on Soil Water Management. 28 May - 5 July 1996, FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf, Austria.(INT/5/139).

Technical Officer: Pierre Moutonnet
Course Director: Felipe Zapata

This six week interregional training course was held at the FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf from 28 May to 5 July 1996. This year the course emphasized topics related to soil water management such as monitoring soil water status using neutron moisture gauges and related equipment, field water balance, irrigation water management, salinity, fertigation, agrochemicals leaching in soils, nuclear techniques in soil erosion and sedimentation studies and the development of water resources.

A selection panel met in April of 1996 to consider 102 nominations received from 50 Member States of IAEA and FAO. Twenty-three participants representing a similar number of Member States successfully concluded the training: N. Hamenni (Algeria), S. Zhitkevich (Belarus), Wei Dongpu (People's Republic of China), L. Rojas-Escobar (Colombia), D. Juarez (Guatemala), Noor Al-Dean Muhawish (Iraq), Said Al-Zuraiqui (Jordan), S. Kitheka (Kenya), S. Bucas (Lithuania), O. Cukaliev (Macedonia), Mhd. Bookeri Md Ludin (Malaysia), R. Osorio-Alatorre (Mexico), D. Chandmani (Mongolia), K. El-Mejahed (Morocco), J. Akhter (Pakistan), Irina C. Ion (Romania), R. van Antwerpen South Africa), L. Samarappuli (Sri Lanka), Nursen Cil (Turkey), A. Kakuru (Uganda), B. Kamilov (Uzbekistan), A. Al-Ghori (Yemen), E. Phiri (Zambia). In addition four fellows from the Soil Science Unit at Seibersdorf participated in the course.

The course consisted of lectures, practical sessions in the laboratory and field/greenhouse, video-films, calculation exercises, use of specialized software programmes and database search on AGRIS. A field excursion was organized by Doz. Dr. Gerzabek to acquaint the participants with the main features of agriculture in Austria. The participants visited the Federal Agency and Research Centre for Agriculture in Hirschtetten and the Federal Agency for Water Management, in Petzenkirchen. In addition to the IAEA staff of the Section (Headquarters) and the Unit (Laboratory), the following scientists contributed as invited lecturers: K. Buchtela (Austria), H. Axmann (Austria), C. Kirda (Turkey), W. Horst (Germany), D. Nielsen (USA), I. Papadopoulos (Cyprus), S. Turner (U.K.) and D.E. Walling

(U.K.). A course evaluation conducted during the last week indicated that the course was a great success. Thanks are given to all those who have contributed to the successful completion of this training course.

Planned

1. **IAEA/FAO Regional Training Course on the Use of Nuclear Techniques in Studies of Soil/Plant Relationships, 2- 27 September 1996, Mexico City/Irapuato, Mexico.**

   Technical Officer: Felipe Zapata
   Course Director: Juan José Peña-Cabriales

Implementation of this training course is proceeding as scheduled. Fifteen scientists from the Latin American region and five local scientists have been selected to take part in this course. Instruction will be given in Spanish. Administrative and technical arrangements are being finalized. More information on this training course will be provided in the next issue.

MEETINGS/WORKSHOPS

Completed

1. **The second Research Co-ordination Meeting of the FAO/IAEA CRP on "The use of Nuclear Techniques for Optimizing Fertilizer Applications under Irrigated Wheat to Increase the Efficient Use of Fertilizers and Consequently Reduce Environmental Pollution". (D1-40.07)**
   El Batan, CIMMYT Research Centre, near Mexico City
   4-8 March 1996

   Scientific Secretary: Pierre Moutonnet

Dr. I. Ortiz-Monasterio, an Agreement Holder in the above programme, was the local organizer of the Meeting. The meeting was attended by 20 participants which composed of 11 Research Contractors, 5 Agreement Holders and 4 from CIMMYT. The programme of the meeting included two days of presentation by all participants who conducted research during 1995, a visit to CIMMYT laboratories, a field trip around El Batan, one workshop and planning sessions for future research.

The workshop was organized with the contribution of Dr. Baethgen from IFDC, on the use of the decision support system DSSAT 3.0 and the CERES-Wheat simulation programme.

Recommendations were made for improving the assessment of water and N-fertilizer losses through leaching. A full report of this meeting is available upon request.

Excerpts from presented reports:

M. I. Khalil
Soil Science Division
Bangladesh Institute of Nuclear Agriculture
Mymensingh
Bangladesh

Isotope-aided studies on nitrate movement in soil under irrigated wheat with emphasis on ground water pollution.

