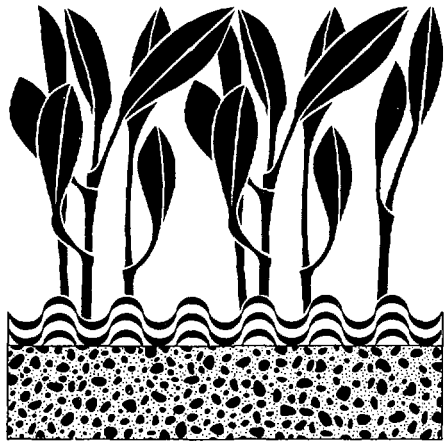

INIS-XA--314

Soils Newsletter

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

Vol.11, No.1 July 1988

CONTENTS

1. TO OUR READERS

We have just completed the training course at Seibersdorf on Soil/Plant Nutrition, with particular emphasis on roots - the interface between soil and plants. We had 20 participants from developing countries in Africa, Asia, Latin America and the Middle East. Isotope and nuclear related techniques are especially valuable in many aspects of studies on roots and the use of soil resources. However, they are not the only methods and we aimed at an integration of the best nuclear and non-nuclear methods. This appears to have been very successful. The course was very intensive and, with assistance from eminent visiting lecturers, it covered a wide range of topics of direct importance to plant productivity. I venture to say it was a course from which many young scientists from advanced countries would have benefited.

The topics dealt with included: basic nuclear physics and radiation protection, radioisotope and stable isotope assays (Professor K. Buchtela, Atom Institute, University of Austria; Helga Axmann, and her analytical services group and Saliya Kumarasinghe), root development and dynamics (Alvin Smucker, Michigan State University and Glynn Bowen), ion uptake for soil (Glynn Bowen), physiology of mineral nutrition, soil salinity, aluminium and acid tolerance (Walter Horst, University of Hannover), fertilizer use efficiency, root activity (Felipe Zapata), N-dynamics of soil (David Eskew), biological nitrogen fixation (Gudni Hardarson, Seth Danso and Nteranya Sanginga), photosynthesis/root respiration (Saliya Kumarasinghe), soil/plant water relations (Cevat Kirda), soil physical constraints to roots (Alvin Smucker, Cevat Kirda), mycorrhizal symbioses (Glynn Bowen), the rhizosphere, the impacts of root diseases on productivity and the recognition of biological soil constraints (Albert Rovira, CSIRO, Australia). There were discussion groups on topics such as designs of field experiments, nitrogen fixation by trees, and problem soils and there was a field visit to Austrian research centres (Prof. H. Haunold, Austrian Research Centre).

No course can be a success without the wholehearted co-operation of all staff, and we thank the technicians and laboratory assistants of the Soils Unit, Seibersdorf, our secretarial staff and Ms. Esperanza Ruhm, Training Officer, for their excellent support and hard work. It is very much appreciated.

It is hoped to produce a manual of methods on the studies of roots, at the various levels from agronomic, to microbiological and physiological, in order to give a starting point for scientists both from developing countries and developed countries.

Meanwhile, it is with pleasure that we announce that an updated manual on "The use of nuclear techniques in studies of methods in soil/plant relations" was issued at the training course. The last such manual issued by us was 1976. My thanks go to all the soils staff for this, but particularly to Gudni Hardarson, who edited it. After final revision this will be published. We are about to start on a Spanish version shortly.

In March we said farewell to Eric Craswell, of the ACIAR (Australian Centre for International Agricultural Research) who had a 6 months sabbatical at the Seibersdorf Lab. Eric worked with David Eskew and myself on phosphate nutrition of Azolla and with Helga Axmann and Aldo Sebastianelli on comparison of ^{15}N analysis by emission spectrometer (NOI-6e) and automatic N-analyzer/mass spectrometer.

We have been pleased to welcome Marcello Calvache to the team from April 1988. Marcello is our expert serving the soil water and soil fertility

programmes in Latin America. He is a soil phyisicist with a B.Sc-Agronomy and a M.Sc. in Nuclear Techniques in Soil Science from the University of Sao Paulo, Brazil, obtained in 1981. He is also Professor in Soil Science, Central University of Ecuador, Quito. He has worked since 1979 on the application of nuclear techniques to soil/plant relationships and has considerable experience in the use of those techniques in irrigation and plant-water relationships, in which he has published several papers. He has periodically served as IAEA expert to Andean countries.

Despite the differing climatic zones of Latin America, there is a commonality of important soil fertility problems e.g. soil water, phosphate and nitrogen deficiencies, a need to optimizing fertilizer efficiency and nitrogen fixation. We have found the provision of a regional expert to be a most effective way to service the various countries and to enhance collaborative networks of similar interests. In particular, Marcello will be servicing our projects in Chile, Paraquay, Uruguay, Ecuador, Colombia and Bolivia.

Glynn Bowen

2. STAFF

(a) IAEA Headquarters Joint FAO/IAEA Division, Vienna International Centre, Wagramerstr. 5, P.O.Box 100, A-1400 Vienna, Austria.
Glynn D. Bowen. Head of Section. Root Biology, Plant Nutrition
Seth K.A. Danso. 1st Officer. Soil Fertility, Microbiology
Cevat Kirda. 1st Officer. Soil Physics, Soil Water, Irrigation
David L. Eskew. 2nd Officer. Plant Physiology, Soil Fertility
Bogdan Astvatsatrian. Visiting Professor, Agricultural Chemistry
Mohan Saxena. Biological Nitrogen Fixation, sabbatical visotor
Marcello Calvache. Co-ordinator, Latin America Programme

Secretarial staff:

Marina Kneissl
Ruth Rossi

(b) Agricultural Laboratory, Soil Science Unit of the IAEA Seibersdorf Laboratory, A-2444 Seibersdorf, Austria.
Felipe Zapata. Head, of Unit, Soil Fertility, Plant Nutrition
Gudni Hardarson. Research Officer. Microbiology
Nteranya Sanginga. Research Officer. Soil Fertility (Trees), Microbiology
Saliya Kumarasinghe. Co-ordinator, African Regional Programme
Helga Axmann. Head Analyst

Technical Staff:

Leopold Mayr. Laboratory Technician
J. Aldo Sebastianelli. Laboratory Technician
Stefan Borovits. Laboratory Assistant
Gerhard Eckhardt. Laboratory Assistant
Habib-Ben-Brahim. Laboratory Assistant
Christine Ficker. Laboratory Assistant

Secretarial staff:

Mehrnaz Tadjabkhsh

3. CO-ORDINATED RESEARCH PROGRAMMES

A. Isotopic studies of nitrogen fixation and nitrogen cycling by blue-green algae and Azolla

(Project Officer: David L. Eskew)

This coordinated research programme has now commenced its fifth and final year. Experiments have been conducted to compare the N availability from Azolla in comparison with urea, to compare different species and strains of Azolla and to study the effects of phosphorus fertilization of Azolla on the N made available to rice. The current experiments are designed to examine the effect of a cover of Azolla on N losses from urea. A cover of Azolla shades the floodwater and reduces the pH and temperature of the floodwater, which may reduce ammonia volatilization. The ^{15}N isotope dilution technique will also be used to measure nitrogen fixation by several strains of Azolla. The final coordination meeting is planned for October 1989 in Vienna.

