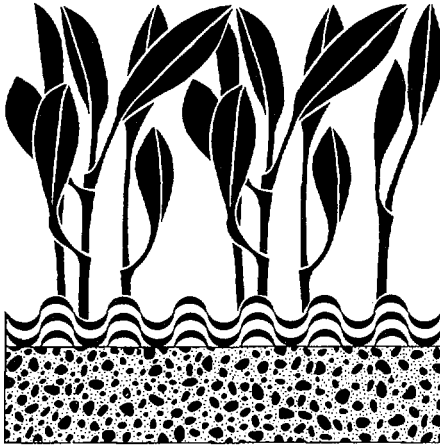




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# Soils Newsletter



JOINT FAO/IAEA DIVISION  
OF ISOTOPE AND RADIATION APPLICATIONS  
OF ATOMIC ENERGY  
FOR FOOD AND AGRICULTURAL DEVELOPMENT  
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA

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1. TO OUR READERS

We are pleased to present the first issue of our Soils Newsletter in 1984. We are sure that many of you have been anxiously waiting to read about what has been happening in the Section since the beginning of the year. Both in Headquarters and in the Seibersdorf Laboratory, the group continues to be very active in coordination of our many Research Programmes, hosting scientific meetings, providing technical responsibility for Technical Cooperation Projects in Member States, undertaking expert/consultant missions abroad, publishing reports/books, providing analytical services for participants of our programmes and above all actively involved in research.

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One major news in the Section is, that Dr. Craig Atkins, of the Department of Botany, University of Western Australia has been seconded to the Section as Head. He replaces Dr. Klaus Reichhardt, who as we reported in our previous Newsletter, has been transferred to the Seibersdorf Laboratory. Craig is a well-known plant physiologist, very active in the field of nitrogen fixation. We are very pleased to have him on the staff and his contribution will undoubtedly give our planned emphasis on research in agricultural biotechnology a big boost.

We are encouraged by the increasing requests for our Soils Newsletter; the circulation has now reached some 500, comprising both institutes and individual readers. We will, however, be pleased to receive from you any comments and suggestions for improvement to the newsletters' format or content. Also, please notify us promptly of any change in your mailing address.

## 2. STAFF

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Helga Axmann, Head Analyst

Aldo Sebastianelli, Analyst

Leopold Mayr, Analyst

## 3. ONGOING COORDINATED RESEARCH PROGRAMMES.

- (a) FAO/IAEA/IG Coordinated Research Programme on the Use of Nuclear Techniques in Improving Pasture Management.

The first Research Coordination Meeting of this programme was held in Vienna from 7 - 11 November 1983. Based on the reports presented and the discussions that followed, it was decided that participants of the programme should concentrate on studies aimed at identifying suitable methods for applying N-15 to plots for the estimation of nitrogen fixed by pasture

legumes. In addition, each participant was to select about four optional treatments, such as estimating how much nitrogen a pasture legume fixes in a sole versus mixed cropping system, the ability of various legume varieties or species to fix atmospheric nitrogen or how specific management practices influence the amount of nitrogen fixed by the legume. The results of these studies will be discussed at the second Research Coordination Meeting of the programme which will be held in Vienna from 26 - 30 November 1984.

(b) FAO/IAEA Coordinated Research Programme on Isotopic Studies of Nitrogen Fixation and Nitrogen Cycling in Azolla and Blue-green Algae.

Research by contractors in this programme is now beginning and the first set of Research Plans has recently been sent out. Contracts have been awarded in Brazil, Bangladesh, Hungary, Malaysia, Pakistan, Philippines, Sri Lanka, Sudan and Thailand. There may still be room in the programme for a few more good contractors. We expect to hold the first coordination meeting in December 1984 in Vienna. Research to be performed by the contractors is based on preliminary research conducted by the IAEA Seibersdorf Laboratory in cooperation with the Research Institute for Irrigation in Szarvaz, Hungary. The results of these preliminary experiments are summarized below.

The symbiotic association of the water fern Azolla with the blue-green algae Anabaena azollae can fix 30-60 kg N/ha per rice cropping season. The value of this fixed-N for rice production, however, is only realized once the N is released from the Azolla biomass and taken up by the rice plants.