A field experiment with winter wheat as test crop was conducted during 1994-95 to study the yield response, fertilizer N and water use efficiency of wheat under several levels of fertilizer: N0- unfertilized check (control), N1- 60, N2- 120 and N3- 180, kg N/ha. The soil has a sandy loam texture, high infiltration and hydraulic conductivity. Wheat emerged 5 days after seeding with a thermal time of 97.3 ^{0}C.d and physiological maturity was attained within 108 days after emergence. Soil water content (SWC) in 0-120 cm soil profile did not vary significantly between levels of fertilizer applications Immediately after irrigation, percolation losses below 90 cm depth increased. Yield and water use efficiency (WUE) of wheat was significantly affected by N levels - the highest grain yield (4.19 tons ha-1) and WUE (165 kg /ha/cm) observed for the N3 treatments but decreased with decreasing levels of N application. The N uptake by wheat increased remarkably following anthesis and varied significantly among treatments. Using N-15 fertilizers, an increase in %Ndff, fertilizer and soil N uptake with the increase rate of fertilizer application was shown. Wheat utilized 39 and 38 % of the fertilizer in the N2 and N3 treatments, respectively. Nitrogen use efficiency increased with decreasing rates of fertilizer N applications. Whereas NH_4-N concentration in the 0-120 cm soil profile did not vary considerably, the NO_3-N concentration was affected by N levels and increased with higher rates of fertilizer N. Increase in NO_3-N content below root zone indicated that leaching losses occurred immediately after the application of irrigation water. The total N loss ranged between 17 and 79 kg/ha and increased with higher rates of N fertilizer.

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Piracicaba, S.P.
Brazil

Nuclear techniques for optimizing the N fertilizer application in wheat under irrigated conditions.

The wheat growing season in the São Paulo State, Brazil is from March to October. Focussing on N fertilization, the research developed in the last years showed that wheat responds positively to N fertilization. Nitrogen is applied at sowing at a dose of 20 kg/ha, complemented with P, K and B. When irrigated, N can also be surface applied at tillering and up to 120 kg/ha can be applied in one application.

An experiment was carried out in 1995 at the experimental station of Instituto Agronomico, São Paulo State (latitude = 22°54 S, longitude = 47°05 W, and 674 m above sea level). IAC 24 is a spring wheat genotype most commonly planted in the state of São Paulo and grows well on acid soils. The growth period of IAC 24 is about 130 days. An application of 90 kg/ha of N fertilizer produced an increase of 870 kg/ha of grains compared to the control. The response of the N fertilization ranged from 6 to 20 kg of grains for each kg of N fertilizer applied. Ammonia volatilization, following urea application on the soil surface at tillering stage, was measured. There was a direct and positive relationship between the rate of N applied and the amount of ammonia lost through volatilization. Recovery of N from urea applied at seeding ranged from 37 to 44%.

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Water and nitrogen fertilization effects on nitrogen uptake efficiency of spring wheat.

Our objectives were: i) to measure the contribution of applied fertilizer N and from soil organic matter to the total nitrogen uptake by spring wheat under different levels of irrigation, and ii) to generate an experimental data set on soil, crop and climate within Mega Environment 1 that can be used for validating the CERES-Wheat Simulation Model.

A line-source sprinkler irrigation system was used to establish a gradient of three water levels with increasing drought stress delineated by distances of 0-5, 5-10 and 10-15 m away from the sprinkler line. The total amount of water applied by block ranged from 57 to 221 mm, depending on the distance from the line-source. Perpendicular to the line-source plots were located which had received four fertilizer N levels (0, 75, 150 and 225 kg N/ha). The N treatments were arranged within each water level. Within each fertilized treatment, ^{15}N microplots were installed which consisted of 5 rows with a length of 1.2 m. Labelled ^{15}N urea (2.9 atom % ^{15}N excess) was applied at similar rates used for the subplot treatments.

The chlorophyll meter was effective as a predictor of N deficiency. We suggest a sufficiency value of 44 units at growth stage 45. Chlorophyll meter readings of leaves at GS-45 and GS-69 accounted for 72 to 82% of the variation in grain yield, respectively. The interaction nitrogen x water on grain yield was significant. Quadratic yield increases were observed for different levels of soil water applications in response to an increase in N fertilizer application. The accumulation of fertilizer and soil N by spring wheat increased with increasing the amount of water application. An optimum level of N accumulation was reached at 150 kg N/ha of fertilizer.

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Optimizing fertilizer application under irrigated wheat.

Because of its intensive agriculture system, Egypt uses large quantities of nitrogen fertilizers. Percentage of N recovery ranges between 28 % (sandy soil) and 40% (irrigated land). A field trial was conducted in 1994/1995 season to study nitrogen use efficiency by wheat under irrigation. Soil at the experimental site is classified as Typic Torrifluvents, contains 35% clay and has a pH of 8.4. The experimental treatments were laid out in a split-plot design with irrigation as the main plots treatments, and N as sub-plots treatments. The two irrigation regimes were W1 (4 irrigations) and W2 (6 irrigations). Nitrogen treatments were 0, 70, 140 and 210 kg N/ha applied as a split (1/3 at planting and 2/3 at stage Z-31). Microplots (1 x 1 m) were established in each plot and ^{15}N-labelled urea (4.91% atom ^{15}N excess) was applied. When urea was applied at the rate of 140 kg N/ha, the labelled urea was used at planting (1/3) as well as at stage Z-31 (2/3). For the rate of 210 kg N/ha, the labelled urea was applied only at planting (1/3), or both at planting and at stage Z-31 (1/3 and 2/3). Wheat (Satha 69) was seeded at a rate of 84 kg/ha. The trial was harvested on 15 May, 1995.