B. The use of isotopes in studies to improve yield and N_2 fixation of Phaseolus vulgaris in Latin America.

(Project Officer: Gudni Hardarson)

The objective of this programme is to use nuclear techniques to measure nitrogen fixation in a range of genotypes of common bean (Phaseolus vulgaris). The first Research Coordination Meeting was held 23-27 November 1987 at CIAT, Cali, Colombia and a second meeting is proposed in the first half of 1989. A more detailed report of the first meeting is given later in the Newsletter.

C. The use of nuclear and isotopic techniques to improve crop production on salt-affected soils.

(Project Officer: Cevat Kirda)

Participants of the programme have now completed the first phase of the project, which dealt with screening for salt tolerant genotypes of different plant species. The second Research Coordination Meeting of this programme is scheduled 10 - 14 October, 1988, Vienna, Austria. Results of the screening work will be discussed and field research plans will be reviewed during the meeting. It is expected that field experiments will be implemented this summer, to evaluate effectiveness of salt-tolerant plant species in amelioration of salt-affected soils.

D. Evaluation and calibration of nuclear techniques compared with traditional methods.

(Project Officer: Cevat Kirda)

Field research plans and detailed experimental procedure as discussed and agreed upon during the first Research Co-ordination Meeting in Vienna, November, 1987 were prepared and mailed to all contractors. It is believed that field research work of all contractors is progressing well. One of the aims of the programme is to compare field calibration of the neutron gauges with the theoretical calibration. To this effect, an agreement has been reached with Nuclear Research Center of Cadarache, France to analyze for thermal neutron absorption and diffusion cross section of soil samples sent by the contractors of the programme, which will be used for theoretical calibration of the neutron moisture gauges. The second and final Research Co-ordination Meeting of this programme is planned to be held in mid-1989, Vienna, Austria.

E. Breeding grain legumes for increased yield and nitrogen fixation in Asia.
(Project Officer: Seth Danso)

This programme was funded as a one year sub-contract from a UNDP-funded project in Asia. Hopes for possible renewal of funding have not materialized. We have therefore had to temporarily terminate this CRP, and all participants have had to submit final reports. For a breeding programme that needs several years to obtain meaningful data therefore the present results were only of preliminary nature, and little can be concluded about the potential of breeding for enhance N_2 fixation. However, there were good indications Rhizobium strain specificity would be crucial to examine in final evaluations for N_2 fixation, and that for the initial phase of the programme, mixed Rhizobium strain inoculants, containing highly effective strains would drastically cut down on the amount of work, compared to identifying single strains for each variety or mutant line. We are seeking independent funding from several sources for this CRP, and when we are successful, the programme will re-start. In the meantime, participants have been advised to continue with the experiments on their own, so that there will be little discontinuity when funds become available.

F. Nuclear techniques for improving pasture management
(Project Officer: Seth Danso)

This programme came to an official end in September 1987. However, there were still a few field experiments in the field, and some N-15 analyses were still outstanding. Final reports for the programme are therefore still coming in, and once they are all received, we hope to publish the major highlights of results achieved. From the results already available, it can be concluded with much confidence that pasture/forage legumes derive most of their N from N_2 fixation, on the average, more than 70 - 80 %. The major limiting factor in pasture management therefore appears to be the low yield of these crops, especially when mixed with non-legumes. Accelerated increase in total N_2 fixed in pastures is therefore more likely to be achieved through breeding or management practices that will enhance yields, than through further increases in rates of N_2 fixation.

G. The management of nitrogen fixing trees for restoring and maintaining soil fertility

We hope to advise successful submissions in the very near future. Meanwhile, we thank all who submitted applications.

4. FELLOWSHIP TRAINING AT SEIBERSDORF LABORATORY, SOILS UNIT

Fellowship training request at the Soils Unit of the Agency's laboratory, Seibersdorf increases every year. Last year 51 m/m of fellowship training was provided. This year's total fellowship training will be higher than last year.

Training on biological nitrogen fixation remains to be the major subject attracting individual fellows. Table 1 gives the list of fellows receiving training on biological nitrogen fixation (BNF)

Table 1. Fellows training on BNF

Name	Number & Country	Period	Year
Mr. P. Wadisirisuk	THA/8659 Thailand	6 months	1987
Mr. V.J. Martin	URU/8605 Uruguay	9 months	1987
Mr. J.Al-Maadhidi	IRQ/8702 Iraq	9 months	1987/88
Mr. V. Kola	ALB/8702 Albania	5 months	1988
Mr. K. Manrique-Klinge	PER/8803 Peru	9 months	1988
Mr. A.O. Osunde	NIR/8801 Nigeria	6 months	1988

Training on the use of nuclear methods in studies of soil fertility, plant nutrition and plant physiology is also receiving an increased number of fellowship applications. Table 2 gives the list of fellows requesting training on this subject.

Table 2. Fellows training soil soil fertility, plant nutrition and plant physiology.

Name	Number & Country	Period	Year
Mr.C.K. Mwamba	ZAM/86 Zambia	6 months	1987
Mr. T. Nguyen Van	VIE/8612 Vietnam	9 motnhs	1987
Mr. Y.M. Jin	ROK/8739 Korea Rep.	11 months	1987/88
Ms. B.T. Hong-Thanh	VIE/8721 Vietnam	12 months	1988

Isotope analytical techniques used in soil-plant-nutrition studies are also among the subjects that the laboratory can provide training. In particular, sample preparation procedures for analysis of N-15 with emission and mass spectrometry receive continuous interest for fellowship training. A total of 9.5 m/m training was provided in 1987 on the analytical techniques. Requests in 1988 have increased to 12 m/m (Table 3.)

Table 3. Fellow training on isotope analytical techniques in 1988

Name	Number & Country	Period
Mr. Z. Al-Sahoub	SYR/8708 Syria	3 months
Mr. L. Luna-Arnaez	BOK/8705 Bolivia	3 months
Ms. L. Guzman-Casas	CHI/8703 Chile	3 months
Mr. O. Bastidas-Ortiz	COL/8802 Colombia	3 months

In addition to fellowship training, the Soils Unit of the laboratory received 9 visiting scientists, each spending 1 to 2 weeks in the laboratory in 1987 and in the first half of 1988. The unit also provided 6 m/m of cost-free internships to fellow scientists in the same period.

