

Kumar · Yadav · Kumar

Emerging
Science and
Technology for
**Food, Agriculture
and Environment**

EMERGING SCIENCE AND TECHNOLOGY FOR
**FOOD, AGRICULTURE
AND ENVIRONMENT**

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**Food, Agriculture
and Environment**

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Commemoration



Prof. Dr. Rishi Kumar Behl

Born on 15th May, 1951 at Hanuman Garh Jn(Rajasthan), Prof. Rishi Kumar Behl, obtained his B.Sc (Agri, 1972) from Rajasthan University, Jaipur, M.Sc (Agri, Plant Breeding,1974) and Ph.D (Genetics,1980) from Haryana Agriculture, University, Hisar, India, with meritorious record. He received advance training in Plant Breeding at University of Goettingen, Germany(1982-84). During his distinguished teaching and research career, he served CCS Haryana Agricultural University, Hisar, for about 33 years (1978-2011) in various capacities from Assistant Professor to Professor levels at the Department of Genetics and Plant Breeding and then as Associate Dean, College of Agriculture. He is now working as Director, New Initiatives at Manav Institute, Jevra. Disst.Hisar (Haryana).

Prof. Behl worked on interesting aspects of cop improvement and identified potential wheat genotypes; mutants and near isogenic lines of dwarfing genes, for target environments, favorable plant microbe interactions and end use quality. Dr. Behl played significant role in restructuring Under and Post Graduate courses in Genetics and Plant Breeding and Seed Technology at national level.

He has been editor in chief of Annals of Biology for about three decades , Associate Editor of Annals of Agri Bio Research, Editorial Board Member of Archives of Agronomy and Soil Science(Germany), International Advisory Board Member of Tropics (Japan), Associate Editor, Cereal Research Communication (Hungary), Associate Editor, South Pacific Journal of Natural Science (Fiji), Sr. Editor, Journal of Basic Microbiology, (Germany) and has about 200 publications in international and national journals and 30 edited books and manuals to his credit.

He has been awarded Bharat Ratna C Subramaniam Award for Out Standing Teachers by Indian Council of Agricultural Research, New Delhi and Honorary DAAD Advisor by German

Academic Exchange Service, Bonn, Germany (2006-09). He is founder Member Secretary of Society for Sustainable Agriculture and Resource Management (SSARM), India. He visited Germany on DAAD/DFG fellowships, Japan on JSPS Fellowship and USA under FAO/ICAR programme besides Czech Republic, Hungary, Poland, Canada, China, and Nepal etc. He participated in and organized several international conferences in India and abroad.

Professor Behl is an embodiment of simplicity, knowledge and deep understanding in subjects of plant sciences and agriculture stream. His immense teaching potential and knack for learning is adorable. His superannuation in 2011, age and circumstances have not belied his zeal in guiding younger researchers to achieve new knowledge, excel in research work and promoting international linkages.

We gladly commemorate this volume entitled “ **Emerging Science and Technology for Food, Agriculture and Environment** ” to Professor Behl, well known for his innovative ideas, thoughts and concepts which ultimately deal with Cutting Edge Science and Technologies in Food, Environment and Health. We wish him sound health and long life to continue

On behalf of the Editors



Dr. D.P. Singh
Former Vice Chancellor
JNKVV University, Jabalpur

FOREWORD

There is an intrinsic link between the challenge we face to ensure food security through the 21st century and other global issues, most notably climate change, population growth and the need to sustainably manage the world's rapidly growing demand for energy, land and water. Our progress in reducing global poverty and achieving the Millennium Development Goals will be determined to a great extent by how coherently these long-term challenges are tackled. A key question is whether we can feed a future nine billion people equitably, healthily and sustainably.

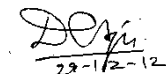
Science and technology can make a major contribution, by providing practical solutions. Securing this contribution requires that high priority be attached both to research and to facilitating the real world deployment of existing and emergent technologies. Put simply, we need a new, 'ever greener revolution'. Important areas for focus include: crop improvement; climate smarted agriculture, sustainable use of natural resources and other inputs and their effective management to avoid resistance and environmental problems; introduction of novel non-chemical approaches to crop protection; reduction of post-harvest losses; and more sustainable livestock and marine production. Techniques and technologies from many disciplines, ranging from biotechnology and engineering to newer fields such as bioinformatics, nanotechnology, will be needed.