Field experiments were conducted to compare the availability of Azolla-N using both direct and indirect N-15 labelling techniques. Azolla caroliniana was labelled directly by growing the fern in a nutrient solution containing N-15 urea and subsequently incorporating the material into the soil at a rate of 144 kg N/ha. Urea-N-15 was applied to comparable plots at a rate of 100 kg N/ha. Both treatments were established just prior to flooding of the fields. Rice was harvested at maturity 110 days later. The N use efficiency for Azolla-N was found to be 32 % compared to 26 % for urea. The difference was not significant.

(c) Report on the FAO/IAEA Research Coordination Meeting on the Use of Nuclear Techniques in Development of Fertilizer and Water Management Practices for Multiple Cropping Systems.

The third meeting of the FAO/IAEA Coordinated Research Programme on the Use of Nuclear Techniques in Development of Fertilizer and Water Management Practices for Multiple Cropping Systems was held in the Centre for Application of Isotopes and Radiation, Jakarta, Indonesia from 5-9 March 1984. Dr. K.V. Kalinin served as the Scientific Secretary for the Meeting and Prof. J. Ahimsa, Director General of the Indonesian Atomic Commission, delivered a speech of welcome during the opening ceremony. Participants of the programme from Ghana, Indonesia, Panama, Thailand, Turkey, United States of America and Zambia all took an active part in the meeting and made reports on their work during 1983-1984.

In the experiments with multiple cropping (cereals and legumes) both method and time of applying N and P were studied. From the results of seven of our contractors a response to N was observed. In three cases N application as half applied as broadcast and incorporated over the entire plot at seeding and half side-dressed four weeks after sowing near the cereal rows was the best treatment. Other contractors found that the best treatments were "banding the entire nitrogen dose near the cereal rows at seeding" or "50 % N broadcast and incorporated near the cereal rows at seeding and 50 % N sidedressed at 4 weeks after sowing near the cereal rows". Similar variation was observed in the experiments with P application. During the meeting the plans for 1984, the last year of the

programme, were discussed and approved. Dr. J. Bole (Canada), a previous Head of the Soils Section in Vienna, was invited to the meeting as a consultant, Dr. C. van Kessel (NIFTAL project, USA) participated as an observer and Dr. R. Roy represented FAO, (AGLF).

The final Research Coordination Meeting of this programme will be held at the Vienna International Center, Vienna, Austria in the middle of 1985.

(d) FAO/IAEA Coordinated Research Programme on Isotope and Radiation Techniques for Efficient Water and Fertilizer Use in Semi-Arid Regions

This programme was formally ended at the Final Research Coordination Meeting held in Vienna, from 6-10 February 1984. During the meeting all contractors and agreement holders presented reports including discussions and conclusions drawn from their experimental work carried out during the whole period of the programme (1978-1983). The main conclusions on water and fertilizer efficiency studies are now being edited and will be part of an IAEA-TECDOC planned for the end of 1984.

4. PLANNED COORDINATED RESEARCH PROGRAMMES

(a) Improvement of the capability of the grain legume-Rhizobium symbiosis to fix atmospheric nitrogen.

A Consultant's Meeting on Breeding for Improved Nitrogen Fixation in Grain Legumes, held in September 1983, recommended the initiation of a Coordinated Research Programme on the subject. This will be a joint programme between the Soils and Genetics Sections of the Joint FAO/IAEA Division and will have the objective to increase grain legume yields by utilizing nitrogen derived from the atmosphere rather than fertilizer nitrogen. In the later stages of screening genotypes with this ability, the N-15 methodology to evaluate atmospheric nitrogen fixation will be used.

Persons interested in participating in the above research programmes should contact the Head, Soil Fertility, Irrigation and Crop Production Section for further information and contract application forms. From the applications received, 10-15 participants will be selected to constitute the Coordinated Research Programme. The contract programme provides limited funds to Institutes from developing Member States of the IAEA for the supply of isotopes and purchase of small equipment items necessary for conducting the research. Participants meet occasionally to review the progress of their research and to plant future studies.

