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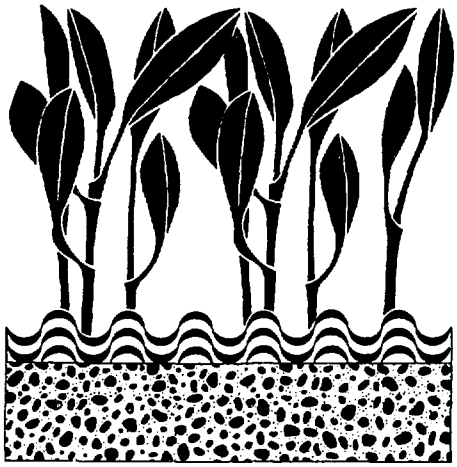

Soils Newsletter

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

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CONTENTS

1. TO OUR READERS

Welcome again to our Newsletter. As usual, we have a number of things to tell you about.

In April we reluctantly said farewell to David and Anne Eskew - and their two children, Laura and Benjamin. David had been with us for 6 years, part of the time at Seibersdorf Laboratory, and was in charge of the SIDA-funded Azolla CRP, which has its final research co-ordination meeting at the end of September. David was a very valued staff member, contributing especially in area of plant physiology/nitrogen fixation, and ideas on molecular biotechnology - some aspects of which we are about to enter (see below). David's new location is: Institute of Agriculture, The University of Tennessee, 269 Ellington Plant Sciences Bldg., POB 1071, Knoxville, TN 37901-1071, USA. Saliya Kumarasinghe, previously coordinator of our African Regional Programme, has been appointed to the position which David occupied. In February, Marcello Calvache, who was the Co-ordinator of our Latin American Technical Cooperation Programme, returned to Ecuador.

I draw your attention specifically to the announcement in this issue of the International Symposium we are holding October 1-5, 1990 on "The use of stable isotopes in plant nutrition, soil fertility and environmental studies". This will be held in Vienna and the formal announcements will be made very shortly. We are finalizing a list of keynote speakers. Each of the sessions indicated in the announcement will have one keynote speaker plus 3-5 volunteered papers. Please give some thought to offering a paper. To make sure you get the formal announcement, please get in touch with me.

We have just concluded an interregional training course in Seibersdorf. Our interregional courses have a permanent core of isotopes and nuclear techniques in soil/plant nutrition studies but each year we give particular focus to a topic, often including an integration of nuclear and important non-nuclear techniques. Last year the focus was roots, this year it was nitrogen relations and next year it will be water. Regional training courses focus on a range of topics of particular concern to the region. In August we have a regional course (in French) in Bambey, Senegal from 21 August to 15 September 1989 and from 6 November to 8 December 1989, we have a regional course (in English) in Bangi (Kula Lumpur), Malaysia, with special reference to tree crops. Some special good news is that work has commenced at Seibersdorf Laboratory on a new training wing for the several training activities in various desciplines each year. This will be some 500 m^2 and will house a lecture room, two laboratories for training activities, and study rooms for fellows. This much needed facility, which is Phase 1 of a Training Centre, is possible as a result of the generosity of the Governments of Austria, the Federal Republic of Germany and the U.S.A. Our heartfelt thanks go to these donors. The facility will be in operation in 1991.

We are about to initiate studies at the Soils Unit, Seibersdorf on the use of DNA probes in microbial ecology. Gudni Hardarson is to get training in this at the Laboratoire de Biologie Moléculaire des Plantes Supérieures, Université de Genève, Chambésy, Genève, Switzerland. In our context, we

wish to follow the population ecology of introduced organisms such as Rhizobium, Frankia, etc. It is also important that we develop a technology to be transmitted to Member States as and when they need it, not only in this context but also to enable them to monitor the fate of various introduced organisms in the future, e.g., biocontrol organisms or genetically engineered micro-organisms.

As a final note, let me remind you that we are always on the look-out for experts to serve on our Technical Co-operation projects. If you believe you have relevant experience in the use of isotope and nuclear techniques in soil/plant studies and would like to be considered, please contact me.

With best wishes from all here.

