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Editorial

Recent Advances in Biological Nitrogen Fixation

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Nitrogen is essential for the growth and functioning of all living organisms; however, only 2% of Earth's nitrogen is available for them [1]. It can mostly be found in the atmosphere as N_2, which can be assimilated only by a small group of microorganisms called diazotrophs, which are able to reduce dinitrogen into NH_3 [2]. This process, referred to as biological nitrogen fixation, is most effective in symbiotic systems formed between soil saprophytic bacteria called rhizobia and legume plants, and can provide considerable amounts of reduced nitrogen for agricultural systems and uncultivated areas [3]. New discoveries and concepts related to biological nitrogen fixation often result in useful improvements in agronomy; therefore, new ideas focusing on enhancing or broadening its application still need to be developed.

The papers in this Special Issue include a review and original research articles covering different aspects of biological nitrogen fixation and organisms associated with this phenomenon. In their extensive review, Santos et al. [4] focused on the demand for environmentally friendly technologies based on microorganisms and their plant hosts that can be used instead of chemical fertilizers and pesticides. In this paper, (a) standards for inoculant production, (b) ways to deliver inoculants to the crop, (c) compatibility between inoculants and pesticides, and (d) detrimental effects of pesticides on inoculants were thoroughly discussed. Maitra et al. [5] proposed new nontoxic polymers that considerably enhance bacterial survival ability, which can be used in preparation of rhizobial liquid inoculants. This might be an interesting finding, since improvement of inoculant formulas are still needed to ensure longer storage with high viability of cells and better competitive properties of strains introduced as biofertilizers. Siczek et al. [6] and Helios [7] described solutions related to sustainable agriculture based on legume–rhizobia symbiotic systems. One of these studies focused on the dynamics of bacterial and fungal communities studied after enrichment of soil with different crop residues in a field trial, and showed that application of legumes as a forecrop not only increased the soil nutrient pool but also had a strong impact on fungal community, acting against phytopathogens, which may result in lower fungicide requirements in the following growing seasons [6]. The second paper presented the use of white clover as undersowing for basket willow (*Salix viminalis* L.), which resulted in reduced weed infestation of young plantations of willow, thus lowering the need for herbicide treatment [7]. As the growth of willow undersown with clover was comparable with plants fertilized with nitrogen, this practice can be assumed as a good alternative for mineral N fertilization of short-rotation woody crops. Radzka et al. [8] focused on maximization of profits of biological nitrogen fixation by plants and described how different sowing densities of soybean could affect the amount of nitrogen obtained from symbiotic reduction of atmospheric N_2. Smytkiewicz et al. [9] described the effect of rhizobial metabolites called chitolipooligosaccharides on the growth, development, and yielding of peas, and demonstrated that such a preparation could be an efficient growth stimulator for legumes. Finally, Marzec-Grządziel et al. [10] described a symbiotic system emerging between ruddy clover (*Trifolium ruberis* L.), an endemic species which is considered endangered in European countries) and their microsymbionts, and showed the perspective for development of an inoculant formulation for this valuable nectariferous plant.

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Recent Advances In Biological Nitrogen Fixation

Surajit de Mandal,Pankaj Bhatt

Recent Advances In Biological Nitrogen Fixation:

Recent Advances in Biological Nitrogen Fixation N. S. Subba Rao,1980 Recent Advances in Biological Nitrogen Fixation Nanjappa Shamanna Subba Rao,1980 Current Developments in Biological Nitrogen Fixation N. S. Subba Rao,1984 This volume discusses the most recent advances in biological nitrogen fixation with chapters written by experts on the ecology physiology biochemistry and genetics of biological nitrogen fixation *The Nitrogen Fixation and its Research in China* Guo-Fan Hong,2013-03-09 Nitrogen Fixation by symbiotic organisms is considered an important contribution to the solution of food problems throughout the world For manyyears Chinese scientists have focused their research in this area Today more than half of the total nitrogen fertilizers applied are from biological fixation sources The editor is an international renowned scientist at the Chinese Academy of sciences He has brought together contributions from various research fields in China and Europe Together they present the state of the art in nitrogen fixation research The studies range from actino mycete fixation induced in various genera andspecies of plants mechanisms and chemical modeling of enzyme systems togenetical engineering of organisms Recent Advances in Ecobiological Research M. P. Sinha,1997 Contributed articles with reference to India commemoration volume for Prof P N Mehrotra **Management of Biological Nitrogen Fixation for the Development of More Productive and Sustainable Agricultural Systems** J.K. Ladha,M.B. Peoples,1995-09-30 Reprinted from Plant and Soil v 174 nos 1 2 1995 this volume is devoted to discussions on the role of biological nitrogen fixation BNF in agricultural sustainability Papers presented on BNF in crop forage and tree legumes are augmented with discussion of integrated farming systems involving BNF soil and N management and recycling of legume residues BNF by non legumes is discussed and attempts to transform cereals into nodulating plants are critically reviewed Also described are advances in the development of new methodologies to understand symbiotic interactions and to assess N 2 fixation in the field means of enhancing BNF through plant and soil management breeding and selection problems encountered in exploiting BNF under farmers field conditions and promising approaches to improve BNF exploitation Lacks a subject index Annotation copyright by Book News Inc Portland OR *Biological nitrogen fixation in forest ecosystems: foundations and applications* John C. Gordon,C.T. Wheeler,2012-12-06 *Biological Nitrogen Fixation for Sustainable Agriculture* J.K. Ladha,T. George,C. Bohlool,2013-03-09 Chemical fertilizers have had a significant impact on food production in the recent past and are today an indispensable part of modern agriculture On the other hand the oil crisis of the 1970s and the current Middle East problems are constant reminders of the vulnerability of our fossil fuel dependent agriculture There are vast areas of the developing world where N fertilizers are neither available nor affordable and in most of these countries balance of payment problems have resulted in the removal of N fertilizer subsidies The external costs of environmental degradation and human health far exceed economic concerns Input efficiency of N fertilizer is one of the lowest and in turn contributes substantially to environmental pollution Nitrate in ground and surface waters and the threat to the stability of the ozone

layer from gaseous oxides of nitrogen are major health and environmental concerns The removal of large quantities of crop produce from the land also depletes soil of its native N reserves Another concern is the decline in crop yields under continuous use of N fertilizers These economic environmental and production considerations dictate that biological alternatives which can augment and in some cases replace N fertilizers must be exploited Long term sustainability of agricultural systems must rely on the use and effective management of internal resources The process of biological nitrogen fixation offers and economically attractive and ecologically sound means of reducing external nitrogen input and improving the quality and quantity of internal resources In this book we outline sustainability issues that dictate an increased use of biological nitrogen fixation and the constraints on its optimal use in agriculture **Biological Nitrogen Fixation for the 21st Century** Claudine Elmerich,Adam Kondorosi,William E. Newton,2013-12-01 Nitrogen availability is one of the most critical factors that limits plant productivity The largest reservoir of nitrogen is the atmosphere but this gaseous molecular nitrogen only becomes available to plants through the biological nitrogen fixation process which only prokaryotic cells have developed The discovery that microbes were providing fixed nitrogen to legumes and the isolation of the first nitrogen fixing bacteria occured at the end the 19th Century in Louis Pasteur s time We are now building on more than 100 years of research in this field and looking towards the 21st Century The International Nitrogen Fixation Congress series Started more than 20 years ago The format of this Congress is designed to gather scientists from very diverse origins backgrounds interests and scientific approaches and is a forum where fundamental knowledge is discussed alongside applied research This confluence of perspectives is we believe extremely beneficial in raising new ideas questions and concepts **CRC Handbook of Plant Science in Agriculture** B.R. Christie,2023-01-06 First published in 1987 this two volume set is an exhaustive compilation of the most recent data on economically important crops Volume I presents information on genetics botany and growth of crop plants while Volume II covers the production of Crops and their utilization **Biological Nitrogen Fixation** Nanjappa Shamanna Subba Rao,1988 Recent Advancements in Microbial Diversity Surajit de Mandal,Pankaj Bhatt,2020-06-02 Microorganisms are a major part of the Earth s biological diversity Although a lot of research has been done on microbial diversity most of it is fragmented This book creates the need for a unified text to be published full of information about microbial diversity from highly reputed and impactful sources Recent Advancements in Microbial Diversity brings a comprehensive understanding of the recent advances in microbial diversity research focused on different bodily systems such as the gut Recent Advancements in Microbial Diversity also discusses how the application of advanced sequencing technologies is used to reveal previously unseen microbial diversity and show off its function Gives insight into microbial diversity in different bodily systems Explains novel approaches to studying microbial diversity Highlights the use of omics to analyze the microbial community and its functional attributes Discusses the techniques used to examine microbial diversity including their applications and respective strengths and weaknesses **Microbiology of**

