Agricultural Nitrogen Use & Its Environmental Implications

Agricultural Nitrogen Use & Its Environmental Implications provides a comprehensive, interdisciplinary description of problems related to the efficient use of nitrogen in agriculture, in the overall context of the nitrogen cycle, its environmental and human health implications, as well as various approaches to improve N use efficiency. The book has been divided into six sections and targets graduates, postgraduates, research scholars and policy makers in Agricultural and Environmental Sciences.

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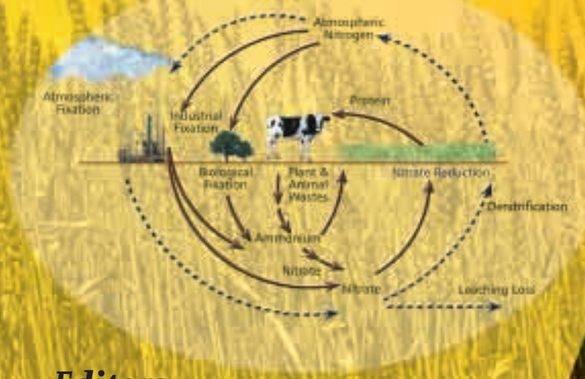

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Foreword

I am very happy that this comprehensive book on "Agricultural Nitrogen Use and its Environmental Implications" has been prepared by Professor YP Abrol along with his colleagues, Dr. N. Raghuram and Dr. MS Sachdev. Nitrogen is the primary input in Indian agriculture, and its management holds the key for quantitative and qualitative improvement of various crops. This book contains chapters written by leading experts in the field. It provides a comprehensive, interdisciplinary description of the problems of N use efficiency in Indian agriculture in the overall context of nitrogen cycle, its environmental and health implications, as well as various approaches to N use efficiency. The topics vary from plant molecular biology to agronomic management, and include issues related to the role of legumes in nitrogen nutrition, groundwater and air pollution, and human health.

Following the rise in the cost of urea and other sources of nitrogenous fertilizers, there has been growing interest in developing and promoting integrated nutrient management systems consisting of an optimal blend of green manure crops, organic manures, biofertilizers, and mineral fertilizers. This book will be useful for all interested in strategies for rational and effective nitrogen use and in addressing the issues related to environmental degradation.

I congratulate the editors for getting such a valuable book prepared and published.

M.S. Swaminathan
FRS, President,
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Preface

This book is one of the outcomes of a long and continuing process of consultations in India (and abroad, lately) to develop an integrated approach for nitrogen research and policy. These efforts were necessitated by the increasing realisation that while majority of the Indian agricultural soils are deficient in usable forms of nitrogen (N), uneven/excessive/improper/inappropriate use of N fertilizers, coupled with contributions from industrial effluents/ exhausts, animal wastes and geo-deposits have led to widespread pollution of ground water and eutrophication of surface waters, posing a severe problem for the public health and ecosystem. The ozone-depleting and greenhouse effects of NO_x gases from various farm and non-farm sources may pose new concerns for nitrogen-carbon balance.

The natural processes of producing reactive N from atmospheric N_2 gas, as well as its reversal by denitrification have been dramatically altered by fertilizer production and consumption in agriculture, cultivation of legumes, animal husbandry, transport and other fossil fuel-consuming industries that produce N wastes. The resulting accumulation of reactive N in the environment has adverse impacts on biodiversity, global warming, water quality, human health etc. Unlike many other human activities in which it is a by-product, reactive N is an essential input for agriculture, constituting upto 70 per cent of the total fertilizer material and is manufactured and consumed on a massive scale. There is no escape from the use of fertilizers to sustain food production, and the environmental consequences of accumulation of reactive N are the same, regardless of whether the fertilizers are of chemical or biological origin. Therefore, the challenge now facing Indian agriculture is to further enhance the productivity of our agricultural system without adversely impacting our environment and ecology. This necessitates an integrated understanding of nitrogen in India's agriculture, industry and environment, so as to identify the appropriate sites for intervention towards a more sustainable N management regime.

This perspective led us to begin a process of consultation with the researchers and others working on various aspects of nitrogen research and policy across the country onto a common platform under the auspices of the Society for Conservation of Nature. The first concrete outcome of this process was a brain storming session sponsored by the National Academy of Agricultural Sciences (NAAS) during October 4-5, 2005, at NAAS, New Delhi, under Prof. YP Abrol, INSA Senior Scientist and Editor, NAAS, as convenor and Dr. S.M. Virmani, Foreign Secretary, NAAS as co-convenor. A background paper on N in agriculture and environment was circulated in advance to over 80 scientists and specialists from agricultural, environmental and industrial sectors, based on which over 50 papers on specific aspects were received. These were integrated into a few position papers that were presented and discussed during the brainstorming session attended by more than 35 participants. Their recommendations formed the basis for a policy paper titled "Policy Options for Efficient N Use". One of the most important realizations that emerged from this exercise is that the problems related to N in agriculture, industry and environment are multidimensional. The sheer diversity of research areas / expertise / approaches it encompasses and the various levels at which the problems need to be identified / tackled calls for an integrated network approach to harness our intellectual, financial and infrastructural resources effectively. In order to further expand the nitrogen network beyond agriculture, the Society for Conservation of Nature (SCON, New Delhi) organized a workshop in March 2006 on "Nitrogen in Environment Industry and Agriculture", at INSA. It was sponsored by INSA, DBT, MOEF and CSIR. Over 50 delegates attended the workshop, including 26 speakers and 8 poster presenters, representing diverse specialisations on various aspects of N, from institutes, universities, and industry. A network of Nitrogen research workers in various sectors in India referred to as "Indian Nitrogen Group" has also been formalized as an outcome of this workshop. In the meantime, we also came into contact with the International Nitrogen Network (INI), which evolved in the recent years to address similar concerns and bring about international coordination. This year, an organization called "Nitrogen in Europe" emerged to address similar concerns at the level of the member countries of the European Union. These emerging networks highlight the growing concerns related to nitrogen at the national, regional or international level.

This book is the first ever attempt to distill the current thinking in India with regards to various aspects of nitrogen, based on the above process of consultation and networking. It encompasses all aspects of the nitrogen cycle with special reference to reactive N in the Indian context to summarise the current knowledge as well as identify the gaps in it for informed decisions on further research and policy. The authors have been chosen for their expertise, strong and long presence in the field, and commitment to interdisciplinary understanding on various aspects of nitrogen. The articles provide state-of-the-art reviews in their respective disciplines integrating global literature and India-specific information as appropriate. In this sense, apart from being a unique reference source at the national level, this book is also meant to be of reference value for an international readership, especially those who wish to understand country-specific issues in the wider international context.

Naturally, the authors of this book had a major responsibility to serve the larger purpose behind this book while contributing their articles, and their efforts are greatly appreciated. We also gratefully acknowledge the rich inputs from all the scientists who have been a part of our consultative process and now constitute the Indian Nitrogen Group. The financial support we received from NAAS, DBT, INSA, MOEF and CSIR for the two brainstorming sessions has greatly facilitated the entire process and emboldened us to embark on the ambitious task of putting together this book.

Finally, I would like to thank I.K. International for their cooperation and support.

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