Glynn Bowen

2. STAFF

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3. CO-ORDINATED RESEARCH PROGRAMMES

A. Isotopic studies of nitrogen fixation and nitrogen cycling by blue-green algae and Azolla
(Project Officer: Saliya Kumarasinghe)

All field and laboratory experiments pertaining to this project are completed. The participants are presently preparing their final research reports which will be discussed during the final research co-ordination meeting, scheduled for 25-29 September 1989, in Vienna, Austria.

B. The use of isotopes to improve yield and N_2 fixation of grain legumes in Latin America
(Project Officer: Gudni Hardarson)

The programme is now in its fourth year, and two research co-ordination meetings have been conducted since it was initiated in 1986. The last meeting was held in Irapuato, Mexico on 10-14 April 1989. The programme has already produced some interesting results on the effectiveness in nitrogen fixation by the common bean-Rhizobium symbiosis. A brief report of the meeting is given elsewhere in the Newsletter.

C. The use of nuclear and isotopic techniques to improve crop production on salt-affected soils
(Project Officer: Cevat Kirda)

This programme is in its fourth year and it has been extended until 1992 to assure completion of field experiments which were started in 1988. Participants of the programme first selected salt tolerant field crops, to be used in subsequent field experiments which aim at the biological amelioration of salt-affected soils. The reports received from the participants of the programme show that the field experiments which will continue for four years are progressing well. The third research co-ordination meeting of the programme is to be held in 1990.

D. Evaluation and calibration of nuclear techniques compared with traditional methods in soil water studies
(Project Officer: Cevat Kirda)

The field experiments which were in this programme have been completed and participants have submitted their final research reports. The programme finished with the research co-ordination meeting which took place on 17-21 July 1989 in Vienna. A detailed report of the final meeting will be included in the next issue.

E. Increasing and stabilizing plant productivity in low phosphate and semi-arid and sub-humid soils of the tropics and sub-tropics.
(Project Officer: Saliya Kumarasinghe)

This CRP which will focus on identification of plant varieties displaying high water use efficiency and/or high phosphate use efficiency was initiated this year. Nine African countries, Kenya: Daniel Nyamai; Morocco: Mohamed Bazza; Nigeria: Nathaniel Afolabi; Senegal: Linamoulaye Cissé; Sierra Leone: Denis Amara; Sudan: Abdelrasoul Mustafa; Tanzania: Luther Lulandala; Tunisia: Mohamed Mechergui; Uganda: John Esegul will participate

in this programme which will run over a period of 5 years. The first research co-ordination meeting is scheduled to be held in Vienna from 18 to 27 Ocotber 1989. Support research at Seibersdorf Laboratory includes an examination of plant factors influencing phosphate and water use efficiency, and genetic variability in these factors.

4. TECHNICAL CO-OPERATION PROGRAMMES

The present number of Technical Co-operation Programmes for which our Section has technical administration responsibility is 61. In this issue, highlights of Technical Co-operation Programmes in the Africa Region are given. The programmes in Latin America Region will be covered in the next issue.

Cameroon
Establishment of a Teaching and Research Laboratory (CMR/5/004)
Institute of Geological and Mining Research, Laboratory for Energy Research, Yaounde.
Counterpart: Mr. Christophe Takoudjou

This project is to rehabilitate an old isotopes laboratory and put it back into active use for research using isotopes and nuclear techniques in Soil/Plant Nutrition. It is also to serve as a teaching laboratory for university students and researchers. Equipment and supplies, including a liquid scintillation counter, monitoring equipment and centrifuge have been provided. An expert was provided to repair broken-down equipment, and to advise on equipment needs. Expert and equipment supply is continuing under this project.

Cote d'Ivoire
Soil Water Studies to Improve Productivity of Rice (IVC/5/012)
Department d'Agronomie, IDESSA, Bouaké.
Counterpart: Dr. J.L. Chopart

This project is examining among others, how methods of cultivating the soil influence water conservation in this semi-arid area, for optimum upland rice yields. As with most projects, expert services have been provided, and among the equipment supplied are neutron moisture meters and a PC computer.