Tropical Soils and Plant Productivity Y.R. Dommergues,G.H. Diem,2012-12-06 It is an established fact that we must continually increase and improve agricultural production if we are to meet even the minimum requirements of a growing popu lation for food shelter and fuel In recent years the introduction of new plant varieties and the extensive use of fertilizers have effectively increased crop yields but intensifying agricultural methods has often led to depleting soil fertility Two examples of the harmful consequences of intensive farming practices are the loss of up to 2 5 cm of topsoil every 15 years in the United States through erosion and the alarming rise in environmental pollution through widespread use of pesticides Countless other processes affecting the activity of soil micro flora and the inter actions between microorganisms and plants may pose an equal danger to soil equilibrium but their potential hazards are often overlooked because of an insufficient understanding of soil microbiology on the part of scientists In the first published study of its kind the authors of this book have attempted to address major aspects of the microbial activity of soil in the tropics Tropical conditions serve as an ideal context for a discussion of soil microbiology since biological processes in the soil are particularly active in tropical environments in comparison to other settings and in relation to physical and chemical processes Recent Advances in Biotechnology F. Vardar-Sukan,S.S. Sukan,2012-12-06 In last decades rapid scientific and engineering developments have been occuring within the context of Biotechnology If the World Economy is to benefit fully from the advances in biosciences and biochemical engineering it must be able to focus new knowledge on commercially appropriate targets Modern Biotechnology is a mixture of far reaching innovation superimposed on an industrial background and it represents a means of production with bright prospects challenging problems and stimulating competition This NATO Advanced Study Institute on RECENT ADVANCES IN INDUSTRIAL APPLICATIONS OF BIOTECHNOLOGY held between September 16 27 1991 in Ku Etdasl was the first ASI on Biotechnology Ln Turkey t was aiming to provide an updated overview of the fundamental principles novel application areas and impact of Biotechnology on international economy Recent developments in the field of Biotechnology have been thoroughly discussed concentrating on various interdisciplinary aspects The illain lectures presented at the Institute covered both scientific and commercial aspects of new developments in biotechnology and discussed the possible ways of meeting the challenges of the industry The main lectures were supplemented by Oral 2nd Poster Presentations Thus this volume is comprised of three sections Part I contains the i vited lectures and Part II oral presentations Exte ded abstracts of poster presentations have been included in Part III to provide a more comprehensive coverage of the ASI **Biological Nitrogen Fixation** Frans J. de Bruijn,2015-06-12 Nitrogen is arguably the most important nutrient required by plants However the availability of nitrogen is limited in many soils and although the earth s atmosphere consists of 78 1% nitrogen gas N2 plants are unable to use this form of nitrogen To compensate modern agriculture has been highly reliant on industrial nitrogen fertilizers to achieve maximum crop productivity However a great deal of fossil fuel is required for the production and delivery of nitrogen fertilizer Moreover carbon dioxide CO2 which is

