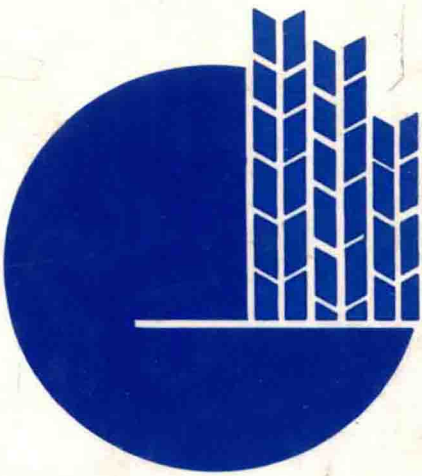
CURRENT PLANT SCIENCE AND BIOTECHNOLOGY IN AGRICULTURE

Biotechnology in Agriculture

Chongbiao You
Zhangliang Chen
Yong Ding
editors



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Biotechnology in Agriculture

Proceedings of the First Asia–Pacific Conference on Agricultural Biotechnology, Beijing, China, 20–24 August 1992

edited by

CHONGBIAO YOU
Chinese Academy of Agricultural Sciences

ZHANGLIANG CHEN
Peking University

and

YONG DING
China National Center for Biotechnology Development

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BIOTECHNOLOGY IN AGRICULTURE

Current Plant Science and Biotechnology in Agriculture

VOLUME 15

Aims and Scope
The book series is intended for readers ranging from advanced students to senior research scientists and corporate directors interested in acquiring in-depth, state-of-the-art knowledge about research findings and techniques related to plant science and biotechnology. While the subject matter will relate more particularly to agricultural applications, timely topics in basic science and biotechnology will also be explored. Some volumes will report progress in rapidly advancing disciplines through proceedings of symposia and workshops while others will detail fundamental information of an enduring nature that will be referenced repeatedly.

The titles published in this series are listed at the end of this volume.

Foreword

The First Asia --- Pacific Conference on Agricultural Biotechnology was held in Beijing, China on 20-24, August, 1992.

Over half the population in the world is in the Asian and Pacific Region. With an increasing population and decreasing farming lands, it is important to develop agricultural biotechnology for improvement of the productivity, profitability and stability of the farming system.

The Conference's main objectives were to bring together scientists working in different fields of agricultural biotechnology to stimulate discussion on this important process and to have an appraisal of the most recent studies concerning genetic manipulation of plants, plant cell and tissue culture, plant gene regulation, plant-microbe interaction, animal biotechnology etc. The Conference was attended by 391 scientists from different countries and regions.

This volume presents the contributions of the lectures and a selected number of posters, which are an up-to-date account of the state of knowledge on agricultural biotechnology. The book provides a valuable reference source not only for specialists in agricultural biotechnology, but also for researchers working on related aspects of agronomy, biochemistry, genetics, molecular biology, microbiology and animal sciences.

It is with great pleasure to acknowledge the contributions of the authors in assuring the prompt publication of this volume. We would also extend our sincere thank to Kluwer Academic Publishers for the publication of these proceedings.

C.B.You
Z.L.Chen
Y.Ding

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Li Zhensheng
(The Chinese Academy of Sciences, Beijing, 100864, China)

It is well known that China has made remarkable progress in agriculture, feeding 22% of the world population with only 7% of world arable land. However, with the increase of population and rise in people's living standards, more and better quality agricultural production and improvement of people's health status, the National Planning Commission and the National Committee of Science and Technology of china has listed biotechnology as one of the projects in the national "Seventh Five Year Plan" since early eighties. Since 1986, biotechnology has been classified as a key project in the High-tech Program (usually called the "863" Program because it was approved in March 1986) and in the programs of the National Natural Science Foundation. According to the statistics, during the period of "Seventh Five Year Plan" (1986-1990), about 3500 Chinese scientists were engaged in biotechnological research, some 40% of them were involved in agricultural biotechnology. The proportion of agricultural biotechnology has been further increased in the period of "Eighth Five Year Plan" (1991-1995).

There are mainly ten items of biotechnological research results which were applied and will be applied in production during the past ten years and in the next five years.

1. Virus-free Meristem Culture and Micropropagation

The plants used for micropropagation and induction of virus-free seedlings included potato, banana, kiwi fruit (*Actinidia chinensis*), apple, citrus, grape, Chinese flowering crabapple (*Malus lumi*), poplar as well as flowering plants. Some of them have been applied in production.

