The production of new potato varieties

technological advances

Edited by

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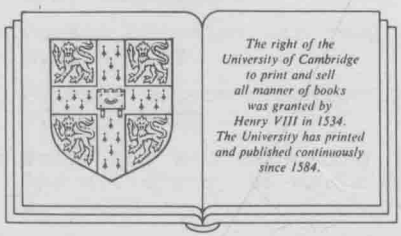

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PREFACE

It has become a tradition that the section Potatoes of the European Association for Research on Plant Breeding, EUCARPIA, and the section Breeding and Varietal Assessment of the European Association for Potato Research, EAPR, hold their section meetings simultaneously, thereby benefiting mutually from the experience of experts from both Associations.

The present proceedings 'The Production of New Potato Varieties Technological Advances', constitute however the very first publication *in extenso* of papers presented at joint meetings of the sections.

The book contains, among other items, papers presented at the meeting held at Cambridge, England, between December 16th - 20th, 1985, under the main theme 'The development and Identification of Superior Potato Genotypes - Limitations and Prospects for the Future'. It is a coherent publication, offering non-participants as well as participants in the section meetings a presentation of such important aspects as the current strategies employed in the breeding of new potato varieties, the achievements to date, and future prospects for varietal improvements.

The European Association for Research on Plant Breeding and the European Association for Potato Research welcome this initiative on the part of the sections, and hope that readers of the book will give it the appreciation it deserves.

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EDITORS' NOTE AND ACKNOWLEDGEMENTS

As indicated in the Preface, this book is based on the EAPR/EUCARPIA Breeding & Variety Assessment Meeting in 1985. A restriction on the size of the book has meant that the most space has been allocated to papers from invited speakers at the Meeting. This does not mean that the shorter contributions are of lesser importance.

In the arrangement of papers we have attempted to follow a logical sequence, but there is often an overlap of interest between the different sections of the book. Cross referencing partly helps to overcome this problem. Four papers are included which are additional to those presented at the Meeting. These aim to cover some additional aspects and to give a general background to the past, present and future state of breeding and variety assessment in potatoes (Foldø, Jackson, Jellis & Richardson, Thomson).

We thank all contributors for their excellent cooperation in compiling this book, particularly those who have been willing to communicate in a language not their own.

We would also like to thank our colleagues at the Plant Breeding Institute and the National Institute of Agricultural Botany for help in organizing the Meeting on which this book is based. In particular we are greatly indebted to both Mrs Susan Jellis for preparing the Index and to Mrs Sheila Tasselland Miss Ann McDonnell for help with the secretarial work.

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INTRODUCTION

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K.M. Swiezynski, Chairman of EAPR: Section "Breeding and Variety Assessment"

The potato is one of the world's most important food crops, being surpassed in total production only by wheat, corn and rice. Therefore, advances in potato breeding may greatly contribute to the world's food supply.

Potato breeders are expected to produce improved cultivars that give high yields of high quality tubers. Furthermore, resistance is required to diseases and pests during growth and storage, to stress conditions and to mechanical damage. Finally, specific properties of the tubers are required for various processing industries.

A rich source of genetic variation is available in existing cultivars, in primitive forms and in wild relatives of potato. The main problem faced by potato breeders is how to exploit most efficiently this large genetic variation.

In the last 75 years there has been a considerable expansion of world potato breeding and associated research. Before World War I breeders used to grow no more than several thousand seedlings, and a few years of basic selection were sufficient to put a new cultivar on the market. Research associated with potato breeding was very limited. Nowadays breeders in many countries grow several hundreds of thousands of seedlings. The breeding cycle is usually 10-12 years and breeding often involves sophisticated selection procedures. Governments in many countries have organized an elaborate varietal assessment system to make sure that only cultivars of satisfactory quality are being released. In addition, many sophisticated research centres make available to breeders new genetic variation, new breeding methods and improved selection techniques.

With such advances one might expect considerable progress in breeding and a quick replacement of old cultivars by better ones. Although significant results have been achieved in potato breeding, e.g. improvement of tuber quality and disease and pest resistance, very old cultivars are still predominant in some countries with advanced agriculture. Striking

examples are Russet Burbank introduced in 1876 in the USA and Bintje introduced in 1910 in the Netherlands; King Edward introduced in 1902 in Great Britain has only recently declined in popularity. The question may be raised as to why so much recent effort has yielded relatively limited results. The conference at Cambridge, on which this volume is based, aimed at elucidating the answer to this question.

In invited papers, breeding strategy and varietal assessment in various countries was presented, and several specialists summarized their experience with various new breeding procedures which they have introduced or developed. These papers were supplemented by numerous others related to all aspects of potato breeding. The opinions of the conference participants on various matters were sought in a general discussion.

The following considerations may be helpful in evaluating the present situation.

1. Potato breeding is at a transition stage. The expansion of activities during the past few decades has not produced satisfactory results, probably because insufficient attention has been paid to some basic problems in potato breeding. The potato is a highly heterozygous autotetraploid crop plant. High heterozygosity is needed for high vigour and tuber yield, but leads to segregation for too many important characters in breeding progenies (Simmonds 1969), thus decreasing the probability of detecting superior genotypes. In addition, many characters of the potato are highly sensitive to environmental influence, especially in early generations. At this stage, satisfactory selection techniques are still lacking (Brown, this volume).

In order to increase the frequency of desired genotypes in breeding progenies, superior parents with high breeding values are needed. However, the production of such parents is a long term and tedious job. Breeding at the diploid level simplifies the genetic segregation patterns and may thus render breeding more efficient if it can be associated with effective techniques for intact transfer of selected diploid genotypes to tetraploid progeny. Such techniques exist but more research is needed on their manipulation in a breeding programme. The concept of introducing homozygous or multiplex loci for certain simply inherited traits, and thereby reducing the number of characters to be selected for in the early generations, deserves careful consideration. An increase in research into these problems is needed. International cooperation should be promoted.

2. The selection in segregating breeding progenies and the selection of advanced clones in varietal assessment should be regarded as one process

with one objective - to eliminate defective genotypes and to introduce those that are superior to those now in production. Consistent selection criteria should be utilized throughout the whole selection process and the limited possibilities for successful selection at each stage should be duly considered. It is necessary to bear in mind that until now the final evaluation of a potato cultivar may only be obtained after testing it in practice.

3. New developments in tissue culture techniques and in genetic engineering of the potato are presented in some interesting and critical papers. Breeders must be prepared to try out any new development which is likely to make their work more efficient. However, new procedures often are not very useful to breeders because they do not help to solve the most important difficulties which are inherent in potato breeding.

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