Results show that N fertilization increased straw and grain yield of wheat between 59 to 150 % compared to no fertilizer application. Nitrogen uptake also increased from 17.8 to 58.4 kg N/ha, and from 35.6 to 113.7 kg N/ha, for straw and grain yield respectively, as the N fertilizer rate increased from zero to 210 kg N/ha. There was not a significant difference in wheat yield due to irrigation scheduling. Percentage of Ndff in straw and grain was estimated using ^{15}N labelled fertilizers. When 140 kg N/ha was applied as fertilizer, on average, 47% of the N in the crop was derived from fertilizer-N. When 210 kg N/ha of fertilizer was applied, the percentage of N derived from fertilizer declined to 32%. The % Ndff in the soil N pool after harvest was low, ranging between 0.3% to 1.1%.

Water consumption (mm) by wheat crop or actual evapotranspiration (ETa) was estimated by measuring the soil content before and after irrigation in the different soil layers. ETa by wheat was 406 mm when the crop was irrigated 6 times and 334 mm when irrigated 4 times.

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Use of nuclear techniques for optimizing fertilizer application under irrigated wheat to increase the efficient use of nitrogen fertilizers and consequently reduce environmental pollution.

The results on grain and straw yield, nitrogen content, total N and fertilizer N uptake and use were reported. There was wide variation in the dry matter yield recorded at Z-30 sampling among the treatments. For the N-0 treatment, dry matter yield ranged from 390 to 479 kg/ha. For the N-60 treatment it ranged from 414-467 kg/ha, in the N-120 treatment between 602-644 kg/ha, and for the N-180 treatment between 643-707 kg/ha. In all the N fertilized plots the N content in plant tissue was similar but was much reduced in the control plants. At the 50% anthesis nearly 85-90% of the total N accumulation by wheat at final harvest was accounted for in the straw and ears. At final harvest the mean grain yield was 2.02 Mg/ha in the check plots, 3.5 Mg/ha in N-60 treatment, 5.11 Mg/ha in N-120 treatment and 5.7 Mg/ha in N-180 treatment. A similar trend was observed for straw yield. Grain from the check plots showed significantly lower nitrogen content compared to the N fertilized wheat and an application of 180 kg N/ha resulted in significantly higher N content in wheat grain and straw. Total nitrogen uptake by wheat crop was 35.7, 86.7, 134.9 and 172.3 kg/ha for the N-0, N-60, N-120 and N-180 treatments, respectively.

In the N-120 treatment the fertilizer N use efficiency from the first split of 40 kg N/ha was 27.8% and increased for the second split applied at Z-30 stage to 63.4%. For the N-180 treatment those values were 25.3 and 49.6%, respectively. The overall fertilizer N use efficiency by wheat from N-120 and N-180 treatments was 51.9% and 41.5%, respectively.

In the soil solution samples, collected at 60 cm, 90 cm and 120 cm depths from the microplots located in the N-120 and N-180 treatments, there was little NH_4-N compared to soil samples extracted with 2N KCl solution from similar depths. However, the NO_3-N content of the soil solution showed an initial increase at 60 cm depth followed by the 90 and 120 cm depths. The concentration of NO_3-N at all the three depths were nearly double when fertilizer was applied at a rate of 180 kg N/ha compared to an application of 120 kg N/ha. The NO_3-N derived from fertilizer in the soil solution also showed a similar trend and was 3-4 times higher in the N-180 treatment compared to the N-120 treatment.

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Studies on N-use efficiency by irrigated wheat, using ^{15}N-labelled fertilizers.

Nitrogen fertilizer recovery has been estimated to be less than 50% for irrigated wheat. Rate and timing of N application are two important factors that affect N fertilizer recovery. To evaluate four rates of N application (0, 85, 167 and 250 kg N/ha) and two times of application (at planting and close to the DC30 stage of development), a field study was established in the Yaqui Valley, Sonora, Mexico. The trial consisted of four treatments and was laid out as a randomized complete block design. For each treatment which covered an area of 225 m^2, two microplots of 1m x 1.5 m were established. The first microplot (M1) received 1/3 of the total rate of fertilizer-N as ^{15}N urea at the time of planting and 2/3 of the total rate was applied at the DC30 growth stage as unlabelled urea. The second microplot (M2)

received 1/3 of the total rate of N as unlabelled urea and 2/3 of the total rate close to the DC30 growth stage as ^{15}N labelled urea. The response to N application rate was quadratic. Nitrogen yield at planting was lower (16%) than close to DC30 (22%) across treatments. Total N recovery on average was 38% for the three rates.

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Effect of bacteria and humic acids on the yield of wheat under irrigated.

