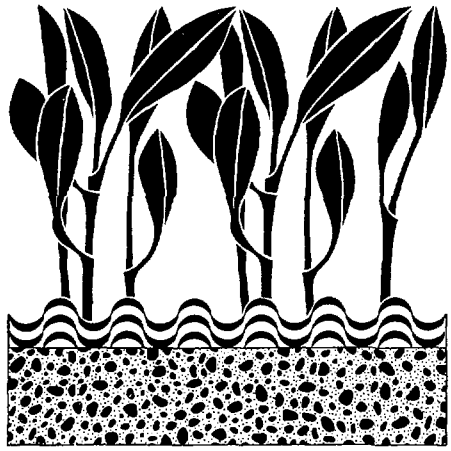

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Soils Newsletter

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

Vol.6, No.1 July 1983

CONTENTS

TO OUR READERS.

This issue summarises the activities of the Soils Section of the Joint FAO/IAEA Division for the 1st half of 1983. The number of letters we are receiving from scientists and agronomists from a many Member States, inquiring about our programmes, activities and meetings, strongly support the value of this publication. To further extend the spectrum of institutes and scientists that receive our newsletter, we kindly ask each reader to send us a list of the main Institutes of his country which are involved in research/training in the field of nuclear applications in agriculture. We also welcome any contributions, comments or suggestions from our readers, and we hope you will find the information in this issue interesting and useful to you and your colleagues.

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(c) Changes in Staff

An additional Staff Member, Dr. David L. Eskew from the U.S.A. joined the Soils Section in February 1983, as Second Officer.

ON-GOING COORDINATED RESEARCH PROGRAMMES

(a) FAO/IAEA Coordinated Research Programme on Development of Fertilizer and Water Management Practices for Multiple Cropping Systems.

The Second Research Coordination Meeting of the programme, which was started in 1980, was held in Vienna from 8-12 November, 1982. The Participants at the meeting discussed results of initial intercropping experiments carried out in previous years and the plans of their work for 1983-1984. It was agreed that all contractors would carry out two seasons of experiments involving legumes and cereals, with the aim of studying fertilizer use efficiencies, water balance and possible nitrogen "transfer" from the legume to the cereal. The main purpose of the first season's experiment is to evaluate amounts of nitrogen fixed by legume plants. In the second season the residual effect of fertilizers will be studied by comparing nitrogen and phosphorous A-values of the soil when the preceeding crop was either a legume or a cereal.

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

The programme started in 1978 and is coming to an end. The Final Research Coordination Meeting is planned to be held in Vienna, during February 1984. The objective of this programme is to better understand water and fertilizer interactions in rain-fed and irrigated crops in the Semi-Arid regions, in order to establish improved water and fertilizer management practices. The Final Research Coordination Meeting will review the five years of the programme, make recommendations and draw conclusions based on the research carried out. A final publication is planned for the end of 1984.

(c) FAO/IAEA/IG Research Coordination Programme on Use of Nuclear Techniques in Improving Pasture Management.

The Pasture Management Programme, started in 1982 with financial assistance from the Italian Government (IG) is in progress with a full complement of contractors from developing countries and agreement holders from developed countries. Experiments are now being conducted in Brazil, Cyprus, Greece, Iceland, Malaysia, New Zealand, Peru, Sri Lanka, Sudan, U.K. and the U.S.A. The initial phase of this programme is concentrating on measuring nitrogen fixation in mixed legume-grass pastures as affected by legume species or variety, level of N and P fertilization, or inoculation with Rhizobium and/or mycorrhizal fungi. The First Research Coordination Meeting is planned for November 1983, in Vienna. In conjuction with this meeting a Workshop on the use of ^{15}N will be offered to the participants.

(d) FAO/IAEA/SIDA Research Coordination Programme on Studies of Biological Dinitrogen Fixation for the Dual Purpose of Increasing Crop Production and Decreasing Nitrogen Fertilizer Use to Conserve the Environment.