5. ROCK PHOSPHATE RESEARCH AT SEIBERSDORF

Rock phosphate deposits are widely distributed in the world but are unevenly mined and consumed. Direct application of finely ground phosphate rock, using (wherever possible) local phosphate deposits, may be the cheapest source of phosphorus to crops grown on acid soils of the tropics. Research on the reactivity as well as agronomic effectiveness of phosphate rock materials in terms of P supply with time to field-grown crops is therefore needed. The agronomic evaluation methods should take into account not only the immediate effect on P availability of rock phosphates but also their residual long-term benefits. It is often reported that rock phosphates have a higher residual effect than high-grade P soluble fertilizers on tropical acid soils.

The FAO/IAEA Agricultural Laboratory at Seibersdorf, Austria, is routinely using ^{32}P-radioisotope techniques for the agronomic evaluation of natural rock phosphate materials in connection with projects of the FAO Fertilizer Programme. This initial evaluation provides basic information on the plant-available phosphorus content of these materials. The questions being the following: Do these rock phosphates provide available phosphorus to plants and if so, to what extent? Short-term studies under controlled conditions are designed to compare the relative ability of natural rock phosphate materials to provide available phosphorus during a limited period of time. It is of particular importance to determine the influence of inherent rock phosphate factors (type, composition, degree of fineness, procedence, etc.) and plant characteristics (genotypic differences) affecting P availability to crops. In subsequent field studies, the agronomic potential of natural rock phosphates is evaluated. Thus it is possible to quantitatively relate rock phosphate to equivalent amounts of superphosphate under the local soil and climatic conditions where the rock phosphate is going to be used. Emphasis must be placed in evaluating the residual effect. For this purpose long-term field trials need to be conducted in the locations of interest.

This technical information is an essential requirement for economic studies of production and use of rock phosphate deposits.

The isotope methodology for the evaluation of natural rock phosphates using ^{32}P-labelled superphosphate was first proposed by Fried in 1954 and later developed at the Seibersdorf Laboratory. Basically this evaluation is made in terms of equivalent units of superphosphate, which can be derived from the difference in uptake of P from ^{32}P-labelled superphosphate by the crop in the presence and absence of the rock phosphate. This is called the A value method because the P availability of the rock phosphate is expressed in terms of equivalent units of a fertilizer standard (superphosphate).

In some cases, the addition of the ^{32}P-labelled superphosphate may affect soil chemical properties drastically, particulary in tropical soils with low available P. The mentioned effect may be due to reactions occurring between soluble P fertilizer and soil components and/or interactions among P sources present in the system, i.e.: native rock phosphate and soluble P fertilizer. Thus another technique in which the soil is "labelled" with a ^{32}P-carrier solution of high enough specific activity to obtain a reasonable count in the plant material has been proposed. The specific activity of the test crop is measured in presence and absence of the rock phosphate, and decline in specific activity (isotope dilution) of the crop in presence of rock phosphate is an index of the P-availability of the rock phosphate. This is the isotope dilution

method. Both techniques have been used at the laboratory in the initial evaluation of rock phosphate materials from different countries. A brochure has been prepared by F. Zapata, Head, Soils Unit, Seibersdorf Lab. and H. Axmann, Head Analyser describing these techniques. Ongoing research is mainly focussing on further development of the isotope dilution technique in tropical acid soils with high P fixation capacity, and on genotypic differences of nitrogen-fixing trees in the P uptake from rock phosphates. This latter work is aiming to maximize nitrogen fixation of tree species in tropical acid soils and benefits to soil fertility.

6. TRAINING COURSES

1. Regional Africa Training Course on the use of isotope and radiation techniques in studies of biological nitrogen fixation and soil/plant nutrition. Accra, Ghana, 22 August - 16 September 1988.

This training course will take place at the University of Ghana, Legon-Accra, in collaboration with the Ghana Atomic Energy Commission, Kwabenya. It has been organized mainly in support of the FAO/IAEA Regional Africa Project on Biological Nitrogen Fixation (RAF/5/010), so that scientists from African countries may be acquire a good working knowledge of the relevant isotope and nuclear techniques in studies of biological nitrogen fixation and soil fertility. Emphasis will also be placed on studies of tree legumes mainly in relation to soil fertility.

In all, twenty-five trainees will participate at this training course representing 18 African countries (Angola, Cameroon, Egypt, Ghana, Guinea, Kenya, Mauritius, Morocco, Niger, Nigeria, Sierra Leone, Senegal, Somalia, Tunisia, Uganda, Zaire, Zambia and Zimbabwe).

The training course will form one of the major activities in the agenda of the Ghana Atomic Energy Commission which celebrates its Silver Jubilee this year.

2. FAO/IAEA Training course on the use of isotope and radiation techniques in studies on soil/plant relationships in 1989

Next year's inter-regional training course will be held from 23 May to 30 June 1989 at the Agency's Laboratories, Seibersdorf (near Vienna), Austria.

The objective of this course is to train scientists from developing Member States in all aspects of the use of relevant nuclear techniques in soil-plant relationships research. Emphasis will be placed on the use of isotope and related techniques in the management of symbiotic nitrogen fixation in integrated plant nutrition systems for increasing soil fertility and plant productivity.

Participants must have a university degree and preferably advanced academic degree with specialization in the fields of soil fertility and plant nutrition. Preference will be given to those who are actively involved in FAO/IAEA Co-ordinated Research and/or Technical Co-operation Programmes on the above topics with particular reference to nitrogen fixation. They will be expected to have an active, personal involvement in research as chief counterparts or members of a team.

Lectures are delivered in English and it is thus essential that applicants should have no difficulty in following lectures and expressing themselves in English.

The official announcement of the course will be issued to the relevant government authorities (in each country) in November 1988. Nominations should be submitted in duplicate on the standard IAEA nomination form for training courses. Completed forms must be endorsed by and returned through the official channels established (the Ministry of Foreign Affairs, the National Atomic Energy Authority, the Office of the United Nations Development Programme or the Ministry of Agriculture). They must be received by the International Atomic Energy Agency, P. O. Box 100, A-1400 Vienna, Austria, not later than 24 February 1989. Nominations received after that date or applications sent directly by individuals or by private institutions cannot be considered.

For additional enquiries, please write to Dr. G. Bowen, Head, Soil Fertility, Irrigation and Crop Production Section, Joint FAO/IAEA Division, Wagramerstr. 5, P.O. Box 100, A-1400 Vienna or Dr. F. Zapata, Head, Soil Science Unit, Agency's Laboratories, A-2444 Seibersdorf, Austria.

3. Regional Training Course in Africa in the use of isotope and radiation techniques in studies of biological nitrogen fixation and soil/plant nutrition in 1990, Senegal.