The effect of several rhizobacteria on dry weight at booting and inflorescence emergence of the stem and root system of irrigated wheat at low nitrogen rate (urea less than 80 kg/ha) was evaluated. Greenhouse experiments were conducted and seed were inoculated with various rhizobacteria isolated from different sources. Plastic containers filled with sterile sandy were used as a support system and plants were supplied with a nutrient solution. Plants were grown for 30-50 days and the soil moisture content adjusted at 60% of field capacity. Control plants were supplied with 150 kg/ha of urea. Results indicate that dry weight of wheat inoculated with some bacteria, alone or as a mixture, is statistically higher than the control plants which suggest that the microorganisms could be used to improve N fertilizer uptake of wheat under irrigation.

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Contribution to the improvement of applied water and N-fertilizer efficiencies for irrigated wheat.

The main objective was to review previous research conducted on water and N fertilizer management of irrigated wheat, one of the most important crops in Morocco. In addition, a survey of over 80 farms was conducted and all practices related to water and N fertilizer application were investigated in order to identify strengths and weaknesses of these practices. To assess the potential of N leaching, 8 farms were closely monitored for soil water content, canopy temperature, and N and water application. Previous research on irrigated wheat in the area revealed that tillering stage is the most likely period when wheat can be subjected to severe water stress. While one or two irrigations during this growth stage will lead to maximum water-use efficiency and a competitive yield, farmers still irrigate three to four times. Water and N applications are based on farmer's experience rather than on recommendations derived from scientific investigations. However, such recommendations do exist, especially with respect to the amount and timing of N application.

Because precipitation during crop growth was low, the restriction on water allocation and the priority of water used for other crops allowed farmers to apply only 130 to 250 mm which subjected wheat to a water deficit of 40 to 60%. The average yield (3,000 kg/ha), therefore, was below the region's potential. When the stress was limited during the critical growth stages, yield reached the more long-term average values (5,700 kg/ha). Early seeding and soils with a high water holding capacity increased yield. Yield was only limited to the amount of water used by the crop rather than to the application of fertilizers. The absence of a response of yield to fertilizer N application was explained by: (1) water was limiting and it affected the yield before a nitrogen deficit occurred, and (2) residual N from previous crops was high. In either case, a large part of the applied nitrogen is not available for plant uptake and is lost through volatilization or drainage where it leads to groundwater contamination.

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Yield response of wheat to irrigation and nitrogen fertilizers in Romania.

Response of wheat to different rates and time of N fertilizer application in the Eastern part of Romania was evaluated. The investigation started in the autumn of 1994 on a level field. Four rates of N fertilizer were used: unfertilized (check plot), 60 kg N/ha, 120 kg N/ha and 180 kg N/ha. The N (urea) fertilizer rates was split between two applications: one third in autumn at seeding and two thirds at Zadoks growth stage 30. Urea labelled with 2 atom % ^{15}N excess was used to study fertilizer use. Urea labelled at 10% atom ^{15}N excess was used to study fertilizer movement in the soil below the rooting zone and to determine the occurrence of ground water pollution. Soil moisture content moisture of >50% of water holding capacity was maintained.

By utilizing the neutron gauge to determine soil moisture content, it is possible to determine the appropriate time and the amount of water to be used for irrigation. The amount of N in the crop derived from the fertilizer was higher when the N fertilizer was applied at tillering. Values increased with increasing rates of N fertilizers application. The values for N use efficiency ranged from 17,5 to 45,1%; its highest value being recorded with an N application of 120 kg/ha at tillering time. The amount of N in the soil to a depth of 0-80 cm soil profile ranged from 14 to 30 kg N/ha and was dependent on the amount of fertilizer applied. Based on the N recovery of fertilizer in plant and soil, a significant portion of the applied fertilizer is lost through leaching or volatilization.

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Nuclear techniques for optimizing fertilizer application under irrigated wheat.

Wheat production in Syria is important because it is the main ingredient of bread. Its yield per unit area and the total production from non-irrigated areas fluctuates year to year due to the vagaries of precipitation events. Yield increased during the last decade by using new highly productive cultivars, by increasing the rate of fertilizer application and through the use of irrigation with water obtained from ground or surface water. However, the average yield of the high productive cultivars remain low (2861 kg/ha) during the 1981 to 1990 period. A field in semi-arid area was selected and two cultivars were grown which were subjected to four rates of N fertilizer and irrigation. A sprinkler irrigation system was used to supply water. The primary results showed a significant effect of applying N fertilizer on grain yield. The yield obtained from Sham 3 cultivar was higher than for Sham 6. Using nuclear techniques in monitoring soil water content over time and the use of labelled fertilizers management practices could be adapted to reduce leaching of water and N below the root zone.

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Wheat yield response to irrigation and nitrogen fertilizer applications.

Wheat yield response to different rates of N fertilizer applications under different degrees of transpiration deficits was evaluated. A single line source sprinkler irrigation system was used with the intention of studying fertilizer N-irrigation interactions. However, experimental data subject to discussion here is limited to only one year, the 1994/95 growing season, when the annual rainfall received was unusually high. Therefore, irrigation treatments envisaged could not be realized. Results presented, therefore, do not include any data on irrigation.