The Nitrogen Fixation Programme, started in 1978 with the financial assistance of the Swedish International Development Agency (SIDA) is coming to an end, with the Final Research Coordination Meeting planned for 22-28 August 1983, in Vienna. The progamme

covered methodological and practical aspects of atmospheric nitrogen fixation by annual grain legume crops. The Final Research Coordination Meeting will review the achievements of the programme over the five-year duration and indicate recommendations and conclusions based on the research carried out. A final publication containing the results and conclusions of this programme is planned for the beginning of 1984.

(e) FAO/IAEA/GSF Research Coordination Meeting on Agricultural Nitrogen Residues with Particular Reference to their Conservation as Fertilizers and Behaviour as Potential Pollutants.

This programme which was funded by the German Science Foundation (GSF) ended in June 1983. The objective of the programme was to evaluate the fate of fertilizer nitrogen, using isotopic techniques to establish nitrogen balances, under different soil/climate/management conditions. The Final Research Coordination Meeting was held in Vienna, from 16 to 20 May, 1983. During the meeting it was decided that the results of the programme would be published in two documents: i) Proceedings and Report of the Final Research Coordination Meeting, which will include the contribution of all contractors and agreement holders during the last 3 years of the programme and ii) Review of world-wide studies on soil nitrogen with particular reference to plant nutrition and environmental protection, which will be prepared by Dr. F.P.W.Winteringham, FAO/IAEA/GSF Consultant. These two publications are planned for the beginning of 1984

PLANNED COORDINATED RESEARCH PROGRAMMES

Based on the recommendations of a consultants meeting held in 1982, the Joint FAO/IAEA Division will be initiating a Coordinated Research Programme in 1984 to study nitrogen fixation and nitrogen cycling by Blue-Green Algae (BGA) and Azolla symbiosis, thus contract applications should be submitted as soon as possible. The primary objective of this programme will be to quantify nitrogen fixation using ^{15}N techniques under field conditions, and to evaluate the availability of the N in Azolla and BGA to crops, primarily flooded rice.

An Advisory Group Meeting held in Aix-en-Provence, France, 18-22 April 1983, on Nuclear Techniques in Studies of the Effect of Irrigation Water Quality and Crop Water Requirements, with specific reference to saline and salt affected soils, recommended to the Joint FAO/IAEA Division, the initiation of a Research Coordinated Programme on the above subject. The specific recommendations of the Advisory Group will be published in the proceedings of a Symposium (see item 8 of this Newsletter) held simultaneously in Aix-en-Provence.

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 Group. The contract programme provides limited funds to Institutes from developing Member States of the IAEA for the supply of isotopes and purchase of equipment necessary for conducting the research. Participants meet occasionally to review the progress of their research and to plan future studies.

TECHNICAL COOPERATION PROGRAMMES

In our last Newsletter, Vol 5, No 2. the Technical Cooperation Programme was described and information was given on how to apply. The Soils Section has, during 1983, Technical Cooperation Projects with Bangladesh, Bolivia, Brazil, Chile, Colombia, Egypt, Guatemala, Greece, Ivory Coast, Kenya, Madagascar, Malaysia, Mali, Mauritius, Morocco, Niger, Pakistan, Panama, Philippines, Republic of Korea, Romania, Senegal, Sri-Lanka, Sudan, Thailand, Tunisia, United Republic of Tanzania, Uruguay, Venezuela, Zaire and Zambia. Several requests for 1984 are now being evaluated by the Soils Section. Requests for 1985 must be received by the IAEA late in 1983 or very early in 1984.

SOILS RESEARCH IN SEIBERSDORF LABORATORY

(a) Multiple Cropping

The effect of competition from an associated cereal crop on nitrogen fixation by a legume was studied in two cropping systems, (i) fababean-barley and (ii) soybean-sorghum mixtures, by the use of N-15 methodology. Nitrogen fixed in the sole crops of legumes and cereals were compared to an intercropping pattern consisting of 5 rows of legume/plot with a variable number of rows of cereals between. Fababean was found to fix 65% of its nitrogen when grown alone but this increased to 96% with maximum competition from barley. The % nitrogen from fixation for soybean also increased from 42% to 60% with increased competition from sorghum. In both systems there was no indication of N transfer from legume to cereal.

