

# 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 forage crop 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 rubens* 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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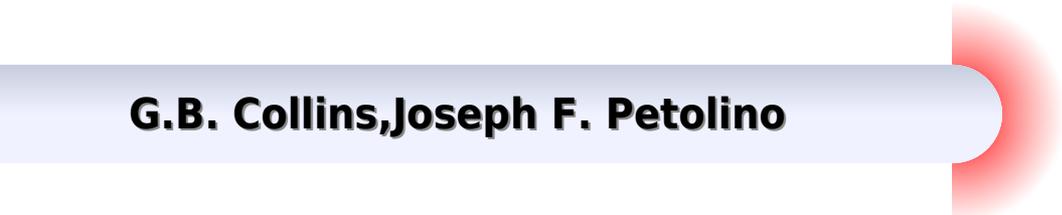
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*Recent Advances in Biological Nitrogen Fixation* N. S. Subba Rao, 1980      *Recent Advances in Biological Nitrogen Fixation* Nanjappa Shamanna Subba Rao, 1980      *Current Developments in Biological Nitrogen Fixation* N. S. Subba Rao, 1984 This 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      **Recent Advancement in Microbial Biotechnology** Surajit de Mandal, Ajit Kumar Passari, 2021-08-14 The rapid increase in microbial resources along with the development of biotechnological methods has revolutionized the field of microbial biotechnology Genome characterization methods and metagenomic approaches further illustrate the role of microorganisms in various fields of research Recent Advancement in Microbial Biotechnology Agricultural and Industrial Approach provides an overview on the recent application of the microorganisms in agricultural and industrial improvements The purpose of this book is to integrate all these diverse areas of research in a common platform Recent advancement in Microbial Biotechnology targets researchers from both academia and industry professors and graduate students working in molecular biology microbiology and biotechnology Gives insight in the exploration of microbial functional diversity in different systems Highlights important microbes and their role in enhancing agricultural productivity Provides understanding to the basics with advance information of microbial biotechnology Explores the importance of microbial genomes studies in agricultural and industrial applications

*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 many years 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 and species of plants mechanisms and chemical modeling of enzyme systems to genetical 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      **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

*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

**Plant-Microbe Interaction - Recent Advances in Molecular and Biochemical Approaches** Prashant Swarnil, 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

**Advances in Plant Physiology (Vol.15) A.** Hemantaranjan, 2014-12-01 In view of changes in the global environment it is important to determine and developing technologies to ameliorate metabolic limitations by biological processes most sensitive to abiotic stress factors warning crop productivity It is reaffirmed that publishing the important Treatise Series has been undertaken with a view to identify the

inadequacies under varied environments and to scientifically extend precise and meaningful research so that the significant outcomes including new technologies are judiciously applied for requisite productivity profitability and sustainability of agriculture Besides this meticulous research in some of the very sensible and stirring areas of Plant Physiology Plant Molecular Physiology are indispensably needed for holistic development of agriculture and crop production in different agro climatic zones Ardently this is also to focus upon excellent new ideas ensuring the best science done across the full extent of modern plant biology in general and plant physiology in particular In Volume 14 with inventive applied research attempts have been made to bring together much needed eighteen remarkable review articles distributed in three appropriate major sections of Nutriophysiology and Crop Productivity Plant Responses to Changing Environment and Environmental Stresses and Technological Innovations in Agriculture written by thirty four praiseworthy contributors of eminence in unequivocal fields mainly from premier institutions of India and abroad In reality the Volume 14 of the Treatise Series is wealth for interdisciplinary exchange of information particularly in the field of nutriophysiology and abiotic stresses for planning meaningful research and related education programmes in these thrust areas Apart from fulfilling the heightened need of this kind of select edition in different volumes for research teams and scientists engaged in various facets of research in Plant Physiology Plant Sciences in traditional and agricultural universities institutes and research laboratories throughout the world it would be tremendously a productive reference book for acquiring advanced knowledge by post graduate and Ph D scholars in response to the innovative courses in Plant Physiology Plant Biochemistry Plant Molecular Biology Plant Biotechnology Environmental Sciences Plant Pathology Microbiology Soil Science Agricultural Chemistry Agronomy Horticulture and Botany

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web may 7 2023 pat the soil down over the newly planted bulb water the bulbs thoroughly cover the area with a few inches of mulch you may omit mulching if you plant the bulbs 12 15 inches deep monitor moisture levels although tiger lilies are fairly drought tolerant they thrive when watered deeply once a week if the blooms look wilted or dry give

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web feb 15 2023 they include improved orange tiger lily liliun tigrinum splendens improved known for larger flowers with darker spots yellow star tiger lily liliun tigrinum splendens yellow star if you want to grow tiger lilies but orange isn't a good color for your garden these are more yellow

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web apr 7 2021 tiger lily flowers liliun lancifolium or liliun tigrinum offer a tall and showy flower that you may remember from your grandmother's garden the tiger lily plant can reach several feet 1 m tall and while the stems are usually stiff and sturdy a slender stake occasionally helps provide an upright appearance and support for multiple flowers

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web jan 10 2023 tiger lily liliun lancifolium or liliun tigrinum is an herbaceous perennial that grows from bulbs with a moderate growth rate while it's an asian species a tiger lily is not rare to see in the united states you can plant tiger lily bulbs in the fall or spring and expect blooms in the summertime

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web tiger lily is a beautiful and vibrant flowering plant belonging to the genus liliun its scientific name is liliun lancifolium or l tigrinum it is native to china japan and korea perennial tiger lilies are bulbous perennial flowers meaning they will come back year after year if properly cared for

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web tiger lilies are summer flowers they are not difficult to grow but they do have some specific needs in order for them to flower well tiger lilies need to have soil that is extremely well drained so amending the soil is definitely step one in ensuring you will grow beautiful and lush plants