Lowest grain yield (3.34 Mg/ha) was recorded under the no N-fertilizer treatment. There was no significant yield increase beyond 80 kg N/ha fertilizer application. Under the treatment where no N fertilizer was applied, total dry matter production nearly stopped after 100 days after planting (DAP); whereas, it continued even after 100 DAP for the plots that received fertilizer. Spike weight increase showed a similar trend. Utilizing ^{15}N-labeled N fertilizer, wheat benefited the least from the fertilizer applied at the seeding. N fertilizer utilization was 2 to 3 times higher when two thirds of the N was applied during tillering (Z-25 growth stage). Percent N derived from fertilizer was not influenced by the rate, but rather by the timing of N application. Residual soil N after the harvest of wheat seems to be proportional to N fertilizer rate used for wheat, and proportionally higher residual N left in the soil was found under high rate of N application. Recovery of N fertilizer by wheat was nearly 50% under the highest rate of N application (240 kg N/ha), and the remaining N was retained in the soil after the harvest. Yield of maize, planted following wheat, showed, therefore, a good response to the preceding N treatments used for wheat, clearly indicating that maize benefited from the residual N, left within the soil profile after wheat was grown. Recovery of residual N by maize was > 30% or about 10 to 15 % of the N fertilizer applied to the preceding wheat crop.

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The use of nuclear techniques to increase wheat production and decrease the nitrogen loss from ammonium bicarbonate.

The effects of fertilizer application method with immediate irrigation on nitrogen uptake by winter wheat (Triticum aestivum c.v. 78-1) were followed by ^{15}N tracing techniques in 1994. Results showed that when urea was applied on the soil surface followed by irrigation, the N recovery efficiency (NRE) was 48.8% at maturity stage. By means of irrigation the recovery increased by 9.4% and the N loss decreased by 28.5% compared to applying urea without immediate irrigation. The NRE of ammonium bicarbonate applied at the surface without immediate irrigation was only 22%. The NRE increased to 29% and nitrogen loss decreased by 14% with immediate irrigation. However, when ammonium bicarbonate was banded beneath soil surface at 10 cm depth, immediate irrigation didn't significantly affect the NRE. When dicyandiamide (DCD), a nitrification inhibitor, was incorporated into soil at 10 cm depth with ammonium bicarbonate at a rate equivalent to 4% of nitrogen applied rate, the NRE increased to 40.9%, equivalent to the NRE when urea was banded on the surface. The NRE increased by 18.9% and grain yield by 30.3% when ammonium bicarbonate was applied without immediate irrigation. Over 50% of the fertilizer N was recovered from the upper soil profile (0-30 cm).

A decision support system for a high-yield cultivation of winter wheat was developed which was based on CERES-wheat model. According to the experimental results, a genetic coefficient of 5144 was defined and the data of soil profile properties and initial conditions in the experiment site and validation of CERES-wheat model made with the data gathered in 1995. Simulation experiments were made to analyse the feasibility of optimization and the decision-making process using CERES-Wheat model. The predicted data generated from the model simulation were compared with measured data from the field experiment. Based on the studies mentioned above and using the CERES-model, the growth stage of winter wheat could be simulated under nominal cultivated condition (without water and fertilizer stress).

Nitrogen application could increase crop growth and stimulate N uptake. However, because ammonium volatilization was not included in the simulation model, the effects of N application on the N balance was not well simulated.

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In situ nitrogen balance of an irrigated maize by continuous monitoring plus sampling at harvest.

Field experiments with ^{15}N-labelled fertilizer were conducted on irrigated maize crops in 1991, 1992 and 1993 at the Experimental Farm at La Côte Saint-André (France). The dynamics of soil and fertilizer-N (nitrate transport and N balance during cropping and intercropping periods) were continuously monitored using ^{15}N isotopic tracing and tensio-neutronic method together with porous cups installed at 0.3, 0.5 and 0.8 m depth. Direct measurements of field water balance (real evapotranspiration and drainage below the root zone) were also carried out at the same sites. The balance of the labelled fertilizer at harvest was determined by conventional soil coring and plant sampling. The two methods were used successfully during the 3 under different climatic conditions. The result shows that the traditional fertilizer input in the area (250 kg/N ha) could be reduced by nearly 30% without any substantial reduction in yield, but with a considerable reduction of non-point-source pollution due to nitrate leaching. It is also shown that with the combined use of the two methods it is possible to characterize separately the fertilizer uptake, fertilizer leaching, immobilization and the losses of N gas.