(b) Pasture Management

N_2-fixation in pure and mixed sward of alfalfa-ryegrass as well as N supply from alfalfa to ryegrass was studied in a field experiment by the use of ^{15}N methodology. Preliminary results of this experiment will be reported at the First Research Coordination Meeting of the Pasture Management Programme (November, 1983).

(c) Nitrogen Fixation by Grain Legumes

Symbiotic nitrogen fixation by soybean varieties growing at different levels of N fertilizer application was studied for the second year at Seibersdorf Laboratory. Again soybean varieties were found to be affected to different extents by the application of N fertilizer. The results will be reported at the Final Research Coordination Meeting on N_2-fixation in Grain Legumes (22-28 August, 1983).

(d) Azolla and Blue Green-Algae

As already mentioned, a consultants meeting on the role of isotopes in studies on Biological Dinitrogen Fixation and Nitrogen Cycling by Blue-Green Algae and their associations was held in Vienna from 11-15 October, 1982. The major outcome of this meeting was the recommendation to initiate a new Coordinated Research Programme to use isotopic techniques to study nitrogen fixation, N cycling and the potential use Azolla and Blue-Green Algae as biofertilizers in rice cultivation.

The Agricultural Section of the Seibersdorf Laboratory was assigned the task of conducting preliminary experiments confined to the Azolla-Anabeana association, with a view to develop suitable methodology for future experiments under the Coordinated Research Programme. Accordingly, investigations have been carried out under greenhouse conditions using N-15 labelled fertilizers, while field experiments are being carried out this growing season.

(e) Rock Phosphates

Natural Rock Phosphates are being increasingly used in the developing countries to replace manufactured phosphate fertilizer. New deposits of rock phosphates are being explored and processed in many countries of Asia, Africa, and Latin America.

Many trials carried out in the green house and the field showed that rock phosphates have the ability to supply phosphorus to plants, but the results obtained are quite variable and the quantity of available phosphorus is dependent on the type of plant and soil, the chemical composition, crystalography and the particle size of the particular rock phosphate etc.

Isotope techniques give a unique opportunity to study the efficiency of different kinds of fertilizers under different local conditions. Since it is not possible to label directly rock-phosphates with radioactive isotopes without changing their original characteristics, an indirect method was tested to evaluate the quality of these rock-phosphates as fertilizers. The treatments were set up to determine the uptake of nutrient from a labelled P source (for example, ^{32}P- labelled superphosphate) in the presence and absence of unlabelled rock phosphates.

Rock phosphate from several sources have been tested at the Seibersdorf Laboratory for P use efficiency under greenhouse conditions using the above methodology, with field experiments being carried out this summer.

(f) Fellowships

A number of fellowships are awarded each year to research workers from developing Member States, to receive specialized training in the use and applications of stable and radioactive isotopes in soil-plant research at IAEA's Seibersdorf Laboratory. This forms part of the regular Fellowships Programme of the Department of Technical Cooperation.

A Fellow usually begins the training as a participant at the Annual Interregional Training Course on the Use of Isotopes and Radiation Techniques in Studies of Soil-Plant Relationships in Seibersdorf. Continuation of the training is then 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.

In 1982, eight scientists successfully completed fellowship training at the Seibersdorf Laboratory.

This year Mr. K.S. Kumarasinghe, a fellow from Sri Lanka is carrying out N-15 studies of the water fern Azolla as a dinitrogen

fixer and also as a biofertilizer in rice cultivation and Ms. R. Afza, a fellow from Bangladesh, is working on fertilization and N_2 fixation of soybean by means of ^{15}N techniques.

REPORT ON THE FAO/IAEA INTERNATIONAL SYMPOSIUM ON ISOTOPE AND RADIATION TECHNIQUES IN SOIL PHYSICS AND IRRIGATION STUDIES, Aix-en-Provence, France, 18-22 April 1983.

