



BNF BULLETIN

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Inoculant Production Capability in Haiti



Muriel Bouchareau and Harold Keyser.



Inoculant Specialist Joe Rourke prepares a shipment of essential materials to be sent to Haiti.



Muriel Bouchareau working in her commercial lab in Port-au-Prince.

In cooperation with the Agroforestry Outreach Project (AID-Haiti), the NifTAL Project is working with a private medical laboratory, Medicom, to establish the capability to produce rhizobial inoculum for tree legumes in Haiti. The inoculum will be purchased by CARE, PADF, and Operation Double Harvest nurseries in Haiti, whose production levels are approaching 10 million trees per year. There is also the potential to expand inoculum production to grain

legumes, since a marked response to inoculum application has been demonstrated on peanuts.

In July, Harold Keyser of NifTAL visited Haiti to conduct the initial assessment of Medicom facilities and capability. From this initial assessment, planning was done for equipment procurement and training. In September, Ms. Muriel Bouchareau, the microbiologist owner of Medicom, spent two weeks getting a crash course in inoculant production.

The final step was to send Joe Rourke, a NifTAL inoculant production specialist, to Port-au-Prince for installation and assembly of specialized equipment and to provide on-site training. The first batches of inoculant were produced in late November and the future looks bright for in-country availability of rhizobial inoculant and their subsequent use in the reforestation of Haiti.

Developing a National Legume Inoculation Program for Uganda

Through support by the Manpower for Agriculture Development Project (MFAD; Ohio State University-AID-Government of Uganda), NifTAL will develop and deliver legume inoculation technology to ensure that national programs to increase legume production are not limited by insufficient biological nitrogen fixation. Over a four-year period, the activities will include training, facilities development, and an applied research program.

During a visit to Uganda, NifTAL's scientist, Paul Singleton initiated the activity by performing an assessment of the need for BNF technology and the level of resources available to deliver the technology to farmers. Subsequently, in November, 1989, he offered a workshop for interested individuals from industry, research, private voluntary organizations, and government planning agencies to in-



Ugandans mining native peat, an important resource for inoculant production.

crease awareness of the benefits of BNF technology. Currently, through support by Ohio State University and Makerere University, NifTAL is helping to develop a pilot

scale inoculant production facility. This activity is related to the new PVO/Peace Corp/NifTAL Consortium (see page 8.).

BNF Fits BIFAD 1990 Projection

Biological nitrogen fixation technology transfer is an inherent part of sustainable agriculture and continuing agricultural development. This excerpt from *BIFAD Briefs* highlights several areas of emphasis by BIFAD which will be of interest to development workers promoting the use of BNF.

The Board for International Food and Agricultural Development (BIFAD) has issued its 1990's statement. The forward-looking statement forecasts a continuing Title XII emphasis on technical assistance projects in the less developed countries in Africa and elsewhere. For the advanced developing countries, it foresees the development of collegial and collaborative relationships between host country institutions and U.S. universities.

Keeping with the focus of the BIFAD Symposium, its progenitor, the report focuses on the three challenges: hunger and poverty, sustainable agriculture, and enhancing trade through development. Despite the progress made, hunger is still with us.

Achieving sustainable agriculture is characterized as a must for the 90's. Solutions to sustainable food production and food security were described as inextricably tied to the long-term enhancement of the natural resource base.

For the 1990's these major challenges are projected: 1) *Institutional development in Sub-Saharan Africa*. Major focus will be placed on strengthening the graduate programs of six-eight universities in developing sustainable environmental systems for food and fuel production; 2) *Professional growth of agricultural scientists in the develop-*

ing world. Communication and collaboration will be fostered among and between U.S. and developing world scientists; 3) *A world-wide focus on sustainable agriculture*. Intellectual leadership will be provided to the world scientific community in the development of sustainable agricultural technologies; 4) *A long-term, in-depth study of development programs*. More focus should be given to development programs, analyzing country situation as the basis for programs and evaluating impact upon the termination of programs; 5) *The use of communication media in technology transfer and extension systems*. Pioneer new approaches to technology transfer are necessary using the opportunities offered by the explosion of communications media; and 6) *Fuller utilization of modern research tools in solving development problems*. Encouraging the application of biotechnology is necessary to solve the problems of alleviating hunger and engendering economic growth.

