

# Crop Improvement and Mutation Breeding

A.K. Sharma  
Ramavtar Sharma





# **CROP IMPROVEMENT AND MUTATION BREEDING**

**Dr. A.K. SHARMA**

Professor  
(Plant Breeding & Genetics)  
SKRAU, BIKANER

**Dr. RAMAVTAR SHARMA**

Principal Scientist  
CAZRI, Jodhpur

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## FOREWORD

Present day agriculture is asked to satisfy two apparently contradictory needs: to become more productive and at the same time more sustainable; that is to supply the food needed without depleting renewable resources. Sustainability might have not been a challenge to early settlements, as they were established on an agricultural base with plenty of cultivable land available. With the increased life expectancy, in the era of modern science, population increased to the level that available lands fall short to feed all the people. Thus very soon, under the impact of modernization the option of expanding area under agriculture exhausted in most developing nations.

Continued use of chemicals, natural resources and improved varieties representing narrow genetic base has generated a series of negative effects on ecosystem, such as pollution (soil, water and air), loss of genetic diversity, soil fertility decline, climatic changes, water scarcity and desertification. Therefore, sustainable development has become a key issue in technology development. From scientific stand point of view, the challenge now is to create a genetic production potential at a significantly higher threshold than is available in the cultivars of the green revolution era coupled with reduced requirement for environmentally damaging inputs because the plateau of yield levels is now a widely prevalent and generally acknowledged phenomenon.

As scientific investigations are becoming easier, faster and manageable with time, it becomes more obvious that basic understanding at molecular level of physiological and biochemical aspects will be available to overcome plateau in yield. These studies while bringing forth a large number of genes from diverse organisms to be directly used to induce special characters in genotypes of interest across species fail to provide opportunities for genetic diversity to evolve in natural conditions and hence further jeopardize the sustainability of agricultural productivity.

Recent molecular information indicates greater flexibility in genome structure and function providing ample evidences in favor of mutagenesis driven evolutionary methods of crop improvement in order to generate novel genotypes and molecules fulfilling the needs of modern civilization. Mutation breeding strategies coupled with properly developed selection techniques are expected to provide continued solutions to ever arising crisis in a genetic diversity battered world.

The present book is one such welcome efforts that the writers of this book made. I have noticed with satisfaction that there are chapters which review the work done on mutation by different scientists. I am sure the book will prove useful not only to scientists and teachers but also to graduate and postgraduate students doing research work in the area of mutation. The authors deserves appreciation for doing an excellent job for writing the book "Crop Improvement and Mutation Breeding".

A handwritten signature in blue ink, appearing to read 'S.K. Jain', with a long horizontal flourish extending to the right.

Vice-Chancellor  
S.K. Rajasthan Agricultural University,  
Bikaner

## PREFACE

The knowledge that the basis of genetic or heritable diversity is mutation and subsequently that it can be induced generated a great hope/interest towards improving the crop plants for desirable traits. Although much hyped notion receded in time both basic and applied work continued generating large amount of information. Mode of action of most physical and chemical mutagenesis has been worked out. Similarly, a large number of varieties covering almost all the crop species have been produced. However, most breeders are ignorant of the contribution of mutagenesis in crop improvement.

Moreover, increasing genomic data base has increased the demand of available variation or to induced variations in gene sequences to understand their function. In recent years an increased interest in developing mutant libraries of model or crop species has been noticed. In addition the reduced diversity owing to adoption of high yielding monoculture varieties, mutagenesis remains the only hope to fulfil the future needs. Mutagens are known to widen range of genetic variation for characters in plants. Mutants so developed can be used as such as an improved variety or can be utilized for further improvement programme by conventional breeding.

Looking to the impotence of mutation in area of teaching and research and realizing the facts that students face a lot of problems in preparing for such wide range courses, we decide to write this book entitled: mutagenesis and mutation breeding with the basic objectives of providing the much needed information at one place. The contents of this book are delt with in 19 chapters, which covers a wide range of topics. We have consulted a large number of available books, original research papers, review articles and the material available at internet on mutation breeding. The ultimate credit of those endearour should go to all the esteemed authors and scientists whose valuable contribution and inputs has been included in this book. We are confident that the book is

expected to stimulate interest in the field of mutation breeding among students, scientist and researchers, users and all those who are engaged and interested in mutation breeding for the benefit of human kind.

**Dr. A.K. Sharma**  
**Dr. Ramavtar Sharma**

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