(b) Nuclear Techniques to Improve Crop Production in Salt-affected Soils

The Agency has given its approval for the initiation of a coordinated research programme on the Use of Nuclear Techniques to Improve Crop Production in Salt-Affected Soils. For further details of this programme, interested participants should contact the Head, Soil Fertility, Irrigation and Crop Production Section.

5. TECHNICAL COOPERATION PROGRAMMES

The Soils section has, in 1984, the technical responsibilities for Technical Cooperation Projects in the following countries:

Bangladesh (1), Bolivia (1), Brazil (1), Chile (1), Colombia (2), Egypt (2), Ghana (1), Greece (1), Ivory Coast (3), Kenya (1), Madagascar (1), Malaysia (2), Mali (2), Mauritius (1), Morocco (1), Niger (1), Pakistan (1), Panama (1), Romania (1), Republic of Korea (1), Senegal (4), Sri Lanka (2),

Thailand (1), Tunisia (3), Tanzania (2), Uruguay (2), Venezuela (1), Zaire (1), Zambia (2).

6. RESEARCH IN THE FAO/IAEA AGRICULTURAL BIOTECHNOLOGY LABORATORY.

(a) Multiple Cropping

Two field experiments using N-15 methodology are being carried out at the IAEA Biotechnology Laboratory in 1983/1984 to study the benefit of including a legume in a crop rotation. These experiments are performed in support of the Coordinated Research Programme on Multiple Cropping systems.

(b) Azolla and Blue-Green Algae

Several greenhouse and field experiments have been carried out using N-15 to study  $N_2$  fixation by the Azolla-Anabaena symbiosis and the use of Azolla as biofertilizer. It has been found that Azolla-Anabaena is able to derive most of its N from the atmosphere, when the concentration of N in the growth medium is low. The use of Azolla as biofertilizer is still being investigated and results of these field experiments carried out in Hungary will be available by the end of the year. Mr. S. Kumarashinghe from Sri Lanka assisted as a consultant in the establishment of these experiments.

(c) Pasture Management

During 1984 a new experiment was started to evaluate the influence of spatial variability on soil water relations, fertilizer uptake and nitrogen fixation in pastures. The experiment consisted of three transects (each containing 64 neutron probe access tubes 1.5 m apart, to assess soil water content) one planted to alfalfa, another to ryegrass and the third maintained bare. Continuous observations of soil water content, fertilizer uptake and nitrogen fixation have been and will continue to be carried out on all 64 plots during the period 84/85. Mr. C. Kirda, a soil physicist from the Physics and Electronics Section of the Seibersdorf Laboratory is responsible for these experiments.

(d) Rock Phosphates

Greenhouse and field experiments continue to be carried out in Seibersdorf using P-32 labelled superphosphate as a standard to evaluate the availability of phosphorus in rock phosphates of different origin. The method is based on the measurement of the fraction of P in plants derived from fertilizer, which is calculated from the ratio of specific activity of P-32 in plant and fertilizer. In the presence of phosphorus from rockphosphate, the specific activity of P-32 in plant samples decreases. From the magnitude of decrease in specific activity the available amount of phosphorus in the rock phosphate can be calculated in terms of superphosphate equivalents.

(e) Apple tree fertilization

To provide support for a possible coordinated research programme on tree fertilization, a plantation of 200 apple trees was established during 1983/1984. In this first experiments N-15 labelled urea was applied to the trees, early and late in the spring 1984, to determine the optimum rates and enrichments of labelled fertilizer. Water relations within the plantation is also being studied using 25 neutron probe access tubes. Sampling methodology for the measurement of nitrogen derived from fertilizer will also be established.

(f) Nitrogen Fixation

Pot experiments are being conducted to determine the sensitivity of different symbiotic associations to the level of combined nitrogen. Here, faba bean, soybean, pea and alfalfa have been tested using barley and the

non-nodulating chippewa soybean isolate as reference crops. The reference crops are also given different rates of nitrogen application to find out whether the estimates of dinitrogen fixed by the above legumes can be influenced by the level of nitrogen application to the reference crop.

