

Biological Nitrogen Fixation and Sustainability of Tropical Agriculture

K. Mulongoy, M. Gueye and D.S.C. Spencer

EDITORS



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Proceedings of the Fourth International Conference
of the African Association for Biological Nitrogen Fixation (AABNF),
held at the International Institute of Tropical Agriculture (IITA),
Ibadan, Nigeria, 24-28 September 1990

Edited by

K. Mulongoy, M. Gueye and D.S.C. Spencer

JOHN WILEY & SONS

Chichester - New York - Brisbane - Toronto - Singapore

A Co-Publication with Sayce Publishing (United Kingdom), and IITA and AABNF (Nigeria)

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Baffins Lane, Chichester
West Sussex PO19 1UD, United Kingdom

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John Wiley & Sons, Inc., 605 Third Avenue,
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Jacaranda Wiley Ltd., G.P.O. Box 859, Brisbane,
Queensland 4001, Australia

John Wiley & Sons (Canada) Ltd., 22 Worcester Road,
Rexdale, Ontario M9W 1L1, Canada

John Wiley & Sons (SEA) Pte Ltd., 37 Jalan Pemimpin 05-04,
Block B, Union Industrial Building, Singapore 2057

Co-Publishers

Sayce Publishing, Exwick Mill,
St Andrews Road, Exeter EX4 2AF, United Kingdom

International Institute of Tropical Agriculture (IITA)
Oyo Road, PMB 5320, Ibadan, Nigeria

African Association for Biological Nitrogen Fixation (AABNF)
c/o IITA, Oyo Road, PMB 5320, Ibadan, Nigeria

A catalogue record for this book is available from the British Library

ISBN 0 471 93560 3

Printed by Ebenezer Baylis, The Trinity Press, United Kingdom

Dedicated to our wives Tina Mulongoy, Fatou Gueye and Joyce Spencer

*and all the small farmers of Africa who have continued to feed us
under increasingly difficult circumstances*

Contents

Preface		xi
Foreword		xiii
INTRODUCTION		1
Biological nitrogen fixation in tropical agrosystems: Twenty years of biological nitrogen fixation research in Africa <i>S.K.A. Danso</i>		3
Sustainable agriculture: Definition and measurement <i>D.S.C. Spencer and M.J. Swift</i>		15
Part 1	NITROGEN-FIXING SYSTEMS	25
1.1	Biological nitrogen fixation systems in tropical ecosystems: An overview <i>G.H. Elkan</i>	27
1.2	A protocol for screening legumes as soil-improving crops <i>M. Sarrantonio</i>	41
1.3	The sustenance of tropical agriculture with multipurpose <i>Azolla</i> <i>N. Esiobu and C. Van Hove</i>	49
1.4	Facteurs pédoclimatiques limitant la fixation biologique de l'azote chez les légumineuses <i>M. Obaton</i>	57
1.5	Response of some tropical nitrogen-fixing woody legumes to drought and inoculation with mycorrhiza <i>O.O. Awotoye, M.O. Atayese, O. Osonubi, K. Mulongoy and D.U.U. Okali</i>	67
1.6	Improvement of the <i>Phaseolus/Rhizobium</i> symbiosis, with particular reference to the Caribbean region <i>E.C. Schröder</i>	79
1.7	Effect of pest management systems on biological nitrogen fixation <i>J.M.F. Roberts</i>	97