Indonesian BNF Assessment

Paul Singleton recently conducted an assessment of BNF technology in Indonesia for the Government of Indonesia, USAID, and the Secondary Food Crops Development/Communication for Technology Transfer in Agriculture Projects. The assessment developed a projection of the expected benefit to farmers from inoculating their crops. In this context, constraints to delivery of the technology were evaluated. It was found that the potential supply of high quality inoculant was in excess of demand and that institutional capability to conduct research is adequate.

The relatively small use of inoculant by farmers was associated with the lack of understanding of the use and economic benefits of this technology by extension personnel and farmers. To address this weak link to further implementation of BNF technology in Indonesia, NifTAL proposed conducting a BNF Technology Training Course for Indonesian extension workers who are active in farmer training. The course will be held in Thailand in conjunction with NifTAL's BNF Resource Center (Bangkok). This proposal is under consideration by the Communication for Technology, Transfer in Agriculture/Secondary Food Crops Development Products (AID- Indonesia and the Government of Indonesia).

Early Announcement of NifTAL Training Course

NifTAL is planning to hold a course, "Modern Methods for the Study of Rhizobium." The course is tentatively scheduled to be held in June, 1991, in Bangkok, Thailand.

For information, write:

Training Coordinator, NifTAL Project, 1000 Holomua Avenue, Paia, Maui, HI 96779 USA.



Moawad Awarded Prize for BNF Work

Dr. Hasan Moawad, a grantee of the BOSTID Research program, received the 1988 State of Egypt prize in agriculture and biology for his contribution in the field of BNF. This prize is given every year to seven scientists whose works have contributed to agricultural development in Egypt. Nominations and application to the prize are open to researchers of all disciplines of agriculture and biology from all universities and research institutions of Egypt.

Hassan Moawad has also been presented the Award of Distinction for the National Research Centre of Egypt in recognition of his research work in soil microbiology. Moawad was an IDRC research fellow in Dr. E. L. Schmidt's laboratory in the Soil Science Department, University of Minnesota, in 1979-80. In 1980-81, he was also a research fellow in Dr. Ben Bohloul's laboratory in the Department of Microbiology, University of Hawaii.

He has been with the National Research Center of Egypt in Cairo since 1967 and has published widely on nitrogen transformations. He translated into Arabic four books in biology, biochemistry, and microbiology. Moawad, a BOSTID grantee since 1984, has been working in competitive relationships between indigenous and inoculant rhizobia nodulating soybean and lentil.

Performing MPN by Computer

The design of most probable number (MPN) experiments is restricted by the availability and completeness of tables for a particular dilution ratio and replicate number combination.

A newly-written computer program, The Most Probable Number Enumeration System (MPNES), generates solutions for the population estimate of MPN data for inoculation of legume hosts by rhizobia.

Tables generated by MPNES agree with existing tables, yet MPNES is able to generate other tables and discrete solutions for design combinations that have not been published.

MPNES can also be used to generate population estimates from fractional base dilution ratios that increase the accuracy of MPN estimates by decreasing the base dilution ratio, by increasing the number of replicates per dilution, or by correcting for constantly inaccurate diluent volumes.

The MPNES program also adjusts for inoculation volume and initial dilution ratios. In this way, MPN experiments can be designed to better measure the organism of interest rather than have the design dictated by existing published tables.

This computer program was developed by NifTAL graduate student Paul Woomer to meet the continuing need to generate MPN data.

By way of background, the algorithm was initially written in IBM Basic and was compiled with Micro-soft Basic Compiler. The program will run on IBM-Compatible micro-computers with one floppy disk. Memory requirements are small (less than 256K RAM).

Other formats may be accommodated on a case-by-case basis. MPNES programs are available from NifTAL at U.S. \$20.

For information on ordering, contact Information Section, NifTAL Project, 1000 Holomua Ave., Paia, HI 96779-9744.

DIRECTIONS IN COMMUNICATION

What's New in Today's Information Environment

Moving research findings from the laboratory and experimental plot to the farmer's field is part of a researcher's job. It's important that researchers take an active interest in communicating new findings as the old information environment rapidly changes.

