Hybridization of Crop Plants
FOREWORD

The publications of a scientific society are the chief tangible evidence of its vigor and vitality; they set a standard by which the society can be evaluated. The American Society of Agronomy and the Crop Science Society of America are pleased to have responded to the needs of our members and other agricultural workers and have shared in the development of this book dealing with hybridization of crop plants. Each chapter of this book was under the supervision of a member of an editorial committee jointly appointed by the American Society of Agronomy and the Crop Science Society of America.

This publication serves as a reference on the principles and procedures used to obtain hybrid seed of self and cross-pollinated crop plants. For many crops, descriptions of these procedures are passed orally from experienced to inexperienced persons and are not available in the literature. This book is not intended only as a text, but should be suitable as a reference even for persons inexperienced in plant breeding. It brings together the experience of plant breeders and other scientists in a form which can be used by persons unfamiliar with the crops and is intended for scientists, teachers, and students in plant science disciplines. It does not discuss in detail the breeding or genetics research for which the seed may be used.

The American Society of Agronomy and the Crop Science Society of America are pleased to bring you this special publication on a very important topic in agriculture. We express our deepest appreciation to Dr. Walter R. Fehr of Iowa State University and Dr. Henry H. Hadley of the University of Illinois, coeditors of the book and to the many authors.

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February 20, 1979
Chapter 1 Environmental Effects on Flowering

D. J. MAJOR

I. Response of Plants to Environment
II. Phases of Plant Development
III. Day Length
IV. Temperature
V. Moisture
VI. Soil Fertility
VII. Techniques for Synchronizing Flowering Dates
VIII. Conditions for Successful Hybridization and Self-pollination
IX. Techniques for Rapid Seed Production

Chapter 2 Reproduction and Seed Development

NELS R. LERSTEN

I. The Inflorescence
II. The Flower
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VI. Penetration of Embryo Sac and Fertilization
VII. Endosperm
VIII. The Embryo
IX. Apomixis and Male Sterility

Chapter 3 Apomixis and Its Application in Crop Improvement

E.C. BASHAW

I. Mechanisms of Apomixis
II. Embryo Development in Apomicts
III. Indicators of Apomixis
IV. Techniques for Confirming Apomixis
V. Genetics of Apomixis
VI. Hybridization and Breeding of Apomicts
VII. Environmental Effects on Apomixis
VIII. Seed Production of Apomicts
Hybridization and self-pollination are important aspects of research for the genetic improvement of crop plants. Hybridization is used to develop new genotypes, evaluate their performance, or exploit hybrid vigor. Self-pollination is used to evaluate genotypes and develop pure lines for cultivar development or genetic research.

This book was prepared to meet the need for written information on methods of hybridization and self-pollination of crop plants. A written description of methods used to obtain desired seed has not been available for many crop species. Successful procedures commonly are communicated verbally among scientists, and new techniques often are not considered important enough for publication in a journal. Lack of written information has hindered persons from learning successful methods without investing considerable effort in contacting scientists who have experience with a crop. Students also have not been able to obtain an overview of hybridization and self-pollination methods.

The book is intended to serve as both a text and a reference. The eight introductory chapters provide an overview of principles to be considered in hybridization and self-pollination, and should be of particular value to teachers and students. The remaining chapters provide detailed information on the procedures used for specific crops. Authors of the crop chapters followed identical subject headings to facilitate comparison of methods used in different species.

Preparation of a book of reasonable length and readability restricted the number of references that could be included by the authors. They were asked to include review articles and key references that would serve as a starting point for readers interested in a more exhaustive review of a subject. Personal communication with scientists provided considerable information, and each source of such information is documented.

The successful completion of this book is the result of the interest and participation of many scientists in the American Society of Agronomy and the Crop Science Society of America. Their first contribution was in the form of letters written early in 1976 to the societies in which they requested the preparation of a book that would bring together this important body of knowledge. The executive committees of the societies acknowledged this request, and appointed a feasibility committee to investigate the need, import, and contents of such a book. The committee, consisting of Walter R. Fehr, Chairman, Marvin K. Aycock, Jr., Jon L. Geadleman, Earl C. Gilmore, Darrell A. Miller, and G. Allan Taylor, recommended in December 1976 that the book be written. The Board of Directors of the societies approved the recommendation and agreed to cooperate in the venture. An editorial committee was appointed in January 1977. Over the next 2 years, numerous society members helped to identify qualified authors, provide information to those selected to prepare chapters, and review manuscripts. Their contribution is gratefully acknowledged.
It is with deepest gratitude that we acknowledge the contributions made by the authors. They were recommended to the editorial committee by their fellow scientists and are knowledgeable in a particular subject area or with a crop species. The quality of the book reflects their diligence in contacting colleagues for information, reviewing the literature, obtaining appropriate figures, and sharing their own experiences. We thank them for sharing their time and talents in service to others.

We acknowledge the contribution of the editorial committee: Robert Forsberg, Arnel Hallauer, and Arne Hovin, in preparing the outline for the book, selecting authors, and coordinating the preparation of individual chapters. The counsel of Domenic Fuccillo, managing editor, and the work of the societies’ staff in the final editing of the book are gratefully acknowledged. We also thank the societies for financial support and encouragement.

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