released during fossil fuel combustion contributes to the greenhouse effect and run off of nitrate leads to eutrophication of the waterways Biological nitrogen fixation is an alternative to nitrogen fertilizer It is carried out by prokaryotes using an enzyme complex called nitrogenase and results in atmospheric N2 being reduced into a form of nitrogen diazotrophic organisms and plants are able to use ammonia It is this process and its major players which will be discussed in this book Biological Nitrogen Fixation is a comprehensive two volume work bringing together both review and original research articles on key topics in nitrogen fixation Chapters across both volumes emphasize molecular techniques and advanced biochemical analysis approaches applicable to various aspects of biological nitrogen fixation Volume 1 explores the chemistry and biochemistry of nitrogenases nif gene regulation the taxonomy evolution and genomics of nitrogen fixing organisms as well as their physiology and metabolism Volume 2 covers the symbiotic interaction of nitrogen fixing organisms with their host plants including nodulation and symbiotic nitrogen fixation plant and microbial omics cyanobacteria diazotrophs and non legumes field studies and inoculum preparation as well as nitrogen fixation and cereals Covering the full breadth of current nitrogen fixation research and expanding it towards future advances in the field Biological Nitrogen Fixation will be a one stop reference for microbial ecologists and environmental microbiologists as well as plant and agricultural researchers working on crop sustainability **Maximising the Use of Biological Nitrogen Fixation in Agriculture** Gudni G. Hardarson,William J. Broughton,2003-07-31 Incorporating contributions from microbiologists molecular biologists plant breeders and soil scientists this volume reports the results and recommendations of an FAO IAEA meeting of twelve experts on biological nitrogen fixation This volume will be invaluable to scientists working on nitrogen fixation soil microbiology agronomy and crop production as well as farm advisers and extension specialists Maximising the Use of Biological Nitrogen Fixation in Agriculture is unique in that it reviews the latest thinking on various aspects of biological nitrogen fixation technology and applications reviews the possibilities in enhancing nitrogen fixation in various cropping systems shows ways how biological nitrogen fixation can be used to enhance crop production considers the applicability of these technologies to small farmers in developing countries **Plant-Microbe Interaction - Recent Advances in Molecular and Biochemical Approaches** Prashant Swapnil,Mukesh Meena,Harish,Avinash Marwal,Selvakumar Vijayalakshmi,Andleeb Zehra,2023-04-17 Plant Microbe Interaction Recent Advances in Molecular and Biochemical Approaches Agricultural Aspects of Microbiome Leading to Plant Defence Volume Two continues the work of Volume One covering the role of these plant microbes and their interaction between plants and microbes These beneficial microbes such as bacteria and fungi are also known as plant growth promoting rhizobacteria PGPR through a biochemical reaction that may improve induced systemic resistance in the plant host via indirectly against phytopathogens or directly the solubilization of mineral nutrients by producing phytohormones and specific enzymes such as 1 aminocyclopropane 1 carboxylate deaminase The book covers biochemical processes such as physiological metabolic etc of plant and microbe interactions the biochemistry of biological systems the

interaction of biological systems above ground or within the rhizosphere and the history of growth promoting microbiomes their roles in phytoremediation efficiency physiological and biochemical studies chemical communication and signaling mechanisms Covers agricultural aspects in which the biochemistry in between plants and microbes helps us understand interactions in the rhizosphere Helps readers understand the molecular and biochemical approaches of plant microbe interactions Enables an understanding of plant microbe interactions which will help to improve crop production

Biological Nitrogen Fixation Gary S. Stacey,Robert H. Burris,Harold J. Evans,1992-04-30 Phylogenetic classification of nitrogen fixing organisms Physiology of nitrogen fixation in free living heterotrophs Nitrogen fixation by photosynthetic bacteria Nitrogen fixation in cyanobacteria Nitrogen fixation by methanogenic bacteria Associative nitrogen fixing bacteria Actinorhizal symbioses Ecology of bradyrhizobium and rhizobium The rhizobium infection process Physiology of nitrogen fixing legume nodules compartments and functions Hydrogen cycling in symbiotic bacteria Evolution of nitrogen fixing symbioses The rhizobium symbiosis of the nonlegume parasponia Genetic analysis of rhizobium nodulation Nodulins in root nodule development Plant genetics of symbiotic nitrogen fixation Molecular genetics of bradyrhizobium symbioses The enzymology of molybdenum dependent nitrogen fixation Alternative nitrogen fixation systems Biochemical genetics of nitrogenase Regulation of nitrogen fixation genes in free living and symbiotic bacteria Isolated iron molybdenum cofactor of nitrogenase *Organic Recycling in Africa* ,1980-01-01 *Applications of Genetic Engineering to Crop Improvement* G.B. Collins,Joseph F. Petolino,2012-12-06 The contributions of plant genetics to the production of higher yielding crops of superior quality are well documented These successes have been realized through the application of plant breeding techniques to a diverse array of genetically controlled traits Such highly effective breeding procedures will continue to be the primary method employed for the development of new crop cultivars however new techniques in cell and molecular biology will provide additional approaches for genetic modification There has been considerable speculation recently concerning the potential impact of new techniques in cell and molecular biology on plant improvement These genetic engineering techniques should offer unique opportunities to alter the genetic makeup of crops if applied to existing breeding procedures Many questions must be answered in order to identify specific applications of these new technologies This search for applications will require input from plant scientists working on various aspects of crop improvement This volume is intended to assess the interrelationships between conventional plant breeding and genetic engineering

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