1.8	Effect of <i>Rhizobium</i> inoculation and phosphorus on growth and nitrogen fixation in tree legumes grown on highland Vertisols <i>N. Luyindula and I. Haque</i>	109
1.9	Management of soil microbial populations to optimize tree establishment and growth, with particular reference to nitrogen-fixing bacteria <i>Y.R. Dommergues</i>	113
1.10	Agronomic evaluation of a rock phosphate as a phosphorus source for <i>Leucaena leucocephala</i> grown on an Ultisol <i>A.O. Osunde, F. Zapata and N. Sanginga</i>	133
1.11	Early growth and symbiotic properties of three woody legumes grown on a sandy soil in south-western Nigeria <i>K. Mulongoy and B.T. Owoaje</i>	139
1.12	Response of soybean to inoculation with <i>Bradyrhizobium japonicum</i> in the northern Guinea savanna of Nigeria <i>O.O. Olufajo and J.K. Adu</i>	147
1.13	Nodulation of soybean grown under field conditions and inoculated with <i>Bradyrhizobium japonicum</i> strains <i>S. Asanuma</i>	155
1.14	Effect of fertilization and <i>Rhizobium</i> inoculation on the growth of <i>Leucaena</i> and <i>Gliricidia</i> on an Alfisol in south-western Nigeria <i>J. Cobbina, K. Mulongoy and A.N. Atta-Krah</i>	161
1.15	Early growth and nodulation in <i>Leucaena</i> and <i>Gliricidia</i> and the effects of pruning on biomass productivity <i>I.V. Ezenwa and A.N. Atta-Krah</i>	171
1.16	Comparative study on the growth and productivity of <i>Sesbania</i> and <i>Leucaena</i> in the Central Plateau region, Rwanda <i>C.F. Yamoah, V.J. Eylands and E. Akyeampong</i>	179
Part 2	BIOTECHNOLOGY AND MODELLING IN NITROGEN FIXATION	187
2.1	Supernodulation and non-nodulation mutants of soybean <i>P.M. Gresshoff</i>	189
2.2	Croissance des racines adventives de <i>Sesbania rostrata</i> : Application à la multiplication végétative de la plante <i>I. Cissé, M.M. Spencer-Barreto et E. Duhoux</i>	199
2.3	Genetically improved rhizobia and their use in agriculture <i>L.D. Kuykendall, M. Hahn, H. Hennecke and W.J. Hunter</i>	211

2.4	Adaptation of more efficient soybean and cowpea rhizobia to replace established populations <i>M.C.P. Neves, M.L.G. Ramos, A.F. Martinazzo, G.R. Botelho and J. Döbereiner</i>	219
2.5	Predicting the persistence of introduced <i>Bradyrhizobium japonicum</i> in tropical soils <i>P. Wooster, W. Asano and B.B. Bohlool</i>	235
2.6	Useful models to predict response to legume inoculation <i>P. Singleton, J. Thies and B.B. Bohlool</i>	245
Part 3	MEASUREMENT AND SOCIOECONOMIC IMPACT OF NITROGEN FIXATION	257
3.1	Estimation of biological nitrogen fixation by three legume tree species using the ¹⁵ N dilution method <i>D.D. Baker, R.A. Wheeler and M. Fried</i>	259
3.2	Estimating nitrogen fixation in <i>Leucaena</i> and <i>Gliricidia</i> using different ¹⁵ N labelling methods <i>N. Sanginga, F. Zapata, S.K.A. Danso and G.D. Bowen</i>	265
3.3	Measuring nitrogen fixed by groundnut varieties in Senegal using ¹⁵ N techniques <i>A. Badiane Niane and F. Gueye</i>	277
3.4	Effect of <i>Rhizobium</i> and <i>Rhizobium/Glomus</i> inoculation on nitrogen fixation in bambara groundnut <i>M. Gueye</i>	283
3.5	Selection of soybean cultivars for a mixed cropping system in Nigeria using the ¹⁵ N dilution technique <i>G.U. Okereke and A.R.J. Eaglesham</i>	289
3.6	Measuring inputs from nitrogen fixation in multiple cropping systems <i>K.E. Giller</i>	297
3.7	Estimation of symbiotically fixed nitrogen using extended N difference methods <i>S. Hauser</i>	309
3.8	The economics of using legumes in cropping systems <i>J.R. Allison</i>	323
3.9	An exploratory survey of soybean production in Ayeye, Nigeria <i>M.A. Baten, A.A. Agboola and H.J.W. Mutsaers</i>	333
3.10	Inoculation des légumineuses en milieu tropical: Recherche, développement et aspects économiques <i>H. Saint Macary, P. Beunard, J.A. Scaglia, A. Hakizimana et J. Pandzou</i>	343

