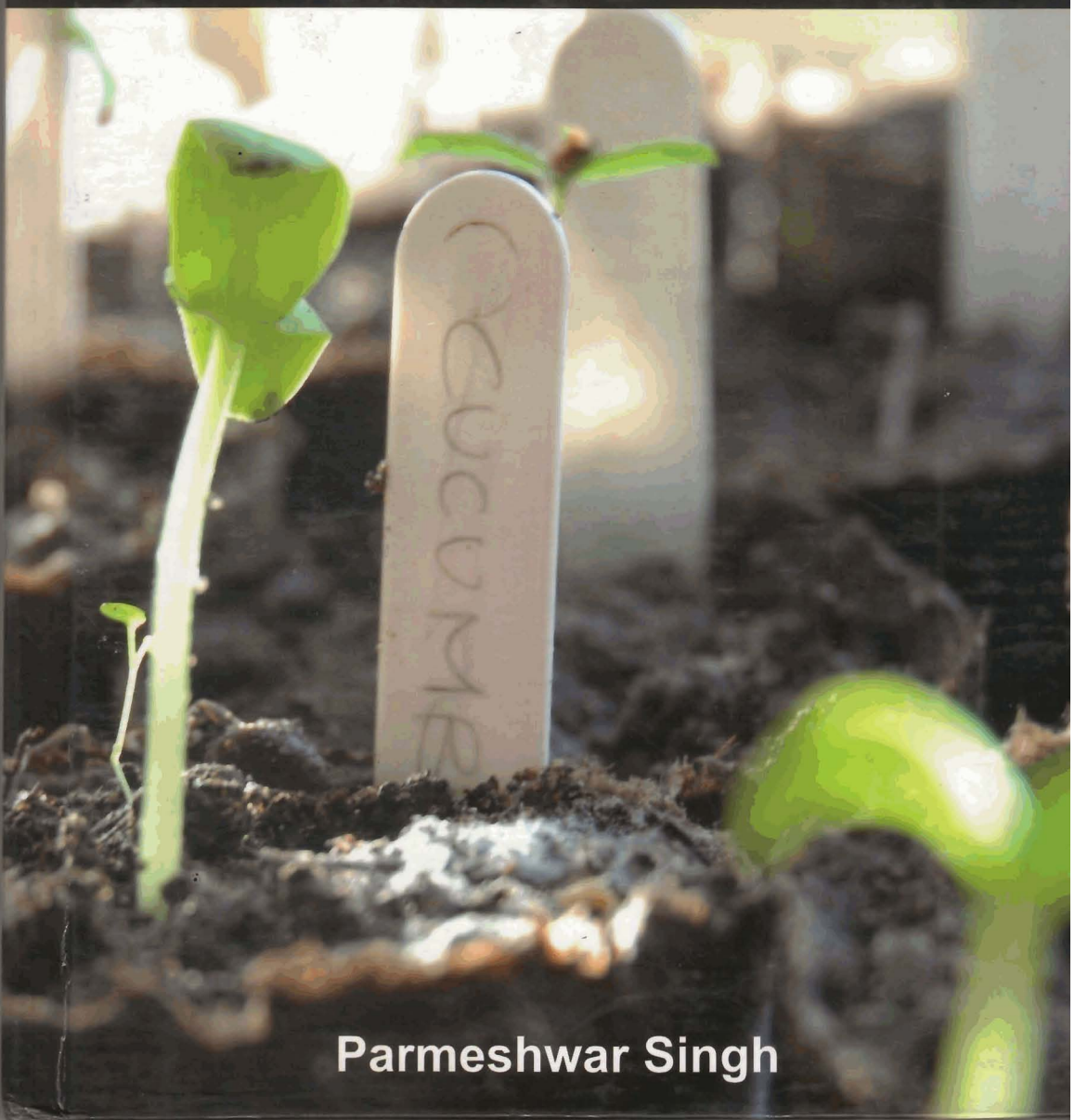
CONCEPTS IN

Plant Breeding



Parmeshwar Singh

CONCEPTS IN PLANT BREEDING

CONCEPTS IN
PLANT BREEDING

Dr. Parmeshwar Singh

ANMOL PUBLICATIONS PVT. LTD.
NEW DELHI-110 002 (INDIA)

ANMOL PUBLICATIONS PVT. LTD.
Regd. Office: 4360/4, Ansari Road, Daryaganj,
New Delhi-110002 (India)
Tel.: 23278000, 23261597, 23286875, 23255577
Fax: 91-11-23280289
Email: anmolpub@gmail.com
Visit us at: www.anmolpublications.com

Branch Office: No. 1015, Ist Main Road, BSK IIIrd Stage
IIIrd Phase, IIIrd Block, Bengaluru-560 085 (India)
Tel.: 080-41723429 • Fax: 080-26723604
Email: anmolpublicationsbangalore@gmail.com

Concepts in Plant Breeding

First Edition, 2013

ISBN: 978-81-261-5379-4

PRINTED IN INDIA

Printed at Thomson Press (India) Ltd.