Ethiopia
Increasing the Protein Yield of Pulse Crops and Fodder Through Biological Nitrogen Fixation (ETH/5/008)
Department of Soil Science and Water Management, Institute of Agricultural Research, Holleta.
Counterpart: Dr. Desta Beyenne

This project aims at enhancing the nitrogen fixing capability of legumes grown in the highland and lowland regions of Ethiopia. This is being tackled through Rhizobium strain selection and inoculation, plus management practices, such as the need for phosphorus fertilization. The N-15 isotope technique is being used to measure nitrogen fixed, using the NOI-6e emission spectrometer supplied by the Agency. In addition to the supply of equipment, the Agency is providing expert services and funds for fellowship training. The project has recently been incorporated into the Agency's Regional Africa Technical Co-operation Network on Biological Nitrogen Fixation.

Ghana
Biological Nitrogen Fixation in Legumes (GHA/5/008)
Faculty of Agriculture, University of Ghana, Legon
Counterpart: Dr. F. Sorwli

This project is among those in the Agency's Regional Project in Africa on Biological Nitrogen Fixation. Isotopic techniques are being used to study nitrogen fixed, and the effect of management practices on nitrogen fixation in important legumes in Ghana, including cowpeas, groundnuts and bambara beans. Various cultivars are being examined for genotypic differences in nitrogen fixed, and the effect of level of soil nitrogen on the fixation process in different cultivars continues to be examined. The IAEA has supplied equipment, including an NOI-6e emission spectrometer and laminar flow hood. Fellowships and expert services have been provided to this project. An African Regional Training Course on the Use of Isotopes in Soil/Plant Nutrition with Special Empnasis on Biological Nitrogen Fixation was held in Legon in 1988.

Madagascar
Increasing Rice Production under Optimum Fertilizer Regimes (MAG/5/005)
Radioisotope Laboratory, Antananarivo
Counterpart: Dr. L. R. Rabeharisoa

The objective is to assess the factors that influence the efficiency of N fertilizer use, thereby cutting down on the fertilizer amounts required to achieve maximum yields of rice. Nitrogen analysis apparatus, N-15 isotopes and a Mill are among the equipment supplied.

Mauritius
Irrigation and Fertilization of Sugar Cane Fields (MAR/5/005)
Mauritius Sugar Industry Research Institute, Reduit
Counterpart: Dr. J. Deville

This project is a follow-up of two earlier ones, MAR/5/002 and MAR/5/003. The objective is to arrive at the best irrigation and fertilizer practices for high sugarcane yield through the use of isotopes and nuclear techniques. Neutron moisture meters, tensiometers, emission spectrometer, etc. and experts have been provided.

Morocco
The Efficient Use of Fertilizers and Nitrogen Fixation in Sugarcane, Wheat and Legumes (MOR/5/013)
Central Radioisotope Station, National Agricultural Research Institute, Tangier
Counterpart: Dr. C. R'Kiek

The effects of nitrogenous and phosphatic fertilizers on the yield of sugarcane and wheat, and on nitrogen fixed in fababeans are being investigated through the use of isotopes. The institute has been supplied with an emission spectrometer, apparatus for nitrogen analysis, N-15 and P-32 labelled fertilizers, etc. Expert services have also been provided. The project is in the Agency's Regional Project in Biological Nitrogen Fixation in Africa.

Nitrogen Fixation in Trees on Marginal Soils (MOR/5/017)
Soil Microbiology Laboratory, Faculty of Science, Meknes
Counterpart: Dr. M. Ismaili

The N-15 technique is being used to assess the capabilities of different leguminous trees to fix nitrogen under marginal soil conditions. This is a new project, and is part of the African Regional Project on Biological Nitrogen Fixation. Various laboratory equipment and supplies have been ordered, and expert recruitment is in progress.

Niger
Symbiotic Nitrogen Fixation in Cowpeas (NER/5/006)
Department of Agronomy, Universty of Niamey.
Counterpart: Dr. I. Soumana

The project aims at quantifying nitrogen fixed in cowpeas grown alone or in mixed cropping, and to select for high nitrogen fixing cultivars. The project is in the African Regional Project on Biological Nitrogen Fixation, and has been supplied with the SOPRA emission spectrometer and other equipment.