People in both developed and developing countries are now faced with increasing volumes of data. This growth of information is not linear, but exponential. Farmers must sort out extraneous data to find the messages that are relevant to their own farming operation. Extension and research can select agricultural messages and reinterpret them for specific clients.

Today, these messages are being delivered by many more information sources than in the past. Industry, universities, technical schools, and other interests bombard farmers with competitive and contradictory messages that are not site specific. Researchers and extension personnel can translate general data into specific recommendations and options for local use.

Much information is from non-local sources. In the old days, most farm information came from sources known to the farmer. Today, farmers are exposed to a large number of non-local sources including federal government organizations and regional, state, county, and district groups. Natural resource interests, environmental groups, health interests, as well as consumer groups, all give advice and consult-

ation to the farmer, as do international groups and trading partners.

Changes in the information environment are combining to involve agricultural researchers in the dissemination of information. In conjunction with extension agencies, researchers must take responsibility for selecting, designing and interpreting messages.

The generation of knowledge suggests it be shared. Sharing is a communication activity and through communication, researchers have the opportunity to extend their knowledge to farmers in manageable, credible, and timely ways.

James King

University of Nebraska

NEW PUBLICATIONS

Gliricida Topic of 2 Books

Released from NFTA is the **Gliricidia Production and Use Field Manual**. It is a practical manual for extension specialist and rural development workers in Third World countries throughout the tropics. Guidelines and experiences from around the world are presented on the uses and management of this species. The 44-page manual consists of nine chapters, selected readings, a list of researchers working with *gliricidia*, and seed sources. The nine chapters are well illustrated with pictures and drawings. The cost is \$US 5 to NFTA associates and \$6 to non-associates, add \$4 for air mail service; there are also bulk order rates. Send orders to NFTA, P. O. Box 680, Waimanalo, HI 96795 USA.

Also available from NFTA is **Gliricidia Sepium (Jacq.) Walp: Management and Improvement the Proceedings of a Workshop, June 21-27, 1987, Turrialba, Costa Rica**. This 225-page report presented the most

recent research on *gliricidia* with an extensive bibliography. Recommended research priorities brought forth during the workshop are included along with a summary on the state-of-the-art knowledge on this species. Copies are \$US 8 for NFTA associates and \$10 for non-associates, add \$6 for air mail service.

Tropical SOM Book Released

Dynamics of Soil Organic Matter in Tropical Ecosystems, state-of-the-art on this topic, has been released by University of Hawaii Press. It is the result of a unique interactive process which brought together approximately fifty expert authors and reviewers. The project was funded by National Science Foundation Ecology Program with support from USAID and NIFTAL and IBSNAT at the University of Hawaii, in collaboration with the University of Georgia, Institute of Ecology. Editors are David C. Coleman, J. Malcolm Oades, and Goro Uehara. Copies of the 300-page book are available for \$30 plus

\$2 for shipping and handling from UH Press, Order Department, 2840 Kolowalu Street, Honolulu, HI 96822 USA. Developing country persons may be eligible for a significant discount of 50%. Persons who believe they are in this category should order directly from the NIFTAL Information Section.

Dynamics of Soil Organic Matter in Tropical Ecosystems



Edited by
David C. Coleman J. Malcolm Oades Goro Uehara

11th Trifolium Conference

This conference, held every two years, provides a forum for clover and special purpose legume researchers to exchange information and discuss common problems and goals. The venue is Silver Falls Conference Center, Sublimity, OR, July 9-11 1990. The program includes paper and poster sessions, a work session on seed production, tour of seed research and production in the Willamette Valley, and an overview of forage legume research in Oregon.

For information and to receive the second announcement contact Dr. Jeffery J. Steiner, USDA-ARS, National Forage Seed Production Center, Oregon State University, Corvallis, OR 97330 USA, telephone 503 757-4375.