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Efficient use of nitrogen fertilizer for irrigated wheat

The Crop Management and Physiology sub-programme at CIMMYT has been working for several years to increase N use efficiency in irrigated spring wheat. Progress is apparent as N fertilizer recovery has increased from about 30 to 60%, using a split application that synchronizes the timing of the largest N application with the time of rapid crop N uptake. On the other hand, nothing was known about the pathways and mechanisms of N losses to the environment in farmers fields. Therefore, it was difficult to assess the impact of these losses on the environment. A collaborative study was initiated among three institutions to study the problem of N use efficiency in the Yaqui Valley. CIMMYT is focusing on the agronomic components, the University of California-Berkeley evaluates the ecological impact and Stanford University (Institute of International Studies) looks at the technical, economic and policy determinants of N fertilizer use. CIMMYT recognizes that N use efficiency in wheat is a world wide problem which is particularly important in the Yaqui Valley because:

a) the location is representative of what CIMMYT defines as mega environment 1 (ME1), and where more than 40% of the wheat production in developing countries is grown,
b) the green revolution started here about thirty years ago,
c) the main cost of wheat production is fertilizer use,

d) the consequences of fertilization on emission of nitrous oxide have been studied in temperate agricultural systems but little information exists from developing countries in the tropics and sub-tropics, and

e) the effect of fertilization on emission of nitric oxide has received much less attention in the temperate world, and virtually none in developing world agriculture outside flooded rice systems.

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Optimizing fertilizer application under irrigated wheat

The study was conducted in western Nebraska about 600 km from Lincoln where our offices are located at the University of Nebraska. Normal precipitation is about 400 mm but in 1995, it was about 50% in excess of the long term average. The study was in co-operation with University of Nebraska wheat breeders and a soil fertility specialist located on site (Sidney, Nebraska). The study consisted of 3 cultivars grown at four N rates (0, 15, 30 and 45 kg N/ha) under linear-drive sprinkler irrigation. The soils specialist at the location was hired by Industry, therefore, co-ordination was handled by Lincoln staff. The first attempt to apply fertilizer was cancelled because of a blizzard, and the second, because of a rain storm. Finally, the fertilizer was applied on 6 April 1996. Chlorophyll meter readings at anthesis and 3 weeks later showed no N treatment difference or yield difference. Isotopic N determinations have been completed, but calculations are not yet completed. Since depleted NH_4NO_3 was used as the tracer on all plots rather than enriched fertilizer on micro plots, results are questionable, because of the low fertilizers rates, and relatively high yields (7-8 Mg/ha).

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Field measurements to investigate the nitrogen leaching by means of the ^{15}N-method

In an apple-tree orchard, a field study allowing the comparison of different techniques of soil water sampling and determination of the nitrate concentration was conducted. Suction cups and tensionics are used to obtain soil water samples in the root-zone at different depths (15, 45, 75 cm). Percolation and nitrogen leaching are measured by small lysemeters and suction cups below the root zone (105 cm). Soil water samples are taken continuously and/or weekly. ^{15}N-labelled is applied as a tracer (ammonium sulfate, 5 atom % ^{15}N excess) during a period of ten weeks. The soil is a chernozium and the texture varies from a deep sandy loam to a shallow sandy silt above gravel. The comparison of the different measurement methods will be presented.

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The use of nuclear and related techniques for optimizing nitrogen fertilizer application under irrigated spring wheat

The objectives of these field studies were to monitor the fertilizer uptake and the fate of mineral nitrogen in the soil as well as the fertilizer use efficiency at different growth stages using ^{15}N labelled nitrogen fertilizer. Therefore, under optimal irrigation, two fertilizer treatments were chosen: N1 as the deficit fertilization treatment with 50 kg N/ha (50% of recommended rate) and N2 as the recommended rate with 100 kg N/ha. Each treatment was replicated six times. For treatment N2, 2.1 atom % ^{15}N labelled ammonium sulphate was used; for treatment N1 only unlabelled fertilizer. The fertilizer was applied in two split applications: one-third at emergence and two-third at Zadoks stage 30 after the first harvest. Three harvest series were done to determine the N uptake at different growth stages: the first harvest at Z-30, the second at anthesis and the third at physiological maturity for treatment N2 and at yield maturity for treatment N1. After each harvest and before the first fertilizer application soil samples were taken at two layers, 0-20 cm and 20-40 cm and analysed for mineral nitrogen in the soil. The plant and soil material were also analysed for ^{15}N. To recover periods of nitrogen deficiency at treatment N1 chlorophyll meter readings with the chlorophyll meter SPAD were weekly taken to calculate the sufficiency index.

For calculating the water required by irrigation the soil moisture content was measured weekly with a neutron probe. Spring and summer of 1996 were wet with 216 mm rainfall throughout the vegetation period and irrigation only took place 75 and 85 days after seeding when a total of 49 mm of water was applied. Total dry matter production increased from 1,663 kg/ha to 11,070 kg/ha for treatment N1 and from 1,751 kg/ha to 12,866 kg/ha for treatment N2. Significant differences appeared only at the third harvest period for total N uptake by the crop. The SPAD readings showed that throughout the entire growing season the readings of treatment N2 were generally higher than those of treatment N1. However, both treatments followed a similar trend with a plateau between Z-30 and Z-69 and a dramatic decrease toward the end of the growing season. The sufficiency index also showed that for this period, treatment N1 had N deficiency. Consequently, it can be concluded that the chlorophyll meter SPAD is a useful tool to determine a possible N deficiency during the growing season.