Part 4	SUSTAINABILITY OF NITROGEN-FIXING CROPPING SYSTEMS	351
4.1	Nodulation and nitrogen fixation and transfer in a cowpea/rice cropping system <i>G.U. Okereke and N. Ayama</i>	353
4.2	The role of legumes in sustaining soil productivity and controlling soil erosion <i>G.W. Langdale, R.L. Clark and R.R. Bruce</i>	361
4.3	Nitrogen contribution of woody legumes in alley cropping systems <i>B.T. Kang and K. Mulongoy</i>	367
4.4	L'azote dans les systèmes de culture du nord et du centre de la Côte d'Ivoire <i>J.J. Gigou</i>	377
4.5	Fitting soil-improving legumes into inland valley rice-based cropping systems in West Africa <i>R.J. Carsky and E.O. Ajayi</i>	395
4.6	Five years of research on improved fallow in the semi-arid highlands of Rwanda <i>V. Balasubramanian and L. Sekayange</i>	405
4.7	Use of legume biological nitrogen fixation in crop/livestock production systems <i>I. Haque</i>	423
4.8	Rôle de la fixation de l'azote par l'arachide dans l'amélioration durable de la fertilité azotée d'un sol sableux tropical par l'amendement calcique et organique <i>F. Ganry</i>	439
4.9	Utilisation de <i>Sesbania rostrata</i> et <i>Crotalaria juncea</i> comme engrais verts sur le maïs <i>J. Pandzou et P. Beunard</i>	451
4.10	Herbage yield and soil fertility restoration potential of some tropical forage legumes <i>J. Cobbina</i>	455
4.11	Effect of fallow and residue management practices on biomass production, weed suppression and soil productivity <i>K.A.B. Ngumbo and V. Balasubramanian</i>	463
	Conference Summary and Recommendations	475
	Authors and Conference Participants	478
	Acronyms	487

Preface

The African Association for Biological Nitrogen Fixation (AABNF) was founded in 1982 with the support of the International Institute of Tropical Agriculture (IITA) at Ibadan, Nigeria, as part of the IITA/United Nations Development Programme (UNDP) project GLO/77/013 on 'Maximising nitrogen fixation by cowpeas and soybeans in farming systems in the humid tropics'. The AABNF is a multidisciplinary group, bringing together soil scientists, microbiologists, agronomists, climatologists, social scientists, breeders, plant physiologists, biotechnologists, nutritionists, policymakers and others interested in the promotion of biological nitrogen fixation systems in Africa.

Biological nitrogen fixation is the process through which microorganisms living in the soil or in symbiosis with plants tap atmospheric nitrogen. The AABNF promotes research, training and the use of biological nitrogen fixation systems to increase food production and alleviate malnutrition in Africa, with the objective of reducing the need for purchased nitrogen fertilizer inputs. It organizes regular conferences to share experiences and information, to evaluate what has been done and to plan the efficient exploitation of biological nitrogen fixation systems in Africa.

The first AABNF meeting was organized by the Microbiological Resources Center (MIRCEN) at Nairobi, Kenya in July 1984. The theme of the conference was 'Biological nitrogen fixation in Africa'. The second conference was organized by the Cairo MIRCEN, Egypt in 1986 on 'The role of biological nitrogen fixation for the development of rural Africa'. The third conference took place in Dakar, Senegal in November 1988. It was organized by the West Africa MIRCEN with the theme 'Maximising biological nitrogen fixation for agricultural production and agroforestry in Africa'. These conferences essentially described the state of biological nitrogen fixation research in Africa; little attention was given to the practical applications and socioeconomic implications of nitrogen-fixing systems.