Nigeria
Biological Nitrogen Fixation in Grain Legumes (NIR/5/015)
Department of Horticulture and Plant Protection, Anambra State University of Technology, Enugu
Counterpart: Dr. G.U. Okereke

Nitrogen-15 techniques are being used to quantify nitrogen fixed in several soybean varieties, and to identify cultivars that have high affinity and symbiotic capability with native Bradyrhizobium strains. The project is included in the IAEA Technical Co-operation-sponsored African Regional Project on Biological Nitrogen Fixation. An autoclave, fermentor, nitrogen determination apparatus, etc. and expert services have been provided.

Studies on Biological Nitrogen Fixation (NIR/5/018)
Institute of Agricultural Research and Training, Obafemi Awolowo University, Ibadan
Counterpart: Dr. K.O. Awonaike

Nitrogen fixed in cowpea cultivars within different maturity groups, the effect of Bradyrhizobium inoculation, and the abilities of cowpea cultivars to continue to fix high amounts of nitrogen on nitrogen-fertilized soils is among some of the studies undertaken. The project is among those in the African Regional Project on Biological Nitrogen Fixation, and has just been supplied with an NOI-6e emission spectrometer. Other equipment and expert services plus fellowships have been provided.

Senegal
Increased Crop Production Through Studies on Crop Management Methods and Higher Efficient Water Utilization (SEN/5/017)
Agricultural Research Institute, Bambey
Counterpart: Dr. L. Cissé

The objective of this project is to use isotopes (N-15 and P-32)and nuclear techniques to study how to improve crop production through increased soil water retention capacity of soils, (e.g., through organic matter amendment) and its efficient use by plants in this semi-arid region, as well as on studies of rock phosphate availability. Neutron moisture meters, tensiometers, expert services, fellowships have all been provided.

Enhanced Legume Yields Through Biological Nitrogen Fixation (SEN/5/018)
National Agronomic Research Centre, Bambey
Counterpart: Dr. P.L. Sarr

Among the legumes being investigated for nitrogen fixation ability are cowpeas and groundnuts, using the N-15 methodology. The effects of nitrogen and phosphorus fertilizers on growth and nitrogen fixation are being studied. This project is included in the African Regional Project on Biological Nitrogen Fixation. Expert services and an NOI-6e emission spectrometer have been provided.

Tunisia
Nitrogen Fixation in Trees (TUN/5/009)
Institute of Forestry Research, Tunis
Counterpart: Dr. M. Hafedh

Growth and nitrogen fixed in trees such as Acacia cyanophylla and Casuarina spp. in marginal lands are being measured. Acacia, in addition, is being used for the reclamation of saline soils. The project is included in the African Regional Project on Biological Nitrogen Fixation, and has recently received the SOPRA emission spectrometer and a laminar flow hood. Expert services have been provided, with fellowships earmarked.

Establishment of Nuclear Agricultural Laboratory (TUN/5/012)
National Agronomic Institute, Tunis
Counterpart: Dr. M. Brini

Items like the liquid scintillation counter, neutron moisture meters, and isotopically labelled compounds and fertilizers are being provided to this new project, aimed as serving as a teaching and research laboratory. Arrangements for expert assignment are almost finalized.

Zambia
Nuclear Techniques in Agriculture (ZAM/5/004)
Mount Makulu Central Research Station, Chilanga
Counterpart: Dr. K.L. Munyinda

The project is an old one, handling several aspects of soil-plant nutrition. The studies centered initially on annuals, but recent emphasis includes nitrogen fixation in trees, using N-15 techniques. The project has provided an IAEA-supplied NOI-5 emission spectrometer and several other equipment as well as experts and fellowship awards.

5. REPORTS OF MEETINGS

1. The second Research Co-ordination Meeting on "The use of isotopes to improve yield and nitrogen fixation of commonbean in Latin America" was held at the Centro de Investigacion y Estudios Avansados del IPN, 10-14 April 1989, Irapuato, Mexico.

The meeting was attended by 13 participants from Brazil, Chile, Colombia, Guatemala, Mexico, Peru and the U.S.A. The programme included presentations by all contractors and agreement holders of research conducted during the past year. The first experiments of the programme included quantification of nitrogen fixation by approximately twenty cultivars or lines of commonbean using the N-15 methodology. Some of these experiments were repeated to get additional data on the differences between plant germplasms in supporting nitrogen fixation. It is now well established that commonbeans are able to fix large percentages of their nitrogen (65%) but this can be very much affected by plant genotypes and environmental factors. The experiments which are being presently implemented include studies on the time course of nitrogen fixation, evaluation of mixed cropping on nitrogen fixation and the effect of various reference crops on quantification of nitrogen fixation in commonbean. A detailed report of the meeting with summaries from each participant will be presented in the next issue of the Soils Newsletter.