Contents

Preface

As a part of agriculture, man started rearing plants and animals to meet his requirements. This is when humans started to learn how to influence the process of natural evolution so as to breed plant or animals. Slowly and gradually, this process of expedited evolution, through selection and cultivation of plants, acquired the form of a routine endeavour—what we today call 'plant breeding'. In this, heredity, which refers to the passage of various characteristic features from the main plant (the parent) to the plantlets (the progeny), plays an important role. The effects of heredity had been apparent to early man and he had taken advantage of them ever since the advent of agriculture. Various methods have evolved in plant breeding. One of the most important methods is that of selection. The ability to choose gave birth to the idea of selection.

This is the most primitive and by and large the most successful method of plant breeding. Selection as a part of plant breeding started with the domestication of plants by early man. Domestication refers to the process of bringing wild species under human management. Not all selection over the years have been human influenced—many of the important crop species have resulted from the natural selection process, which is an integral part of evolution. As human knowledge of agriculture grew, man started shuffling crop species from one geographical terrain to another, thus making new introductions. The first prerequisite of selection is the availability of variability, i.e. different types of forms. After a variable population is recognized, individuals that are the best performers for the desired feature, say fruit size in the case of tomatoes, are chosen and the rest of the population is discarded or rejected. The progeny of the selected individuals is grown further and again screened for the desired feature. This process is repeated until a uniform plant population is attained which has the best-desired

characters. Eventually, a desired uniform crop variety is produced by this successive selection followed by multiplication of the selected individuals. Selecting higher yielding plant varieties is no easy task. Various tools have been devised to deal with plant selection. In fact, the birth of genetics as an independent discipline in plant science started with some clever mathematical computations. This brainchild of yesteryears is now an important branch of genetics known as biometrics. Biometrics is defined as the application of statistics in biology. This has contributed greatly to the development of various systems based on which selection of plants is done. There are various methods by which plant selection is carried out, namely selection for uniform plants, known as pure line selection; selection from field-grown plants, known as bulk selection or mass selection; and selection from a well-documented list of parentage, commonly known as the pedigree system. Overall, the hallmark of selection lies in human ability to chose the best plants from a cluster of many.

In traditional terms, hybridization refers to the union of the male and the female gamete to produce a zygote. In plant science, hybridization also refers to the crossing or mating of two plants. The story of scientific hybridization of crop plants started with J G Kolreuter, who in 1761 published his work on the scientific bases of hybridization. Since then, hybridization followed by selection, has been the major tool of plant breeding. In his quest to find more variability, man started experimenting with hybridization of plants so as to achieve the perfect plant type. This process was actually the beginning of expedited evolution since it led to the formation of new plant types artificially or due to human intervention at a much faster pace than it would have happened in nature. For example, the bread wheat that we eat today has taken about 500 years to evolve to its present form through human intervention. This form of wheat would have taken thousands of years to evolve had it been left to the natural evolution process.

This book has been intended as a manual for students of this subject.

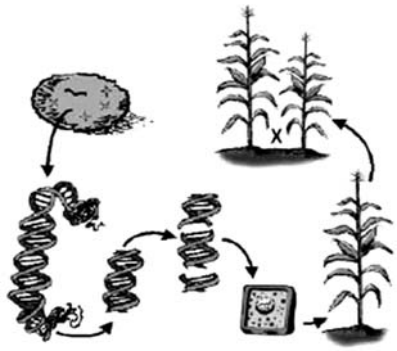
—Editor

1

Introduction

Plant Breeding

Plant breeding is the art and science of changing the genetics of plants for the benefit of humankind. Plant breeding can be accomplished through many different techniques ranging from simply selecting plants with desirable characteristics for propagation, to more complex molecular techniques. Plant breeding has been practiced for thousands of years, since near the beginning of human civilization. It is now practiced worldwide by individuals such as gardeners and farmers, or by professional plant breeders employed by organizations such as government institutions, universities, crop-specific industry associations or research centres.



International development agencies believe that breeding new crops is important for ensuring food security by developing new

Concepts in Plant Breeding

Publisher : Anmol Publications ISBN : 9788126153794 Author : Singh Parmeshwar