The above training course, which is similar in content and purpose to the one that will be held in Ghana this year, is planned to be held in Senegal in September 1990. The duration of the course would be four weeks. About twenty participants will be selected mainly from Francophonic countries. Preference will be given to those who are involved with the FAO/IAEA Regional Africa Project on Biological Nitrogen Fixation RAF/5/010 or other IAEA projects related to increasing crop productivity and soil fertility.

7. REPORTS OF MEETINGS

(1) The first Research Co-ordination Meeting on "The use of isotopes in studies to improve yield and nitrogen fixation of common bean in Latin America" held at the Centro Internacional de Agricultura, 23-27, 1987, Cali, Colombia.

The aim of the present programme is to use nuclear techniques to measure difference in nitrogen fixation between genotypes of common bean (Phaseolus vulgaris). The programme was initiated after a consultants meeting in Vienna, Austria in 1983 and a preprogramming meeting at CENA, Piracicaba, Brazil in 1985. These meetings reviewed research data from previous programmes which had revealed large variations in nitrogen fixation potentials of various legume crops. In these previous studies, common bean was the poorest fixer of atmospheric nitrogen. The present CRP was initiated as a regional programme for Latin America in 1986. The meeting held at CIAT, Cali, Colombia was the first Research Co-ordination Meeting of this programme. It was attended by 17 participants of which 9 were funded by IAEA, 3 by FAO and 5 were local participants from CIAT.

Excerpts from the progress reports presented during the meeting:

J.Kipe-Nolt, CIAT, Cali, Colombia.
CIAT's Programme for increasing biological nitrogen fixation in common bean.

The breeding programme for increasing biological nitrogen fixation in small-seeded bush beans was initiated about 10 years ago. Two ^{15}N trials, one in the field and the other in the glasshouse, showed higher levels of fixation in the RIZ (selected for BNF) lines than in early parental materials. Levels of fixation in the field experiment ranged from 18-36 kg N/ha (20-40 % Ndfa) in nitrogen derived from the atmosphere. In a glasshouse experiment, ranking of genotypes was similar although 94 % of the N was derived from air. A second set of 12 genotypes was evaluated in two locations and over two seasons. At the Palmira site nitrogen fixation values ranged from 0-32 kg N/ha. In the Santander site, fixation levels were again fairly low or 8-40 or 2-25 kg N/ha depending on the reference crops.

F.A. Bliss, University of Wisconsin, USA.
Breeding progress for increased dinitrogen fixation in common bean.

Host plant improvement through effective selection has been achieved by combining the use of accurate assays to measure N_2 fixed with suitable breeding methods. The availability of genetic variability in N_2 fixation and various traits associated with fixation allows for the production of genetically variable population of lines following crosses of superior parents with standard bean cultivars.

The high fixing line, Puebla 152, has been used as a donor parent in crosses with standard cultivars such as Sanila and ICA Pijao to produce populations of inbred backcross lines. Selected lines were grown in field trials on low-N sandy soil in Wisconsin and at CNPAF/EMBRAPA near Goias, Brazil. ^{15}N isotope based estimates of N_2 fixation indicate that in the selected progenies, up to 50 % of the shoot N was derived from fixation, which was equivalent to approximately 55 kg N/ha in the best lines. Since the best progeny lines did not fix as much N_2 as the high fixing donor parent, they were intercrossed to produce F3 progenies. The N_2 fixed by the best F3 lines grown in field trials conducted one year at a single field site was comparable to that fixed by the donor parent, Puebla 152. The progenies possessed agronomic traits similar to their respective recurrent commercial parents.

R.A. Henson, EMBRAPA/CNPAF, Goiania, Brazil.
Quantification of nitrogen fixation in Phaseolus vulgaris L., by the isotope dilution method.

As part of the FAO/IAEA programme to improve yield and N_2 -fixation of Phaseolus vulgaris L. in Latin America, a ^{15}N experiment was planted at EMBRAPA/CNPAF in 1986 to evaluate 16 bean genotypes for N_2 fixation and four grasses as potential isotope dilution technique control crops. Half of the experiment received N-15 applied with sugar before planting and the other half received the same quantity of N-15 applied in eight split applications during the growth cycle. Samples for plant dry matter and N content were taken during early and late vegetative stages, full bloom, physiological and full maturity.

Genotypes selected for N_2 fixation produced higher shoot, root and nodule dry matter and contained more shoot N during the season than the traditional cultivar Rio Tibagi. However, these differences were not

reflected in grain dry matter and N yield. In general, entries bred specifically for N_2 fixation using the inbred backcross method were intermediate between the high-N_2-fixing donor parent and the agronomically good recurrent parent.

S.M.T. Saito, CENA/USP, Piracicaba, Brazil.
Induced mutations for enhancing biological nitrogen fixation and crop productivity in Phaseolus vulgaris-Rhizobium phaseoli.

Thirty-one genotypes previously selected from three EMBRAPA/CNPAF research programmes were screened in the field at CENA for ability to support BNF when associated to maize which received 0, 30 or 60 kg N/ha as ammonium sulphate. At 0 N level, the total amount of fixed nitrogen was estimated using the ^{15}N natural abundance technique with wheat used as reference crop.

The ^{15}N data revealed a high potential of bean genotypes to fix N_2 symbiotically, with the most promising material averaging between 50-60% of seed-N coming from BNF. Genotypes CNF-480, Puebla-152, Mexico-309, Negro Argel, CNF-178, Venezuela 350 PS and the Wisconsin lines 22-3, 22-55 and 22-50 were ranked as good fixers.

J.J. Pena Cabriales, CIFAPEG-CINVESTAV, Irapuato, Mexico.
Nitrogen fixation of 20 cultivars of Phaseolus vulgaris in Mexico.

A field experiment was established to assess the capacity of 20 cultivars of Phaseolus vulgaris to fix N_2 using ^{15}N techniques. Barley, maize, wheat, sorghum and non-nodulating soybean were included as standard crops. The labelled fertilizer was applied in two ways: one week before sowing, and 3 applications during the growing cycle.

The results showed significant differences between the 2 ways of applying fertilizer and among cultivars. The % N derived from atmosphere ranged from 2 to 59 %.

Other field experiments were conducted to study the fate of introduced strains of R. phaseoli. Generally low (less than 8 %) nodule occupancy by inoculated strains were observed.

C.R. Villagran, DGEN, Guatemala.
Evaluation of nitrogen fixation of ten varieties of common bean (Phaseolus vulgaris) by ^{15}N methodology.

The objectives of the present study are to evaluate N_2 fixation potential of the most commonly used varieties of beans in Guatemala, to select varieties with good N_2 fixation potential and to introduce the ^{15}N methodology for the quantification of N_2 fixation. The experiments will be established at two altitudes using 10 varieties of common beans.