(g) Improving biological nitrogen fixation in grain legumes

In previous FAO/IAEA Coordinated Research Programmes on grain legumes significant differences in biological nitrogen fixation were observed between species. The bush type of common beans (Phaseolus vulgaris) were generally relatively inefficient in  $N_2$  fixation and a research programme was therefore established at the laboratory, in cooperation with the Plant Breeding and Genetics Section, to increase  $N_2$  fixation of beans by mutation breeding. The materials from this programme are now in the M 3 generation and are being evaluated under low N conditions in the field.

7. Report on the FAO/IAEA INTERREGIONAL TRAINING COURSE ON THE USE OF ISOTOPES AND RADIATION TECHNIQUES IN STUDIES OF SOIL/PLANT RELATIONSHIPS.

The seventh annual Interregional Training Course on the Use of Isotopes and Radiation Techniques in Studies of Soil/Plant Relationships was hosted by the Seibersdorf Laboratory, Vienna, Austria, from 22 May to 6 July 1984. The course provided training, on the use of both stable and radioactive isotopes, to scientists in developing countries who are actively engaged in research in Soil Science and Plant Nutrition, Atmospheric Nitrogen Fixation, and Fertilizer and Water Management Practices. Twenty participants from Chile, Cuba, Ecuador, Egypt, Ghana, Hungary, Indonesia, Kenya, Republic of Korea, Democratic People Republic of Korea, Lybia, Malaysia, Pakistan, Peru, Sierra Leone, Sri Lanka, Thailand, Turkey, Uruguay and Vietnam, successfully concluded the training.

As invited lecturers we had the collaboration of Drs. H. Broeshart (Austria), H. Faust (DDR), K. Buchtela (Austria), S. Kumarasinghe (Sri Lanka), G.M. Higgins (FAO) and S. Verniau (FAO).

This year, for the first time, the training course was carried out in cooperation with the Austrian Government through the Austrian Research Center of Seibersdorf, and with the United Nations Organization for Industrial Development (UNIDO). We hope that these links will be strengthened in future training courses held both in Seibersdorf and elsewhere.

8. FELLOWSHIPS

A number of fellowships are awarded each year to research workers from developing Member States, to allow recipients to undergo specialized training in various advanced laboratories in the use and application of stable and radioactive isotopes in soil-plant research. This forms a part of the regular Fellowships Programme of the Department of Technical Cooperation and the IAEA's Seibersdorf Laboratory has trained several such Fellows.

Usually fellows begin in the training as participants in the Annual FAO/IAEA Interregional Training Course on the Use of Isotopes and Radiation Techniques in Studies of Soil-Plant Relationships in Seibersdorf. Continuation of the training may then be arranged in the fields of research in which the laboratory and the fellow are active. The period of training may vary depending on the requirements of each fellow.

Five of the participants of the 1984 training course will continue as fellows at our laboratory and receive additional training in all the above described research activities.

## 9. COMING EVENTS.

### (a) FAO/IAEA/GOVERNMENT of Belgium International Training Course in Soil Physics.

As announced in Soils Newsletter Vol. 6, No. 2., the above training course will take place in Ghent, Belgium, from 3 to 21 September 1984. This course will provide training on the calibration and use of neutron and gamma probes in soil moisture studies to scientists in developing countries who are actively engaged in Soil Physics, Irrigation and Water Management Research. Many Applications in response to invitation letters sent to Member States were received, and 16 successful candidates have been selected to participate in the course.

### (b) FAO/IAEA/Government of Turkey Seminar on the Use of Isotopes in Studies of Biological Nitrogen Fixation for Developing Countries in the Middle East and Africa

The above Seminar is now being restricted to scientists from the Middle East and Africa, as the new title above shows. The dates for the seminar, however, remain unchanged. It will be held in Ankara, Turkey, from 12-16 November, as previously announced in our Soils Newsletter (Vol. 6 No. 2). The purpose of the seminar is to critically review the merits of using isotopic techniques, relative to other available methods for detecting and/or measuring nitrogen fixed, in various biological systems. The closing date for the submission of applications was 11 June, but we are still receiving applications and hope to make the selection of successful candidates soon.

### (c) Second Research Coordination Meeting on the Use of Nuclear Techniques in Improving Pasture Management.

The second Research Coordination Meeting of the FAO/IAEA/IG Coordinated Research Programme on the Use of Nuclear Techniques in Pasture Management will be held in Vienna from 26-30 November 1984. Letters of invitation have been sent to participants in the programme.