For the past 20 years IITA has conducted research to improve and maintain soil fertility through alternatives to shifting cultivation and related bush fallow systems. Biological nitrogen fixation through the use of grain legumes, leguminous cover crops and woody legumes has always been an integral component of improved technologies for the African small-scale farmer. It was particularly appropriate, therefore, that the fourth AABNF conference should be held at IITA on the role of nitrogen-fixing systems in alleviating malnutrition and ensuring economically and ecologically viable and sustainable agriculture.

The conference was attended by over 100 participants from 25 countries — 21% from IITA, 29% from Nigeria excluding IITA, 27% from Africa excluding Nigeria and 23% from other continents. Fifteen percent of the

participants were women. Forty papers were presented orally and 30 posters displayed. Mr J.H. Davis delivered the welcome address on behalf of the Director General of IITA. The conference was declared open by Dr O.A. Adegbaro, Acting Director of the Agricultural Sciences Department, on behalf of the Hon. Minister of Science and Technology, Federal Government of Nigeria.

The papers reproduced in this book have been selected and reviewed independently, after their presentation at the conference. They cover a wide range of subjects, including the identification and management of factors limiting biological nitrogen fixation using conventional methods; biotechnology and modelling; measurement and socioeconomic impact of nitrogen-fixing systems; and the implications of these systems for agricultural sustainability.

The AABNF gratefully acknowledges the financial assistance of the following organizations, without which the conference could not have taken place:

- Bank of Credit and Commerce, Chartered Bank Ltd. and Rank Xerox (Nigeria) Ltd. in Nigeria;
- International Cooperation Program (ICP) and Resource and Crop Management Program (RCMP) at IITA, Ibadan, Nigeria;
- United Nations Educational, Scientific and Cultural Organization (UNESCO), Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Institut de Recherches Agronomiques Tropicales (IRAT) and the Ministère Français de la Coopération in France;
- Technical Centre for Agricultural and Rural Cooperation (CTA) in The Netherlands.

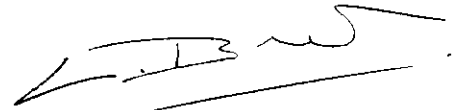
We are grateful to the following organizations for having sponsored scientists to attend the conference: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Germany; International Atomic Energy Agency (IAEA), Austria; International Development Research Centre (IDRC), Senegal; International Fertilizer Development Corporation (IFDC), Togo; International Foundation for Science (IFS), Sweden; International Livestock Centre for Africa (ILCA), Ethiopia; Institut National de Recherches Agronomiques (INRA), France; National Research Council, Brazil; Nitrogen Fixation by Tropical Agricultural Legumes (NifTAL), USA; Rodale International, Senegal; UNESCO/ROSTA, Kenya; United States Agency for International Development (USAID); United States Department of Agriculture (USDA); and the West Africa Rice Development Association (WARDA), Côte d'Ivoire.

We also wish to thank all the participants and the members of the Organizing Committee, including IITA publications personnel, for their dedication and enthusiasm, and Dr K. Fischer, IITA Deputy Director General for Research, for his support in publishing this book.

K. Mulongoy, M. Gueye and D.S.C. Spencer

exploit. Soybean is a unique source of protein and oil. High-yielding soybean cultivars bred in North America require inoculation with the appropriate rhizobia when grown in soils in which soybeans have not previously been cultivated. The breeding programme at IITA has developed cultivars with adequate seed longevity which can nodulate with indigenous rhizobia to fix atmospheric nitrogen.

In recognition of the importance of legumes, the African Association for Biological Nitrogen Fixation (AABNF) was founded in 1982 under the auspices of IITA and the United Nations Development Programme (UNDP). It was timely that the fourth AABNF conference took place at IITA when the contribution of research to sustainable agriculture is being emphasized. The ideas and recommendations discussed at the conference were aimed at improving the well-being of the African farmer. They thus merit close attention from scientists, policymakers and donors.



Lukas Brader
Director General, IITA