M.P. Salema, Sokoine University of Agriculture, Tanzania.
Variation in nodulation, nitrogen fixation and yield among genotypes of common bean.

In this study, variation in nodulation nitrogenase activity, nitrogen yield of grain yield of ten bush type varieties of common bean were studied to identify superior genotypes, which could be used in breeding programmes. The genotypes differed greatly in all the parameters measured. It could be concluded that poor N_2 fixation in beans is, at least in part, due to low nitrogen fixation longevity of the nodules.

A. Hakizima, ISAR, Rwanda
Evaluation of 22 genotypes of common bean in Rwanda

In 1986 two experiments using N-15 technique have been conducted in Rwanda in collaboration between FAO/IAEA and ISAR to study nitrogen fixation in 22 genotypes of common bean. The objective of these assays was to determine the relative nitrogen fixation of various varieties from Rwanda and to compare these to previous results on nodulation. The experiments were conducted in two different plots with wheat used as a non-fixing standard crop. The crops were harvested at physiological maturity and analysed for ^{15}N atom excess. Percentage N derived from atmosphere were found to be very high in the range of 20-70 %. A repetition of the experiment is being planned to confirm these preliminary results.

M.R. Cigales-Rivero, Colima, Mexico.
Introduction of forage legume species into the agrosystem of Colima-Mexico.

The amounts and quality of forage is insufficient specially during the dry season (March-June) in the temperate areas of the coastal region of Colima-Mexico. To improve this situation one possibility is to introduce some forage legumes into grass pastures with the objective to improve the quality and the availability of the forage crops. Several projects which are recently implemented to attain the above objective are discussed.

A. Manrique, La Molina, Peru.
Improvement of common bean through induced mutations.

Nitrogen fixation of 20 different cultivars of bean is being tested. The initial results showed that Caballero Negro, Brasilero and Blanco were among the best fixing varieties, having 57 % or 59 and 43 kg N/ha fixed, respectively. Other varieties (Canario and Bayo) which have high commerical consumption were not as efficient in nitrogen fixation.

G. Hardarson, FAO/IAEA, Seibersdorf, Austria.
Biological nitrogen fixation by several varieties and lines of common bean.

A field experiment was conducted in the summer of 1987 at the FAO/IAEA laboratory to quantify symbiotic nitrogen fixation by 29 lines of common bean using the ^{15}N isotope dilution method. 23 of the lines were obtained from the CIAT's bean programme, 4 were from Rwanda and 2 were local varieties. Large significant differences were found between varieties or lines of bean in terms of % N derived from atmosphere (i.e. fixation) with the lowest line fixing 27 % and the best one 67 %. The amount of nitrogen fixed ranged between 22 and 147 kg N/ha. Among the best fixing lines in terms of %Ndfa were RIZ 44, BAT 332, RIZ 13, from CIAT as well as Ikinimba and Tostada from Rwanda. In addition RIZ 53, RIZ 30 (CIAT) and Rubona (Rwanda) fixed large amounts of N (kg N/ha).

The experiment showed that the Phaseolus vulgaris-Rhizobium symbiosis is able under favourable environmental conditions to produce good nodulation and fix large quantities of N.

Additional presentation on symbiotic nitrogen fixation by eight tropical forage legumes at two levels of PK-supply was given by G. Cadish, CIAT, Cali, Colombia.

Future Research

During the meeting, it was decided that the following items should receive the main attention:

1. Continuous screening of varieties and lines of common bean for efficiency in nitrogen fixation using the ^{15}N isotope. This part of the work was to be performed by Cigales, Hakizimana, Longeri, Salema and Villagran.

2. Breeding for enhanced nitrogen fixation. Contractors that have already sufficient information on the nitrogen fixation of various lines of common bean are to transfer high nitrogen fixation characteristics to those varieties, which are important in each country but not necessarily good fixer of nitrogen. This work will be performed by Henson, Manrique, Peña-Cabriales, and Saito.

3. Additional experiments are to be performed with the objective to gain further understanding of the symbiotic nitrogen fixation of common bean. This will involve the following experiments:

   (a) Time course of nitrogen fixation in two varieties (good and poor fixers) of common bean (Peña-Cabriales)
   (b) Dry matter and N accumulation patterns of two varieties (early and late nodulators) of common bean (Henson).
   (c) Effect of an associated crop of maize on nitrogen fixation in common bean (Saito).
   (d) Comparison of the ^{15}N natural abundance method and the isotope dilution method to quantify nitrogen fixation (Saito).
   (e) Effect of various strains of Rhizobium on nitrogen fixation in common bean (Manrique and Scaglia).

(2) Coordination Meeting of the FAO/IAEA Technical Co-operation Projects on the Use of Nuclear Techniques in Soil Studies and Plant Productivity, 21-25 March 1988, Ecuadorian Atomic Energy Commission (CEEA), Quito, Ecuador.

This meeting was a follow-up of the planning workshop on the use of isotope techniques in soil/plant/water relationship studies, held in Bogota, Colombia during 23-27 November 1986. It was organized with the purpose of creating a network of the ongoing technical assistance projects in the area as one step to the establishment of a regional project.

Dr. F. Zapata participated as IAEA co-ordinator and discussion leader, while Mr. Marcelo Calvache, CEEA staff member and counterpart of the project ECU/5/012 was the local co-ordinator.

The meeting was attended by 14 participants, of which the following were counterparts of the ongoing FAO/IAEA Technical Co-operation Projects:

Mr. E. Alarcón, Paraguay (PAR/5/002); Mr. M. Calvache, Ecuador (ECU/5/012); Mr. J. Comerma, Venezuela (VEN/5/009, soils component); Mr. R. Goyenola, Uruguay (URU/5/018;) Mr. J. Pascuali, Bolivia (BOL/5/005); Ms. I. Pino, Chile (CHI/5/014); Ms. L. Rivero, Peru (PER/5/014, soils component); Mr. R. Tejeira, Panama (PAN/5/003).

Highlights of the meeting were:

1. More than 25 papers using nuclear techniques in several topics of soil science and plant nutrition (water use efficiency, plant recovery of

fertilizer nitrogen, soil phosphorus and P fertilizer studies, biological nitrogen fixation, root activity studies, etc.) were presented by the local counterparts of the ongoing IAEA TC projects in the region. Relevant methodological aspects and results of practical importance were discussed.

2. Drawing up of experimental plans to be performed within the framework of the approved TC projects during the period 1988-1990. In addition to the research topics of interest to each country, it was possible to identify areas of common interest (core experiments). It was also agreed to give high priority to processing of data from experiments already performed (calculation of data, interpretation of results and preparation of reports).

3. Implementation plans including expert needs, list of equipment and fellowship training were prepared and reviewed for each TC project.