### (d) FAO/IAEA/SIDA Research Coordination Meeting on Isotope Studies of Nitrogen Fixation and Nitrogen Cycling in Azolla and Blue-green algae.

The first Research Coordination Meeting of the above Coordinated Research Programme will be held in Vienna late this year. The exact dates will be communicated to participants later.

### (e) Consultants Meeting on Future Trends in FAO and IAEA Programmes in Agricultural Biotechnology.

This meeting will take place on 17 - 19 October 1984 in IAEA Vienna. Participants will come from all Sections of the Joint FAO/IAEA Division, the Seibersdorf Laboratory, FAO, Rome and outside the UN Organization.

## 10. STAFF DUTY TRAVEL

- S.K.A. Danso represented FAO/IAEA and gave a lecture at an International Symposium on Nitrogen and the Environment, Lahore, Pakistan, and discussed Technical Cooperation Projects in Pakistan, 7 - 17 January 1984. He also visited FAO, (Rome) 18-20 January to discuss present and planned programmes, and visited Ethiopia, 15-22 June, to evaluate the feasibility of their Technical Co-operation Project in the Soils area.

- D.L. Eskew served as a consultant for Technical Cooperation Project SRL/5/019 for one week at the end of January in Colombo, Sri Lanka and has set up experiments on N transfer from Azolla to rice at the Research Institute for Irrigation in Szarvas, Hungary, 6-8 June. He was also invited to present a seminar on role of Ni in the Nitrogen metabolism of higher plants at the Friedrich Wilhelms Universität, Bonn, FRG, 30 April.

- K. Kalinin served as scientific secretary for the third FAO/IAEA Coordination Meeting on Isotope and Radiation Techniques in Development of Fertilizer and Water Management Practices for Multiple Cropping Systems, Jakarta, Indonesia, 5-9 March.
- D.L. Eskew set up experiments on Nitrogen transfer from Azolla to rice at the Research Institute for Irrigation in Szarvas, Hungary, 6-8 June 1984.
- F. Zapata attended the 9th Consultation on the FAO Fertilizer Programme in Rome, from 8-14 April 1984. He also visited counterparts of Fertilizer and Plant Nutrition Service of FAO Headquarters to discuss common interest projects.
- H. Axmann assisted in the installation of a high vacuum line for the preparation of N-15 samples for emission spectroscopy, at the Department of Microbiology, University of Uppsala, Sweden, from 23 to 27 January.
- A. Sebastianelli served as expert to the Technical Cooperation Project BOL/5/004, in La Paz, Bolivia, from 26 March to 13 April, for the installation of an emission spectrometer to measure N-15.
- G. Hardarson was in Wageningen, The Netherlands, from 2-4 April in order to coordinate the publication of papers presented at the FAO/IAEA Consultant Meeting on Mutation Breeding for Improved Nitrogen Fixation in Grain Legumes, which are to be published in "Plant and Soil" and the same in the Series "Advances in Agricultural Biotechnology".
- L. Mayr served as expert for seven days in May for a Technical Research Contract between IAEA and the Zentralinstitut für Isotopen- und Strahlenforschung, Leipzig, DDR, which is concerned with the improvement of the NOI-5 emission spectrometer. The future NOI-6 will be fully automated and computerized, avoiding many steps of laborious sample preparation.
- J.L. Arrillaga was in Hungary, Szarvas Experimental Station, for 3 days in June, in order to assist in the establishment of Azolla experiments in combination with irrigated rice.

#### 11. PUBLICATIONS

##### Field Soil-Water Properties measured through Radiation Techniques. IAEA-TECDOC 312.

The TECDOC, which has been written jointly by K. Reichardt (IAEA) and D.R. Nielsen (USA), provides an overall view of the results of investigations carried out from 1972 to 1979 in the Coordinated Research Programme on the use of Isotope and Radiation Techniques in Studies of Soil Water Regimes. It is hoped that these data will be useful for the development of more realistic models to describe water movement in field soils and, ultimately, help to establish more efficient agricultural practices in the use of water resources.

#### Soils Newsletter

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