2. Consultants Meeting on formulation of interregional/regional technical co-operation project on isotope-aided studies on productive utilization of salt-affected wasteland for sustainable agriculture. Vienna, 20-24 May 1996.

Following experts missions organized in Egypt, Iran, Iraq, Morocco, Myanmar, Pakistan, Syria and Tunisia, a Consultants Meeting was organized by IAEA Technical Co-operation Department and Soil Section of the Joint FAO/IAEA Division, to finalize the formulation of an interregional project on the above subject. Drs. J. Gallagher (USA), A.M. Mashali (FAO, Rome), M. Naqvi (Pakistan) and I. Szabolcs (Hungary), were the experts who participated at the meeting and C. Hera was the Scientific Secretary. The main objective of the project is to demonstrate the potential of the use of saline groundwater to irrigate halophytes plants growing on salt-affected soils that currently are not part of an agriculture ecosystem and are considered wastelands. The technical co-operation project will be developed in close collaboration with the Isotope Hydrology Section of the Division of Physical and Chemical Sciences.

Planned

1. Second workshop on the FAO/IAEA Regional project for Asia and the Pacific on "Nuclear techniques for the promotion of agroforestry system" to be held in Faisalabad, Pakistan on 28 July - 1 August, 1996.
Technical Officer: C. van Kessel

2. **The final Research Co-ordination Meeting on "Enhancing soil fertility and crop production by better management of *Rhizobium*", 2-6 September in Vienna, Austria**
Scientific Secretary: G. Hardarson

3. **The second Research Co-ordination Meeting on "The use of irradiated sewage sludge to increase soil fertility and crop yields, and to preserve the environment", Cairo, Egypt from 14-18 September.**
Scientific Secretary: C. Hera

4. **The first Research Co-ordination Meeting on "The use of isotope techniques in studies on the management of organic matter and nutrient turnover for increased, sustainable agricultural production and environment preservation", 7-11 October 1996, Vienna, Austria.**
Scientific Secretary: C. van Kessel

5. **The first Research Co-ordination Meeting on "The assessment of soil erosion through the use of ^{137}Cs and related techniques as a basis for soil conservation, sustainable agriculture production and environmental protection", 11-15 November 1996, Vienna, Austria.**
Scientific Secretary: F. Zapata

6. **FAO/IAEA Consultants Meeting on "The use of nuclear techniques in rainfed agriculture" will be organized in the last quarter of the year in Vienna, Austria.**
Scientific Secretary: P. Moutonnet.

7. **The first Regional Co-ordination Meeting of Technical Co-operation Project on "Plant Nutrition and Soil-Water Management" (RLA/5/036) is scheduled from 30 September to 4 October 1996 in Irapuato, Mexico.**
Scientific Secretary: F. Zapata

8. **Workshop on strengthening analytical laboratories in Latin America, November 1996, Santiago, Chile.**
Scientific Secretary: F. Zapata

TECHNICAL CO-OPERATION PROGRAMMES

The Soil and Water Management & Crop Nutrition Section currently has the responsibility for some 50 Technical Co-operation Projects. In this issue, we highlight the activities of some Technical Co-operation (TC) projects in Latin America.

1. Inter-regional TC project on Quality Assurance Services for N-15 Analyses by Optical Emission Spectrometry (INT/5/130)

This project was initiated in 1994 with the main objective of establishing a quality control programme for N-15 analyses using optical emission spectrometry aiming at the effective use of nitrogen -15 technology for nitrogen research in developing Member States. Within the framework of the IAEA Technical Co-operation Programme, emission spectrometers for measuring nitrogen isotopic ratios have been supplied to several Member States for the establishment of their own laboratory facilities for N-15 analysis. It is, however, necessary to ensure that results generated from these laboratories are reliable and accurate and thus will meet international standards. This can be achieved through an international laboratory network for comparing analytical results of reference and problem samples. The Soil Science Unit of the FAO/IAEA Agricultural and Biotechnology Laboratory at Seibersdorf will be assisting as

the central reference laboratory. The first inter-comparison run was completed in 1995 and an assessment of the analytical variations among laboratories was made. Possible sources of error were identified and ways to correct it recommended. Expert missions have been carried out to laboratories in the Latin American region. A final report is in preparation and the project is expected to be completed this year.

As a result of the increased awareness for this type of quality assurance services in the laboratories of the Member States, future activities in 1997-98 are envisaged to be continued as regional projects.

2. Regional TC Project for Latin America (ARCAL XXII) on Plant Nutrition and Soil-Water Management (RLA/5/036)

This project was first approved in 1995 as a "footnote" project and was upgraded to a full project this year. The main objectives of this project are to develop strategies for integrated and efficient use of fertilizers and alternative nutrient sources under different cropping systems, to assess improved water and soil management practices in order to maintain the productivity of land resources and to control soil degradation.

Implementation of this project during 1996 will include the first co-ordination meeting, a workshop and a national training course among other activities. The first co-ordination meeting is planned at the Irapuato Unit of the CINVESTAV of the National Polytechnic Institute, Irapuato, Mexico from 30 September to 4 October 1996. A training workshop on strengthening the analytical laboratories in the region will take place at La Reina Nuclear Centre, Santiago, Chile from 11 to 15 November 1996. A national training course is likely to be organized in Cuba.