2nd International Food Legume Research Conference

This meeting which will be held from April 28 to May 2, 1991, will focus on Pea, lentil, faba bean, chick-pea, and grass pea. The latter was recently added to the list of species covered in the meeting. Objectives of the gathering are to review and assess recent results from national and international research programs on cool season food legumes and to develop strategies for increasing production per unit area and increasing use of these cool season food legumes in various cropping systems. Both basic and applied research will be addressed and multidisciplinary research efforts emphasized.

To be included in the mailing list for the second announcement, send your name and title, address, phone

and/or fax number, and mail to Dr. A. E. Slinkard, IFLRC-II, Crop Development Centre, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0 CANADA, telephone (306) 966-4978, telefax (306) 343-1025.

Nepal Biotechnology Association Hosts Meeting

The role of genetic engineering and biotechnology in agriculture and health will be the subject of the International Conference on Genetic Engineering and Biotechnology planned for September 9-13, 1990, in Kathmandu, Nepal. The first circular notes: "For a country like Nepal whose economy depends primarily upon agriculture and forest products, application of biotechnology is the only means for development." The meeting objective is to create awareness about genetic engineering and technology and provide Nepalese scientists the opportunity to interact with scientists working in various areas of technology.

Those interested in attending the meeting, being speakers, or presenting posters should contact the Secretary General, ICGEB Conference Organizing Committee, Nepal Biotechnology Association, P. O. Box 2128, Kathmandu, Nepal; telephone: 977-1-522-900, telex: 2492 MURARKA NP, cable: RLABB, Kathmandu.



Meeting Set for '91

Co-chairman Chris van Kessel announces that plans are set for the 13th North American Rhizobium Conference (now referred to as Symbiotic Nitrogen Fixation meeting). It will be held in Banff, Canada, from August 25-30, 1991. Expect further details and meeting announcements by mid-1990.

Biotechnology Course Offered

From 3 September to 17 October 1990 GBF (Gesellschaft für Biotechnologische Forschung mbH Braunschweig) will hold its fourth course, "Introduction to Industrial Biotechnology." The course is designed for individuals from developing countries with a strong scientific background, especially in general microbiology and biochemistry, but who lack practical experience in biotechnological processes, such as fermentation technology. Emphasis will be given to selecting applicants from a wide geographic distribution. Fluency in English, including speaking, writing and understanding, is absolutely necessary. There are no course fees, but applications are encouraged to seek funding for travel and subsistence costs. No candidate should be discouraged from applying on financial grounds. To receive an application, write to International Training Programme Office, GBF, Mascheroder Weg 1, D-3300 Braunschweig, Federal Republic of Germany; telephone: (0531) 61 81 - 172; telex: 9 526 67 gebio d; telefax (0513) 61 81 515.

In Memorium: Joe Burton

Yes: I knew Dr. Burton since July 1960 when I joined the Lab of Late Prof. D. N. Allen for my M.Sc. and Ph.D. studies which lasted five years. Now and then I had a meeting with Dr. Burton for discussion of my results and consultation for future work.

In 1970, I visited Dr. Burton in his laboratory in Nitragin Company when I was awarded the Andre Mayer FAO fellowship. I had the pleasure to meet Dr. Burton in different meetings in various parts of the world. In 1982-83, Dr. Burton, visited my country (Egypt) and wrote, in association with Dr. Lloyd Frederick, an analysis of the state of art of rhizobiology, a document which is very useful for me and my colleagues. The last time we met was during the meeting on "Cool Season Legumes" in August 1986 in Spokane. Dr. Burton was a sincere friend and a colleague and I will always remember him. My deep condolences to Mrs. Burton and family, and may God bless them all.

This letter was received from Dr. Yousef Ali Hamdi.

Janez Hacin

A researcher from the University of Ljubljana, Ljubljana, Yugoslavia, Janez Hacin is spending a year working at NifTAL Headquarters as a visiting scientist. He is primarily working with Ben Bohlool and doing some interesting work on elucidation of possible mechanisms involved in host control of nodulation in soybeans.

Hacin is a research fellow supported by the OECD (Organization for Economic Co-operation and Development) in their Co-operative Research Project on Food Production and Preservation Program. It is expected that he will continue the BNF research along with teaching at the Department of Microbiology at his home university when he returns to Yugoslavia in late 1990.



Purifying antisera by dialysis.