2. The first Research Co-ordination Meeting of the Regional Africa Project (RAF/5/010) on "Biological nitrogen fixation" was held at the National Institute for Forest Research, 15-19 May 1989, Tunis, Tunisia.

Eleven counterparts from nine African countries (Egypt: M.S.A. Safwat, Ghana: F.K. Kumaga; Morocco: C. R'Kiek, M. Ismaili; Niger: M.G. Goubé; Nigeria: K.O. Awonaike, G.U. Okereke; Senegal: A. Badiane; Tunisia: N. Hafedh; Zaire: N. Luyindula; and Zambia: K. Munyinda) presented their results obtained from field experiments conducted using N-15, during the first phase of the project in 1987/1988. Inoculation with a mixture of elite strains of rhizobia resulted in increased nitrogen fixation in some varieties of soybean and fababean but not in cowpea. Contrary to the general belief that high levels of inorganic N inhibit N_2 fixation, an application of 100 kg N/ha compared to 20 kg N/ha of ammonium sulphate did not decrease N_2 fixation. In some varieties of cowpea and fababean. Such cultivars would be of great agronomic significance in view of their possible use in mixed cropping systems practised in many parts of Africa. Follow-up experiments to be carried out during the second phase of this project (1989/90) were also planned.

6. FROM OUR READERS

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 the information of our readers.

1. Quantitative determination of symbiotic nitrogen fixation by soybean (Glycine max. L. merr) using isotope techniques

L. Rivero
Agronomy Faculty, National Agricultural University, La Molina, Lima, Peru

A field experiment was carried out on an entisol soil at the National Agcultural University La Molina, Peru to quantify symbiotic nitrogen fixation by soybean using ^{15}N methodology and to examine the suitability of reference crops for such quantification.

^{15}N labelled fertilizer was applied at different rates, to experimental plots of the fixing nodulating soybean and of different non-fixing reference crops (soybean without inoculation, non-nodulating soybean, barley and sorghum). The ^{15}N isotope allowed the assessment of whether reference crops absorbed the same amounts of available soil N ('A' soil nitrogen values). The fixing legume measured both available soil plus fixed N. The proportion of N derived from fixation was measured using the 'A'-value approach.

'A'-soil values estimated with barley were very similar to the 'A'-value measured with non-fixing soybean, both uninoculated and non-nodulating ones. However, the 'A'-value measured with sorghum was higher than that measured in the treatments of non-fixing soybean. Therefore, it was concluded that barley is a suitable reference crop to estimate N-fixation by soybean. At physiological maturity of the soybean, the amount of N derived from fixation, as estimated using barley as reference crop, was approximately 116 kg/ha, equivalent to 60% of total N assimilated, while the contributions from soil and labelled fertilizer accounted for 23 and 11%, respectively.

2. The behaviour of phosphate rock granules as phosphorus fertilizer

R. Reyes

Universidad de Chile, Comisión Chilena de Energía Nuclear, Santiago, Chile.

Pot assays were done in a greenhouse, using Ryegrass (Lolium perenne/Lolium multiflorum) as the indicator plant growing in a volcanic Chilian soil. The phosphorus mobilization and the nutrient source identification in the plant were made with the inverse isotopic dilution technique, using triple superphosphate (TSP) labelled with ^{32}P. Three phosphoric rock (PR) granules (carbon hydrate recoveries) were prepared using mannitol, cellulose and a mixture of both at 1:1 ratio in weight. The experiment consisted of 16 treatments, including a control. Three cuts of the plants were done every 20 days, harvesting the aerial part of the plant. The vegetative material was dried, weighed and analyzed for total P, ^{32}P, Fe, Cu and Zn. The results indicated that the phosphoric rock is a sparingly soluble mineral. As such, the carbon hydrate recoveries are not effective and therefore behave similarly as slow releasing fertilizers. A better growth response was however observed from its residual effects than for a corresponding TSP application.