(3) European Science Foundation/IAEA Workshop on ^{15}N Studies in Forest Ecosystems, 29 February - 3 March 1988, Vienna

The meeting was jointly hosted by the European Science Foundation and the Agency and partly supported by the Austrian Science Foundation. There were 28 participants, in addition to staff of our Section and the Soils Unit of the Seibersdorf Laboratory.

A series of lectures on stable isotopes, in particular ^{15}N isotope dilution technique in soil/plant systems were given by our staff Dr. Zapata, Ms. Axmann and Dr. Danso during the workshop. Additional lectures were:

1. Nitrogen cycling in forest ecosystems: an overview. Dr. H.G. Miller, (University of Aberdeen, UK)
2. ^{15}N in forest uptake studies Dr. K. Killham, (University of Aberdeen, UK)
3. ^{15}N in root and mycorrhizal studies. Dr. G. Bowen, (IAEA)
4. ^{15}N in the study of decomposition of forest humus. Dr. B. Berg, (Swedish University of Agric. Sciences, Uppsala, Sweden)
5. ^{15}N as a tracer in agricultural studies. Dr. D.S. Powlson, (Rothamsted Exp. Station, Harpenden, Hertz., UK)
6. ^{15}N use for measuring N-fixation in forests. Dr. K. Jones, (University of Lancaster, Lancaster, UK)
7. ^{15}N in the study of forest nutrient cycles. Dr. H. Nommik, (Swedish University of Agric. Sciences, Uppsala, Sweden).
8. Natural abundance techniques: agricultural usage. Dr. A. Mariotti, (Université de Pierre et Marie Curie, Paris, Cedex, France)
9. Natural abundance techniques, Dr. A. M. Domenach, (University of Lyon, Laboratoire de Biologie de Sols, Lyon, France).

Discussions during the workshop indicated that ^{15}N tracer can be used as a useful tool in nutrient cycling experiments in forest ecosystems. For additional information on general recommendation of the workshop please write Dr. P. Ineson, Institute of Terrestrial Ecology, Merkwood Research Station, Grange-over-Sands, Cumbria LA11 6JU, U.K.

8. TECHNICAL CO-OPERATION PROGRAMMES

The number of Technical Co-operation programmes handled by our section increased to 77. In this issue, highlights of Technical Co-operation Programmes in Asia, Pacific Regions are given.

Bangladesh
Nitrogen Fixation in Grain Legumes (BGD/5/012)
Bangladesh Institute for Nuclear Agriculture, Mymensingh
Counterparts: Dr. M.M. Mia, Dr. M.A. Sattar, and Mr. A.K. Poddar

Several host-*Rhizobium* strain combinations of lentil (*Lens culinaris*) and groundnut (*Arachis hypogea*) are being checked for high levels of biological nitrogen fixation using the ^{15}N isotope dilution assay.

Democratic Republic of Korea
Fertilizer use efficiency studies (DRK/5/002))
Institute of Experimental Biology and Research Institute of Crop Cultivation, Pyongyang. Counterpart: Dr. Ryang Hong Gun.

The project is aimed at establishing a capability to use N-15 and radioisotopes in agricultural research work to increase rice and maize yields with better fertilizer management practices.

Indonesia
Soil water management studies (INS/5/020).
National Atomic Energy Agency, Center for the Application of Isotopes and Radiation, Jakarta, Brawijay University, Faculty of Agriculture, Malang. Counterpart: Dr. Natodimejo Soewarno

This is a recently implemented project to develop better water management practices through isotope-aided research work.

Republic of Korea
Soil water relationship studies (ROK/5/019)
Office of Rural Development, Institute of Agricultural Sciences, Soil Physics Division, Suweon. Counterpart: Dr. Kwan Shig Ryu

This project has been recently completed. The main objectives were the development of rational land-use practice, more efficient water use, adequate soil and water conservation measures in high-slope agricultural areas.

Republic of Korea
Isotope-aided Studies on Mulberry Physiology (ROK/5/024)
Sericulture Experiment Station, Suweon Counterpart: Mr. Lee Won-Chu

The problem of non-sprouting of mulberry trees in the spring is being studied. Mulberry trees are pruned heavily to obtain the leaves for feeding silkworms. Radioisotopes are being used to study the effects of prunning patterns and cold on translocation of nutrients.

Republic of Korea
Isotopes and Radiation in Agricultural Research (ROK/5/025)
Agricultural Sciences Institute, Office of Rural Development, Suweon
Counterpart: Dr. K.K. Kim

This is a large multi-disciplinary project funded by UNDP. In the soil science component, the emphasis is on nitrogen fertilizer efficiency, root activity and cold tolerance in rice.

Malaysia
Nitrogen-15 Studies (MAL/5/018)
Participating institutes: (i) Tun Ismail Atomic Research Center, Prime Minister's Department, Nuclear Engery Unit, Bangi, Selangor. Counterparts: B.M.N. Razley, Jenny L.A. Lee (ii) Malaysian Agricultural Research and Development Inst., Kuala Lumpur, Counterpart: K.C. Tham.

This project has been recently implemented. It is an inter-institutional project. The main objective is to use isotopes and nuclear techniques in studying fertilizer and soil nutrient use, biological nitrogen fixation and nutrient cycling in annual and perennial crops, with special emphasis on tree crops.

Mongolian People's Republic
Soil science and plant nutrition (MON/5/004)
Scientific Research Institute for Plant Breeding and Agriculture, Darhan. Counterparts: Drs. G. Davaadorj and T.S. Surenjav

This project has recently started, and is studying of fertilizer management under different tillage practices in largely rainfed and dry agricultural areas. Different land preparation methods will be assessed for the objective of increasing water conservation and rain harvesting. Plant water consumption studies will be implemented to assess existing crop rotation systems.

Pakistan
Radioisotopes in Agriculture (PAK/5/017)
Pakistan Atomic Energy Commission, Atomic Energy Agricultural Research Centre, Tandojam. Counterpart: Dr. Saeed Arian

The project studies influences of legume/non-legume cropping sequences and different irrigation and fertilizer management practices on crop production.

Sri Lanka
Crop Water and Soil Management (SRL/5/016)
Atomic Energy Authority, Colombo. Counterpart: Dr. K.G. Dharmawardena

The Atomic Energy Authority is collaborating with the Coconut Research Institute, Tea Research Institute, Rubber Research Institute and the Irrigation Department of the Land Use Division on studies of soil water and nitrogen.

Sri Lanka
Radioisotopes in Plant Nutrition and Physiology (SRL/5/019)
Rubber Research Institute, Agalawatta. Counterpart: Dr. M.K.S.A. Samaraweera

Studies on the physiology of latex production are being performed. Translocation of ^{14}C labelled photosynthates and ^{45}Ca, and activity of critical enzymes in latex production are being examined.