Course participants inspecting interior of a steel fermentor.

Genetics New Topic
Continued from page 8

Bangkok. It was organized by NifTAL in collaboration with the Thai Department of Agriculture, The BNF Resource Center, and the University of Hawaii Biotechnology Program.

Course participants were: Drs. P. Lodha and Palaniappan from India; Dr. N. Inciong and Mr. C. Cali from the Philippines; Mr. O. Cosenza from Honduras; Ms. K. Moors from Belgium; Ms. Nbt. Ab. Rahim from Malaysia; Ms. C. Ruraduma from Burundi; Mr. S. Setradi from Indonesia; Mr. S. Sivakumaran from Sri Lanka; Mr. X. Zang from China; and Dr. S. Suthipradit, Mrs. K. Tangcham and Mr. Worawich Rungrattankasin from Thailand. Instructors were: Dr. N. Boonkerd, local organizer and Director of NifTAL's BNF Resource Center;

Dr. P. Somasegaran, course director and NifTAL microbiologist; and Mr. H. J. Hoben, international organizer and NifTAL training coordinator.

Most participants were fully supported through outside sources ranging from local USAID missions and home institutions to UNESCO funds. NifTAL and the University of Hawaii Biotechnology program subsidized tuition costs for some participants.

The course was judged by participants to be well worth the effort of working more than eight hours each day. The course contents were based on a well tested outline along with adjustments in content made to meet the particular needs and interests of participants. NifTAL expects to announce its next course in early 1990.



N-FIXING TREE NOTES



Priority Tree Legumes

With much international activity in the area of multipurpose tree planting, it is deemed necessary to re-evaluate NifTAL's list of priority species in order to reflect current emphasis. From reviewing current literature, and from discussions with staff of NFTA (Nitrogen Fixing Tree Association) and F/FRED (Forestry and Fuelwood Research and Development), the following priority list was established:

Acacia mangium
Acacia auriculiformis
Gliricidia sepium
Calliandra calothyrsus
Sesbania sesban
Sesbania grandiflora
Leucaena leucocephala
Leucaena diversifolia
Albizia lebbbeck
Paraserianthus falcataria
Acacia mearnsii
Cajanus cajan (perennial habit types)
Dalbergia sissoo
Flemingia macrophylla

Faidherbia albida

Acacia nilotica

Prosopis cineraria

Prosopis juliflora

Continued efforts in selecting rhizobia that are effective, competitive, saprophytically competent and compatible with several host species will be directed toward the species on this list.

Why Nitrogen Fixing Trees?

Nitrogen fixing plants are key constituents in many natural ecosystems. They are the major source of all nitrogen that enters the nitrogen cycle in these ecosystems. Many nitrogen fixing plants are woody perennials, or nitrogen fixing trees, most of these being found in the tropics. In temperate areas, the nitrogen fixers tend to be herbaceous.

NFTs have been removed or reduced in most man-made ecosystems, such as agricultural and forest lands and urban environments. These lands require expensive chemical fertilizer inputs in order to maintain their productivity. Man-

made systems can be improved by learning and adopting from natural ecosystems. For example, the reintroduction of NFTs, with appropriate management, can increase and sustain productivity. Agroforestry land-use practices do this.

The above text introduces a release from NFTA which is in its series "NFT Highlights." Interested persons can request a copy of this short paper and a list of other available "Highlights" from NFTA, P. O. Box 680, Waimanalo, HI 96795 USA.

NifTAL & NFTA Teaming Up

NifTAL is supplying peat based legume inoculant for NFTA's Cooperative Planting Program. In this program, approximately 3100 seed packets per year are sent throughout the world for field trials. Having the appropriate rhizobia for the specific legume trees will insure adequate nitrogen nutrition during the early growth of the trees. Small packets (16 g) of peat inoculum are provided semi-annually. Currently, there are 50 legume species in the NFTA Cooperative Planting Program.

Short Takes

Two Thai scientists, Benjavan Rerkasem and Amporn Bhromsiri, a former NifTAL trainee, of the Faculty of Agriculture, University of Chiang Mai, Thailand, are involved in a research project with ACIAR (Australian Centre for International Agricultural Research). Their project on food legumes is part of ACIAR's Project 8800 - Measurement of Nitrogen Fixation in Legume Production System.