On the other hand, it was observed that dry matter yields were similar at the end of the assay in all treatments, irrespective of the P source and that the uptake of Fe and Zn decreased. It would seem then, that the available P levels reached were sufficient for plant growth. However, the micronutrient contents (Fe, Zn) became insufficient after 65 days.

In conclusion, the phosphoric rock from Bahia Inglesa could be used as a potential fertilizer source. Seven kg of PR provided the equivalent of 1 kg of TSP fertilizer.

3. Efficiency of tripple superphosphate in four soils of volcanic ash origin

I. Pino, A. Michaud, L. Casas
Nuclear Energy Commission, Santiago , Chile.

Efficiency of triple superphosphate in four soils derived from volcanic ashes was evaluated. Ryegrass (Lolium multiflorum L.) was used as a test crop in greenhouse experiments to assess phosphorus uptake from triple superphosphate (TSP). Three rates of TSP (150, 300 and 600 kg P_2O_5/ha) labelled with ^{32}P were used. The fertilizer was applied 2.5 cm below the seed bed. The phosphorus derived from the fertilizer supplied 70% of the total P absorbed by the plant. The 'A'-value increased somewhat with the rate of fertilizer application but it gave comparatively close values for the four soils studied.

7. FUTURE TRAINING COURSES

1. FAO/IAEA Africa Training Course on the use of isotope radiation techniques in studies of biological nitrogen fixation and soil/plant nutrition. Bambey, Senegal, 21 August to 15 September, 1989
(Technical Officer: Saliya Kumarasinghe)

This training course, which is similar to the one held in Ghana in 1988, will take place at the National Agronomic Research Centre (CNRA) in Bambey in collaboration with the Institute for Agricultural Research in Senegal (ISRA) in Dakar. The language of the course will be French. It is organized mainly in support of the FAO/IAEA Regional Africa Project on BNF (RAF/5/010), with a view to assisting scientists from African countries to acquire a good working knowledge of the relevant isotope and nuclear techniques in studies of biological nitrogen fixation and soil fertility. Emphasis will be placed on N_2 fixing trees and Rhizobium technology.

2. FAO/IAEA Asian Training Course on the use of isotopes and radiation techniques in studies on soil/plant relationship with special emphasis on trees. Kuala Lumpur (Bangi), Malaysia, 6 November to 8 December, 1989
(Technical Officer: Seth K.A. Danso)

The course is open to scientists from FAO and IAEA Member States from the Asia and Pacific Region. The number of participants is expected to be 20. Emphasis will be placed on the use of isotopes and nuclear techniques in research on soil fertility and plant nutrition, with particular emphasis on trees. Lectures will be delivered in English and a necessary prerequisite is that participants should have no difficulty in following lectures and expressing themselves in this language. Participants should be university graduates specialized in the field of soil fertility and plant nutrition.

The official announcement of the course has already been issued to the relevant government authorities in each country, and the closing date for the submission of applications was 30 June 1989.

8. SPECIAL ANNOUNCEMENT

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

We are happy to announce that the above symposium will be held 1 to 5 October 1990, Vienna, Austria. The symposium will examine the following topics, their present status and future potential, each topic will have an invited overview speaker and three to five volunteer papers. There will probably also be poster sessions.

- Advances in stable isotope methodologies
- An evaluation of the ^{15}N dilution method for measuring BNF
- The ^{15}N natural abundance method for measuring BNF, practicalities and possibilities
- Special applications in ^{15}N methods in BNF. Trees, Azolla, associative N-fixation
- Stable isotopes in soil organic matter studies
- ^{13}C applications to soil organic matter studies.
- N-transformation in soil
- N fertilizer use efficiency, uptake and use of N in the plant
- Ground water pollution, studies
- $^{13}C/^{12}C$ as a measure of water use efficiency
- ^{13}C in photosynthesis/N-fixation studies
- Carbon flow in aquatic, ecosystems, aquaculture
- Stable isotopes of A and O in agricultural ecosystem studies and environmental studies

For additional enquiries or to receive the announcement, please write to Dr. Glynn Bowen, Head, Soil Fertility, Irrigation and Crop Production Section, Joint FAO/IAEA, Wagramerstr. 5, POB. 100, A1400 Vienna, Austria. Please also write (as soon as possible) if you would like to suggest sessions or additional topics.