Thailand
Utilization of Soil and Fertilizers Nitrogen Under Zero Till Farming Systems (THA/5/026)
Nuclear Research Laboratory, Bangkok. Counterpart: Ms. Patoom Snitwongse

Nitrogen fixation by leading soybean varieties in Thailand, and of introduced legumes under zero and conventional tillage practices have been studied. Soybean varieties performed equally well under both tillage

systems. Inoculations with effective strains of Bradyrhizobium japonicum significantly increased yield and N_2 fixation. Nitrogen fixation averaged 100 kg N/ha.

Thailand
Improvement of Food and Agricultural Production with Nuclear and Related Technology (THA/5/031).
Ministry of Agriculture and Cooperatives, Bangkok. Counterpart: Dr. Riksh Syamananda, Ms Patoom Snitwongsee

This is a multi-disciplinary project supported by UNDP. In soil science, projects on nitrogen fertilization phosphorous fertilization, root activity, soil water and nitrogen fixation are included.

9. PUBLICATIONS

1. D.L. Eskew (1987) Use of ^{15}N in N_2 fixation and N cycling studies of Azolla. (In: "Azolla Utlization", Proc. of the Workshop on Azolla Use, Fuzhou, Fujian, Peoples Republic of China, 31 March - 5 April 1985, p: 233-239, IRRI.

In physiological studies ^{15}N has been used to demonstrate excretion of fixed N by the Anabaena azollae endosymbiont. Reported conversion ratios of $C_2H_2.N_2$ reduction measured using $^{15}N_2$ vary from 1.7:1 to.7.9:1. Preliminary indications using the ^{15}N isotope dilution technique are that 80% or more of Azolla N is derived from N_2 fixation. Post and field studies using ^{15}N-labelled Azolla indicated that 20-30% of Azolla N was taken up by the first rice crop, and N recovery from Azolla and urea were similar in field studies. A time course study using ^{15}N, however, revealed that, uptake of urea-N occurred primarily with 30 d of application whereas the major uptake of Azolla N occurred between 30 and 60 days.

2. Danso, S.K.A. (1988). The use of ^{15}N enriched fertilizers for estimating nitrogen fixation in grain and pasture legumes. In nitrogen fixation by legumes in Mediterranean Agriculture (D.P. Beck and L.A. Materon Eds.) ICARDA.

This paper reviews the N-15 isotope dilution and A-value techniques for measuring nitrogen fixation in grain and forage legumes. The influence of reference crops on the accuracy of nitrogen fixation estimates is discussed, with particular mention of criteria to be used in assessing the suitability of reference crops, and practices such as ^{15}N organic matter labelling to get more stable $^{15}N/^{14}N$ ratios in soil and thus reduce errors in nitrogen fixation estimates. The paper suggests that greater caution is needed in selecting reference crops when nitrogen fixation is low, than when it is high. Many pasture or forage legumes luckily derive over 70 % of their N from fixation, and therefore are less likely to be influenced by reference crop induced errors than many grain legumes.

3. Danso, S.K.A., Labandera, C. Pastorini, C. and Curbelo S. (1988). Nitrogen fixation in a two-year old white clover-fescue pasture: Influence of nitrogen fertilization. Soil Biol. Biochem. 20:261-262.

The paper reports on the use of N-15 to estimate nitrogen fixed in a mixed legume-grass pasture in Uruguay. An essential theme was to call attention to the role of N-15 in most N_2 fixation studies, i.e. as a

label rather than as a fertilizer. Thus, the most important considerations in using N-15 were pointed out. The paper shows that it is not always necessary to use the labelled form of the same form of fertilizer used by farmers. Where necessary, e.g. when studying the influence of forms of fertilizer, data was presented to show that a combination of a small dose of a cheaper N-15 fertilizer with the agronomic dose of the normal form of fertilizer used will achieve the dual function of measuring nitrogen fixed and at the same time assessing the agronomic impact of the other type of fertilizer. Although total nitrogen fixed was low, the proportion of nitrogen fixed was high, and was measured with high precision because this estimate is yield independent, which is a unique advantage in using the N-15 techniques.

4. Danso, S.K.A. (1988) The influence of Bradyrhizobium inoculation and seed pelleting with lime and rock phosphate. Soil Biol-Biochem. 20:259-260.

The paper discusses problems of securing satisfactory nodulation in acide tropical soil devoid of native Bradyrhizobium inoculation. Several inoculation methods with or without local and imported pelleting materials were tried. Coating materials were found to be essential in the acid soil studied (pH 4.3), and without these, Bradyrhizobial inoculation resulted in poor nodulation and plant growth. Lime pelletting of the Bradyrhizobium inoculum was the best method, although rock phsophate, filter mud and bagasse used together with gum arabic gave satisfactory inoculation responses.

5. Danso, S.K.A., Hardarson, G. and Zapata, F. (1988). Dinitrogen Fixation Estimates in Alfalfa-Rygrass swards using different nitrogen-15 labelling methods. Crop Science 28:106-110.

Three methods of adding ^{15}N to soil, and the use of residual ^{15}N following previous ^{15}N applications were assessed as to their suitability for estimating nitrogen fixed over four harvests in two years. All methods generally gave similar measures of nitrogen fixed at each harvest. However, the residual ^{15}N approach estimated significantly lower % nitrogen fixed at the last harvest in the second year than when fresh ^{15}N was added. The ^{15}N data showed that the residual ^{15}N taken up by plants from the soil was very low in the second year, and therefore likely to be more affected by errors due to re-translocation of left-over N (which would differ in $^{15}N/^{14}N$ ratio in fixing versus non-fixing crop) for the new regrowth. It is postulated that fresh ^{15}N addition would tend to minimize the effect of differences in $^{15}N/^{14}N$ retranslocated by the fixing and non-fixing reference crops. Of agronomic importance however is the fact that total nitrogen estimates were statistically similar for all methods, includign the use of residual ^{15}N.

6. Labandera, C., Danso, S.K.A., Pastorini, D., Curbelo, S. and Martin, V. (1988). Nitrogen fixation in a white clover-fescue pasture using three methods of nitrogen-15 application and residual nitrogen-15 upake. Agron. J. 80:265-268.

The repeated ^{15}N application to the same plot, to different plots (at seeding and at each harvest), and the uptake of residual ^{15}N were compared for their suitability for estimating nitrogen fixed in alfalfa over a two-year period (five harvests) in Uruguay. All methods measured high values of nitrogen fixed (86% in the first year and 93% in the second

year). The yield-independent estimates of % nitrogen fixed were more precise than the yield dependent total nitrogen fixed values. In general, higher values of % nitrogen fixed were obtained from estimations based solely on residual ^{15}N uptake. In all cases, however, values of total nitrogen fixed were similar. The paper discusses possible problems arising from the retranslocation of left-over ^{15}N in stable for regrowth, and how this may inflence measurements of nitrogen fixed, especially when soil ^{15}N values are very low.