Consortium

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specific techniques as the means to reach the goals.

In its first year, the project focuses on five countries, Uganda, Haiti, Nepal, Senegal and Indonesia. PVOs and NGOs in those countries—in cooperation with the BNF/LM project staff—are at the moment assessing the resources and needs and designing an action plan. This plan can range from the development of extension materials to applied research or setting up collaboration between organizations.

In Haiti, for instance, NifTAL has helped a private enterprise set up a rhizobial inoculant production unit. The unit has a capacity great enough to be able to provide rhizobia to all Haiti's potential users. In March a conference on the principles and opportunities of BNF was held for all Haiti's potential users. This conference was offered to all interested agencies active in agriculture in Haiti. A future strategy for the project was determined during the conference.

A CONSORTIUM FOR BNF-EXTENSION

In November 1989 a unique step was taken to join technical expertise acquired over years of research with well-established local agricultural outreach systems. NifTAL, Agricultural Cooperatives Development International, Africare, CARE International, Pan American Development Foundation, Save the Children, Winrock International, World Vision International and Peace Corps united efforts and started the Biological Nitrogen Fixation and Legume Management (BNF/LM) Outreach Project.

The project aims at increasing and improving the knowledge and use of nitrogen fixing plants and their compatible inoculants by small-holders in tropical countries. BNF can provide small farmers with a cheap alternative for fertilizers and higher protein food. Currently, small farmers hardly use inoculation techniques. The project will use awareness building, training, organization and introduction of

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Genetics New Topic at Course

NifTAL's most recent training course—held in Thailand during November—included exercises on genetics. This addition emphasizes NifTAL's continuing efforts to keep abreast of an increasingly promising area of rhizobiology. Other areas of emphasis were inoculant production and strain identification techniques. The trainees learned by doing with hands-on exercises used to maximize practical experience. Twenty-six lectures were presented to support the course exercises. Seminars highlighted the applications of techniques and encouraged discussions to enhance greater understanding of experimental approaches.

The course entitled "Modern Methods For the Study of Rhizobium" was held at the Rhizobium Building of the Thai Department of Agriculture in

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PVO/Peace Corp/NifTAL Consortium: A Reality



From left: Eugene Chiavaroli, Deputy Assistant Administrator for S&T, USAID; Ms. Phyllis Dobyns (at podium), Senior Vice President for Save-The-Children; Noel P. Kefford, Dean, CTAHR, University of Hawaii; Sarah Ford, Peace Corp; Ambassador Mark Edelman, Acting Administrator, USAID; Senator Daniel Inouye, Hawaii.

A commemorative agreement was signed at the State Department in Washington, D.C., between key persons from the organizations which are members of the consor-

tium to further BNF use in sustainable agriculture for developing country farmers. The consortium is a landmark cooperation between these diverse groups.

SERVICES FROM NifTAL

OUTREACH

- Rhizobial germplasm
- Research quality inoculants
- Custom antisera
- Distribution of symbiotic plasmids and cloned genes
- Detailed field trial design for inoculation response studies
- Long-term rhizobia repository
- Methods for rapid, low cost screening of rhizobia for soil stress tolerance

TRAINING

- Basic 6-week courses
- Specialized extension and inoculant production courses
- Graduate degree support
- Short courses on genetic technologies, serology, and commercial inoculant production
- Training materials (manuals, slides, etc.)
- Visiting scientist's program

RESEARCH

- National research program design assistance
- Technical backstopping to support developing country entrepreneurs
- Documents and information on BNF and tropical legumes
- Technical assistance on inoculant production systems
- Advisory services on inoculant manufacture, distribution, and quality control

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For information on the NifTAL Project and to request services, contact NifTAL Project Director, NifTAL Project, 1000 Holomua Rd., Paia, Hawaii 96779-9744. Submission to the BNF BULLETIN may be sent: Attention: Communication Section.

The views and interpretations in this publication are those of the author(s) and/or the editor and should not be attributed to the Agency for International Development or to any individuals acting on its behalf.

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