9. NON-AGENCY MEETING

Conference on "Biological nitrogen fixation and sustainablility of tropical agriculture" to be held at the International Institute of Tropical Agriculture (IITA), 25-29 September 1990, Ibadan, Nigeria.

For further information please write to Dr. K. Mulongoy, International Institute of Tropical Agriculture, Oyo Road, PMB 5320, Ibadan, Nigeria.

10. SOME PAPERS WE HAVE NOTICED

As was done in some of the previous issues of the Newsletter, here again we provide a summary of papers which have attracted our attention.

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. Martin, B., Thorstenson, Y.R. 1988. Stable carbon isotope composition ($\delta\ ^{13}C$), water use efficiency, and biomass productivity of Lycopersicum esculentum, Lycopersicum pennelli, and the F_1 hybrid. Plant Physiol., 88:213-217

Three tomatoes, Lycopersicon esculentum Mill. cv UC82B, a drought-tolerant wild related species, Lycopersicon pennelli (Cor.) D'Arcy, and their F_1 hybrid, were grown in containers maintained at three levels of soil moisture. Season-long water use was obtained by summing over the season daily weight losses of each container corrected for soil evaporation. Plant biomass was determined by harvesting and weighing entire dried plants. Season-long water use efficiency (gram dry weight/kilogram H_2O) was calculated by dividing the dry biomass by the season-long water use. The season-long water use efficiency was greatest in the wild parent, poorest in the domestic parent, and intermediate (but closer to the wild parent) in the F_1 hybrid. Instantaneous water-use efficiency (micromole CO_2/millimole H_2O) determined by gas exchange measurements on individual leaves was poorly correlated with season-long water use efficiency. However, the relative abundance of stable carbon isotopes of leaf tissue samples was strongly correlated with the season-long water use efficiency. Also, the isotopic composition and the season-long water use efficiency of each genotype alone were strongly negatively correlated with plant dry weight when the dry weight varied as a function of soil moisture.

2. Hulm, S.C., Killham, K. 1988. Gaseous nitrogen losses from soil under Sitka spruce following the application of fertilizer ^{15}N urea. Journal of Soil Sci., 39:417-424

Gaseous N loss, through denitrification and NH_3-volatilization, was monitored throughout the growing season after spring application of ^{15}N labelled urea fertilizer to peaty clay soils supporting N-deficient Sitka spruce. From the ^{15}N data, it was calculated that only about 0.28% of applied N was lost through NH_3-volatilization, almost all within the first few days after fertilizer application. Approximately 0.05% of applied N was calculated to be lost through denitrification. Denitrification decreased slowly over a 4-month period after fertilizer application. Rates of NH_3-volatilization correlated with available NH_4^+ in the litter layer, while for the early part of the study when N-losses were highest, denitrification rates correlated with available NO_3^- in the litter layer.

3. Mathew, G., Vasu, K., Vamadevan, V.K., Wahid, P.A. 1988. Measurement of transpiration rate in coconut palm with tritiated water: Tritium profile in coconut crown. J. Nuclear Agric. Biol., 17:110-112.

This communication reports the distribution pattern of tritium and its peak arrival time in coconut crown observed during the course of an investigation on the measurement of transpiration and biomass in coconut palm. The method involves the artificial injection of tritium into coconut trunk about 30cm from its base. The coconut palm (var., Laccadive ordinary) was 256 cm high, having a girth of 127 cm at the point of injection with tritiated water. The plant had 24 leaves at the time of injection of the tracer. The radioactivity was injected into the palm through five equally spaced holes drilled around the stem to about one third of the trunk radius. Into each hole, 1mCi of THO was injected using a fixed volume (0.2 ml) lambda pipette. The total radioactivity injected into the palm was 5mCi (sp. act., 5mCi/ml). Leaves were sampled at different time intervals from 1 to 500 hours after injection of the label for ^{3}H assay. Results indicated that there is accumulation of the tracer in the older leaves of the plant, showing that, the contribution of the matured part of the crown towards the overall transpiration rate of the plant is relatively small. The activity-time curves of individual leaves also confirm this as, there is considerable variation in the areas under the curve which has a direct bearing on the estimation of the transpiration rate of the plant.

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