7. Hardarson, G., Danso, S.K.A. and Zapata, F. (1988) Dinitrogen fixation measurements in alfalfa ryegrass swards using nitrogen-15 and influence of the reference crop. Crop Science 28:101-105.

The study was designed to compare estimates of nitrogen fixed over a 2-yr period in mixed legume-grass pastures, using either a sole cropped reference crop, or the mixed grass as the reference crop. Except for the first harvest, the ^{15}N atom excess in mixed ryegrass was slightly lower than in the pure grass. Because these differences were insignificant, it was postulated that there was generally hardly any nitrogen transfer from the legume to the grass in the mixture. Although at one stage, it was estimated that 16 % of the mixed ryegrass nitrogen was derived from alfalfa, this did not seriously affect estimates of nitrogen fixed, neither was it as at any other time. It was concluded that when nitrogen fixation is as high as was observed in this study (780%) over the 2 years), reference-crop induced errors (e.g. from nitrogen transfer) on the estimates of nitrogen fixed are likely to be small. A theoretical model was set-up to illustrate this hypothesis.

For further information on the above publications, please write to any of the individuals concerned, or to the Head, Soil Fertility, Irrigation and Crop Production Section.

10. SOME PAPERS WE HAVE NOTICED

Below we give a summary of papers which have attracted our attention. We invite scientists from developed and developing countries to send us copies of their papers using isotopes and nuclear related techniques - not only for our own information but also for possible mention to our readers.

Please give us a feed back on the value of bringing a selection of papers to your notice. Send opinions and copies of your papers to Head, Soil Fertility, Irrigation and Crop Production Section, Joint FAO/IAEA Division, Wagramerstrasse 5, A-1400 Vienna, Austria.

1. Brenzinger, J.S., Gilpin, H.E. (1987). Observation of unsaturated water flow using real-time neutron radiography. Soil Sci. 144:122-127.

Previous studies showed that water flow may be greatly affected by the presence of fractures of macropore structure in soils. Neutron radiography was introduced to study the effects of macropore structure on water and solute flow in unsaturated media. Neutron radiography is similar to X-ray radiography in concept and it is based on creation of "shadowgraph" images

on a suitable imaging device, such as photographic film. The imaging system used by the authors was a Thompson-CSF neutron-image-intensifying system. A video camera was optically coupled to the intensifier and fed video signal to a monitor, video recorder and a digital image processing system. The technique allowed high-resolution spatial measurement of the wetting front advance and water-flow patterns, non-destructively in soil columns.

2. Barraclough, D., Smith, M.J. (1987) The estimation of mineralization, immobilization and nitrofication in nitrogen-15 field experiments using computer simulation. J.Soil Sci. 38:519-530.

A combination of mathematical analysis and computer simulation, using a porometer readily measured with nitrogen-15 tracer in field experiments, was employed to determine rates of mineralization, immobilization and nitrofixation under a growing crop.

Results which were verified with experimental data from grass lysimeters, indicated that inhibition of nitrifixation in grassland soils may be attributed to poor substrate competion by nitrifying bacteria. The simulation model also suggested that nitrogen mineralization/immobilization was lower at the high fertilizer rate. The procedure also gives the proportion of crop nitrogen uptake occurring as ammonium and nitrate.

The paper concludes that the simulation model may greatly increase the ability to interpret field experiments in terms of the complexity of soil nitrogen transformations with the reservations which were discussed in depth by the authors.

3. Misra, R.K., Alston, A.M., Dexter, A.R. (1988). Role of root hairs in phosphorus depletion from a macrostructured soil. Plant and soil 107:11-18.

One rape (Brassica napus cv. Wesroona) plant and four cotton (Gossypium hirsutum cv. Sicot 3) plants were grown in pastic cells containing soil labelled with 407 kBq of ^{33}P g^{-1} soil. After 5-8 days of growth, the ^{33}P depletion zones of all plants were autoradiographed and ^{33}P uptake by plants was measured. The autoradiographs were scanned with a microdensitometer and the optical densities at several places with the ^{33}P depletion zones of roots were obtained. The volume of soil explored by root hairs was estimated from measurements of root diameters and lengths of roots and root hairs. About half of the total ^{33}P depleted by cotton roots came from outside the root hair cylinder whereas most of ^{33}P taken up by rape was from within the root hair cylinder. Plants grown in a macrostructured soil may have roots growing in voids, within aggregates or on the surfaces of aggregates. The results of this study demonstrate that root hairs have a strong influence on the accessibility of phosphorus to roots in such a soil, and thus on the phosphorus nutrition of plants.

11. IMPORTANT ANNOUNCEMENTS

Symposium on "The use of stable isotopes in plant nutrition, soil fertility and environmental studies".

Due to budget constraints, we have postponed the symposium from 1989 to 1990.

A new Co-ordinated Research Programme on increasing and stabilizing plant productivity in low phosphate and in semi-arid soils in the tropics and sub-tropics of Africa.

It is likely that we will shortly be calling for applications from African institutes for contracts in a CRP on increasing and stabilizing plant productivity in low phosphate and in semi-arid soils in the tropics and subtropics of Africa. The CRP is based on two major constraints to productivity in Africa - soil water deficits and low soil phosphate (with their effects also on biological nitrogen fixation) and the economic impracticability in many cases of correcting them by expensive management inputs such as irrigation or large applications of phosphate. There are a great many records of genotypic differences in the efficiency of water uptake and water use and of phosphate uptake and use of absorbed phosphate. The programme will aim at identifying genotypes of crop plants, or of species and genotypes of trees which are highly efficient in uptake and use of water and/or phosphate. Field programmes will identify such genotypes; laboratory back-up research will examine the importance of root and plant physiological characteristics determining these and genetic variation in these characteristics.

We would welcome expressions of interest from potential African collaborating institutes, and also suggestions from readers around the world of groups who should be contacted.

Please write to Glynn Bowen, Head, Soil Fertility, Irrigation and Crop Production Section, Joint FAO/IAEA Division, IAEA P.O. Box 100, A-1400, Vienna, as soon as possible. Many thanks in anticipation for your co-operation.

We have had several requests for Newsletter 1985 Vol.2 and Newsletter 1986 Vol. 2. However, due to changes in staff, they were not issued.

Notes for readers for consideration for the next issue of our Soils Newsletter should reach us by October 1, 1988.

Soils Newsletter
Joint FAO/IAEA Division
of Isotope and Radiation Applications
of Atomic Energy for Food and Agricultural Development

International Atomic Energy Agency

Wagramerstrasse 5, P.O. Box 100
A-1400 Vienna, Austria

Printed by the IAEA in Austria
August 1988

88-03364