This Symposium was jointly organized by FAO and IAEA to assess the recent advances, and to discuss the future trends of isotope and radiation techniques applied in soil physics and irrigation research. Agricultural production very much depends on the physical properties of the soil, mainly those related to the soil's water holding and transmission capacities. These properties affect the availability of water to crops and may therefore affect crop yields. Knowledge of soil physical properties is essential to define and/or to improve soil water management practices in order to achieve optimum productivity under each soil/climate condition.

The physical characterization of soil in the field, however, strongly depends on the spatial and temporal variability in the field. To successfully describe large agricultural fields from the physical point of view better ways have to be found to handle this variability. The Symposium exhaustively discussed this subject and indicated major future lines of research which should be followed. It was recognized that the use of the neutron moisture meter is extremely suitable for field conditions and that methods of scaling data and geostatistical analysis, when applied correctly to soils, will lead to a better understanding of the problem.

Papers focussed on the problems of irrigation water quality and crop production under saline and sodic conditions. A special advisory group has delineated areas of research in which appropriate isotope and radiation techniques can be applied successfully and with advantage over other techniques. It was recognized that salinity of soil and water is a great impediment to the development of agriculture in various countries, particularly, those in the semi-arid tropics. Salinity problem was seen as a complex hydrological, pedological, biological problem, the solution of which requires further multi-disciplinary research and applied field work.

Interesting results were shown on soil water studies and managment practices, indicating means to have crops use the available water and the added fertilizer more efficiently . These papers dealt with the use of ^{15}N as a tracer in fertilizer studies and the use of neutron probes in field water balances. Also new developments and improvements of relevant nuclear methodology were presented. These included soil water content and soil bulk density measurement devices, using either (i) two neutron sources, (ii) one gamma source and one neutron source , (iii) two gamma sources, and (iv) multigamma-neutron source systems. The symposium showed that progress has been made in the methodology to measure soil water contents with neutron moisture meters, but that much remains to be done to improve the equipment and the methodology.

The Symposium was hosted by the Government of France. Over 100 scientists participated, coming from Europe, Asia, Africa and North and South America.

REPORT ON THE ADVISORY GROUP MEETING ON NUCLEAR TECHNIQUES IN STUDIES OF THE EFFECT OF IRRIGATION WATER QUALITY AND CROP WATER REQUIREMENTS WITH SPECIFIC REFERENCE TO SALINE AND SALT AFFECTED SOILS, Aix-en-Provence, France, 18-22 April, 1983.

This Advisory Group Meeting was convened to examine the problems associated with the use of saline/sodic soils for agricltural production and to examine existing or potential methods available for reclaiming such soils. In addition, the group was to review the effect of poor quality irrigation water on soil physico-chemical as well as biological properties and how these would reflect on the productivity of land irrigated with such water, and make appropriate recommendations as to what management practices would be compatible with the use of poor quality water for irrigation. Nuclear aided techniques have played a key role in many studies related to soil moisture and soil nutrient uptake studies. One major task assigned to the Advisory Group was to recommend what role nuclear technqiues could play in studies designed to make adequate use of saline/sodic soils or poor quality water, and the role FAO and IAEA could play in realizing these goals. The recommendations of the meeting will be published together with the proceedings of the above mentioned Symposium.

The group consisted of specialists in the field of salt-affected soils, coming from Czechoslovakia, Egypt, France, India, Israel, Netherlands, Pakistan, Peru, U.S.A. and Venezuela.

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

The sixth annual Interregional Training Course hosted by the Seibersdorf Laboratory, Vienna, Austria, was held from 16 May to 1 July 1983. 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.

This year 20 trainees were selected from 80 scientists nominated by Member States of the FAO and IAEA..

REPORT ON THE INTERREGIONAL TRAINING COURSE ON THE USE OF N-15 IN SOIL SCIENCE AND PLANT NUTRITION, Leipzig, German Democratic Republic, 25 May to 22 June, 1983.