The authors have felt the urge to meet this challenge and present the topics, which are most important in broader understanding and having implications for sustainable growth in agricultural. They seem to have strong conviction that cutting edge technologies will be beneficial for human welfare in present or future era. Hence, the authors have presented them along a logical sequence from simple to complex form of the understanding of the concepts and technologies.

The contents of various topics covered in the edited book entitled "**Emerging Science and Technology for Food, Agriculture and Environment**" permit stimulating, selective, and detailed compilation of each of the various aspects of the broad field of agricultural science. Thus, the book is designed to cover the contemporary scientific thought, serving as a thorough, up-to-

date cutting edge technologies support in the field of agricultural science. I hope that, the reader toward advance technologies might even have more perceptive than those described here.

The authors Dr Sandeep Kumar, Dr Pawan K Yadav and Dr. Sunil Kumar have fittingly justified the contents for this edited book. I congratulate them in bringing out this anthology for the benefit of young researchers and academicians and other interested readers.

A handwritten signature in black ink, appearing to read 'D.P. Singh', with a horizontal line underneath it. Below the line, the date '22-1/2-12' is written.

(D. P. Singh)

Preface

The challenges of feeding over 9 billion peoples by 2050 in a sustainable and environmentally friendly way cannot be met without the continued innovation and adoption of new cutting edge technologies in the agricultural science. The emerging technologies and concepts; like molecular breeding includes Marker assisted selection or Genomics assisted breeding, bioinformatics for crop improvement and development of new cropping system and crop modeling, under climate change in agricultural science played a significant contribution for improving agricultural productivity in terms of quantity and quality. Implementing the advance approaches for transformation of primary products into end-consumer products, prevention and correction of adverse environmental effects and theoretical production ecology played a pivotal role in meeting these challenges of producing enough food to feed the ever increasing population. The active participation of researchers and farmers to discuss, exchange the knowledge, experiences and collaborate for achieving the overall sustainable development and fulfilling the food and nutrient requirements would pay rich dividends.

All these aspects have been in focus of the editors while preparing this book entitled “**Emerging Science and Technology for Food, Agriculture and Environment**”. This edited book covers different aspects of agricultural science and technology which provides updated recent information on modern approaches/methods as possible with in the limitation of the space.

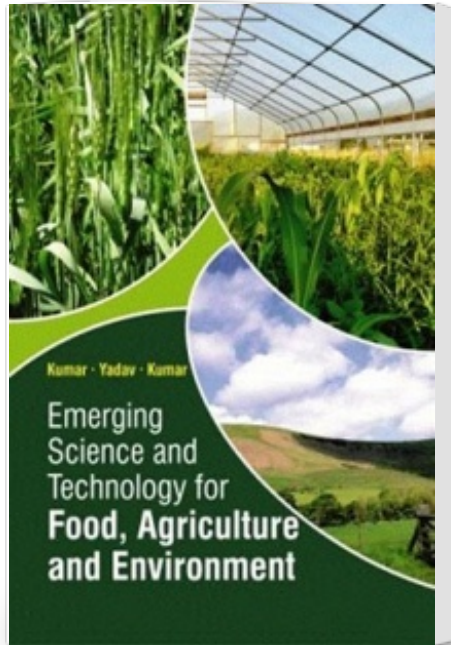
The editors are greatly thankful to Prof. Dr. Rishi Kumar Behl, Assoc. Dean (Retd.), CCSHAU, Hisar, India for his kind support and patronage. The book is commemorated to him in recognition of his contributions to science and society in general and young researchers in particular. Also, we are indebted to Dr. Ramesh Kumar Yadava, Senior Scientist *cum* Head, CCS Haryana Agricultural University, Hisar, India for his critical reviewing and immense help for preparation of this manuscript. We also express gratitude to young innovative minds/thinkers for their scientific efforts and valuable suggestions which are incorporated in this edited book.

The editors are confident that this book will be a stepping stone for young researchers to develop new ideas and innovations and be useful to young researchers, academicians, policy planners and corporate persons.

Editors

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