IN MEMORIAM

K. SALIYA KUMARASINGHE

The demise of our dear Saliya Kumarasinghe, was a painful shock to his family, colleagues and friends. He passed away after a brief illness on 17 June 1996 at the age of 52, at the Rudolfstiftung Hospital in Vienna.

Saliya was born on April 17, 1944 in Sri Lanka, obtained his Ph.D. degree in Crop Physiology in 1975 at the Imperial College of the University of London and Rothamsted Experimental Station, Harpenden, England. He had 24 years of successful professional experience in the use of nuclear techniques in soil fertility and plant nutrition research with particular reference to isotopes ^{15}N, ^{14}C, ^{13}C and ^{32}P. Almost all his work had been conducted in tropical countries.

Saliya was the Project Officer of several Co-ordinated Research Programmes implemented by the Soil Fertility, Irrigation and Crop Production Section of the Joint FAO/IAEA Division. From 1989 to 1994 he was the Project Officer of the FAO/IAEA/SIDA Co-ordinated Research Programme on "The use of isotope studies on increasing and stabilizing plant productivity in low phosphate and semi-arid and sub-humid soils of the tropics and sub-tropics", which included Egypt, Ghana, Kenya, Morocco, Nigeria, Senegal, Sierra Leone, Sudan, Tanzania and Tunisia. This project was successfully completed in 1995 and as a result a TECDOC was published in 1996. He was the Project Officer of the ongoing FAO/IAEA Co-ordinated Research Programme on "The use of irradiated sewage sludge for enhancing soil fertility and crop production and reducing environmental pollution", which he successfully conducted.

Saliya assisted the Agency as Technical Officer of Technical Co-operation Projects in the field of soil fertility and plant nutrition. He served as an expert in this area in different countries of Africa (Ghana, Nigeria, Uganda), East and West Asia (PR of Korea, Malaysia, Syria and Thailand) and Latin America (Ecuador). He also served as the first Regional Expert for the African Regional Technical Co-operation Project on Biological Nitrogen Fixation during the period 1987-1989. He was also Technical Officer of the Regional Project for Asia and the Pacific on "Nuclear Techniques for the Promotion of Agroforestry Systems", with the following participating countries: Bangladesh, Indonesia, Malaysia, Myanmar, Pakistan, the Philippines, Sri Lanka, Thailand and Viet Nam.

In addition to project management, he had wide experience in teaching and running of regional and interregional training courses involving isotope and nuclear related techniques in soil/plant studies. He assisted, as a lecturer, in our FAO/IAEA Interregional Training Courses in Seibersdorf for the last 12 years and was the Technical Officer for Regional Training Courses on the use of isotopes and radiation techniques in soil/plant relationships held in Ghana (1988), Senegal (1989), Malaysia (1990) and Thailand (1995).

He published 30 scientific papers, and to his credit, the book "Isotopic studies of *Azolla* and nitrogen nutrition of rice", was published by the Kluwer Academic Publishers, in collaboration with the Joint FAO/IAEA Division.

Saliya was known for his frankness, in-depth analysis, high intellectual approach to life, and for his charming personality. Through his work he made many friends. He was always modest. He invariably sought to bring a spirit of harmony amongst his colleagues.

It is very hard to accept that Saliya is no longer with us. No one could have imagined that he would not return healthy from the hospital, he had never been sick before. I remember the last time, a few hours before he died, speaking with him on the telephone. He was so optimistic, and we agreed to meet the next day to discuss future activities. We will miss him very much - we won't forget him.

Christian Hera

Excerpts from letters received:

"Heard the shocking news of Saliya's death. I am deeply sorrowed of thinking that he is no longer alive. He had really worked and gave a lot from himself to the Section and the Division. My deepest condolences to all his friends in the Section and the Division". (Cevat Kirda, Turkey).

"I cannot accept and take the news on Saliya's death. How can such a good person die so prematurely?" (Seth Danso, Ghana).

"I was saddened to learn of Kumar's untimely passing" (Craig Atkins, Australia).

"Very sorry to know about the sad demise of Dr. K.S. Kumarasinghe. Please convey my condolence to the bereaved family". (Sultana Ahmed, Bangladesh).

"I heard the terrible news about the sad demise of our dear friend Saliya". (Kauser Malik, Pakistan).

"This morning I received a very sad news that Dr. Saliya Kumarasinghe of your Section suddenly passed away due to heart attack". (Etsuo Amano, Japan).

"I am very shocked and saddened by this terrible occurrence. I have known Saliya for many years. He was about to leave IAEA and return to Sri Lanka when he was struck by heart attack". (David W. Lawlor, U.K.).

The former Director of the Joint FAO/IAEA Division, Dr. B. Sigurbjörnsson, and the former Head of Soils Section, Dr. Glynn D. Bowen, expressed also their sincere condolences.

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