The Third Interregional Training Course hosted by the Zentralinstitut fur Isotopen und Strahlungforschung, Leipzig, German Democratic Republic, was held from 25 May to 17 June, 1983. The programme of the Training Course included 22 lectures on different aspects of using N-15 in soil studies and plant nutrition and practical studies (e.g. Mass-spectrometers; emission spectrometers; NOI-5, Izonitromat, NOI-6; preparing the samples for isotope ratio analysis; calculations involved in N-15 experiments).

Sixteen candidates from the following Member States participated in this Training Course: Bangladesh, Bolivia, Cuba, Cyprus, Ecuador, Egypt, India, Iraq, Malaysia, Mexico, Sudan, Tanzania, Thailand, Turkey, Uganda, and Zaire.

The participants of the Training Course also visited a number of scientific institutes and experimental stations dealing with relevant agricultural research.

COMING EVENTS

(a) Final RCM on N-Fixation

The Final Research Coordination Meeting of the FAO/IAEA/SIDA Coordinated Research Programme on Studies of Biological Dinitrogen Fixation for the Dual Purpose of Increasing Crop Production and Decreasing Nitrogen Fertilizer Use to Conserve the Environment, is scheduled for 22-28 August, 1983.

(b) Consultants Meeting on Mutation Breeding for Improved Nitrogen Fixation in Grain Legumes

The Plant Breeding and Genetics Section and the Soil Fertility, Irrigation and Crop Production Section are jointly planning to convene a consultants meeting on Mutation Breeding for Improved Nitrogen Fixation in Grain Legumes to be held at the Headquarters of the International Atomic Energy Agency, Vienna. The meeting is tentatively scheduled for 26-30 September, 1983.

The purpose of the meeting is to provide precise and reliable guidelines for plant breeders, particularly in developing countries, on the approach and methods to be used in selecting grain legume mutants with a better capability for supporting symbiotic nitrogen fixation.

(c) First RCM on Pasture Management

The First Research Coordination Meeting of the FAO/IAEA/IG Coordinated Research Progamme on Use of Nuclear Techniques in Improving Pasture Management, will be held in Vienna during November 1983. The week after the meeting will be devoted to a ^{15}N workshop, during which participants will be given lectures on concepts in the use of the N-15 methodology, interpretation of data, etc.

(d) Final RCM on Water and Fertilizer Efficiency Studies

The Final Research Coordination Meeting of the FAO/IAEA Research Coordination Meeting on Isotope and Radiation Techniques for Efficient Water and Fertilizer Use in Semi-Arid Regions, is planned to be held in Vienna during February 1984.

(e) Third RCM on Multiple Cropping

The Third Research Coordination Meeting of the FAO/IAEA Coordinated Research Progamme on Development of Fertilizer and Water

Management Practices for Multiple Cropping Systems, is planned to be held in Indonesia during March 1984,

(f) Advisory Group Meeting on Minimum Tillage

It is planned to hold an Advisory Group Meeting on Agricultural Nitrogen Residues, in Vienna during May, 1984.

STAFF DUTY TRAVEL

H. Broeshart was invited to attend the Symposium on "Nitrogen and Sugar Beet" at the International Institute for Sugar Beet Research, Brussels, Belgium (16-17 February 1983) and to report on the work done at the Seibersdorf Laboratory on the use of ^{15}N tracer techniques for the determination of active root distribution and nitrogen uptake by sugar beet and on soil nitrogen supply and the efficient use of nitrogen fertilizer by sugar beet in Austrian soils. He also lectured for the period of one week at the Leipzig Training Course,

K. Kalinin represented the FAO/IAEA at the opening session of the Training Course, in Leipzig, the Democratic Republic of Germany, 24-28 May, 1983.

S.K.A. Danso visited Technical Cooperation Projects in Senegal, the Ivory Coast and Ghana from 26 May to 22 June, 1983.

F. Zapata visited Technical Cooperation Projects in Uruguay and Colombia, at the beginning of March 1983.

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