During the period of "Sixth Five Year Plan", the systems and net work of virus-free potato propagation were established jointly by the Institute of Botany, the Institute of Zoology and the Institute of Microbiology, the Chinese Academy of Science (CAS) and Inner Mongolia University. By 1984, the virus-free potato

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had been released and planted on 68000 hectares with an average yield of 3750 kg per hectare (with an increase of 50%). By 1990, a three-level system of virus-free potato propagation had been established in many provinces, and the cultivated area of virus-free potato reached more than 265000 hectares, accounting for 10% of the total area of potato cultivation in China.

During the period of "Seventh Five Year Plan", Xinhui County and Shunde County of Guangdong Province set up factories for micropropagation of superior banana varieties, with technical assistance from South China Institute of Botany, CAS, they produce 5-6 million test-tube plants per year. Such banana plants gave a yield of 25% higher than the suckers of local varieties. In order to further improve the quality of stock plantlets, it is planned to promote the development of techniques for fast virus identification in the future. A similar facility has been established in Luancheng County, Hebei Province for producing one million poplar plantlets per year. This work has done by Shijiazhuang Institute of Agricultural Modernization, CAS. In recent years, they produced test-tube plants of a Chinese flowering crabapple variety "Zhumei", which can be used as salt tolerant stock for apple and is proved that it grows well in coastal soil containing 0.4-0.6% salt. Through the field test in the areas of Hebei, Shandong and Tianjin in large scale (18 thousand plants), over three hundred thousand plants would be released in 1992. In addition, production system of virus-free apple stock center and 22 stock nurseries were established in Xincheng Institute of Fruit Tree, Liaoning Province. The virus-free plants of gladiolus, orchid and carnation are now commercially produced.

2. Anther Culture and Haploid Breeding

Since Guha and Maheshwai first induced successfully haploid pollen plant from *Datura innoxia* in 1964, pollen plants of wheat were first induced by the Institute of Genetics, CAS in 1971. Since then, haploid plants have been induced from more than 40 species, such as corn, rubber tree, apple, poplar and ginseng, which has greatly promoted the development of haploid breeding in China. By 1986, more than 20 new superior crop varieties had been developed by using anther culture method. For example, new rice varieties with high yield, good quality and rice blast-resistance, Zhong Hua #8, #9, #10 and #11 have been developed by the Institute of Crop Science of Chinese Academy of

Agriculture Sciences (CAAS), and they have been released in Beijing area. The superior wheat varieties Jing Hua #1, #3, and #5 have been developed by Beijing Academy of Agricultural Sciences, and they have been released on more than 650 thousand hectares.

3. Plant Breeding by Chromosome Engineering and wide Hybridization

Chromosome engineering of plants has been listed as a key project by National Committee of Science and Technology since 1981. After ten years' effort, a great progress has been made in this field. A large number of new varieties and lines of wheat have been developed, such as octoploid triticale (The Institute of Crop Science, CAAS), Octoploid Agrotriticum (Shanxi Academy of Agricultural Sciences), alien addition lines with two sets of chromosomes from *Agropyron* (Northeast Teachers University), alien addition lines with chromosomes from *Haynaldia* (Nanjing Agricultural University), seven kinds of blue-grained monosomic and self-fertile nullisomic wheat (Northwest Institute of Botany, Shijiazhuang Institute of Agricultural Modernization and Institute of Genetics, CAS), one set of "Abbondanza" monosomic and 18 kinds of self-fertile nullisomic wheat (Shaanxi Academy of Agricultural Sciences), one set of monosomic derived from a wheat variety, Yangzhou #1 (Shanghai Teachers University), one set of monosomic derived from a winter wheat variety, Fengkang #13 (The Institute of Crop Science, CAAS) and translocation lines with resistance to yellow leaf virus derived from *Agropyron* (the Institute of Crop Sciences, CAAS). The superior wheat variety "Xiaoyan #6" was developed by combining wide hybridization (*Triticum aestivum* and *Agropyron elongatum* 10x) and chromosome engineering technique (Northwest Institute of Botany, CAS). By 1988, it had been released on 3.6 million hectares, and 1.6 billion kg of wheat had been increased.

In addition, a new cotton variety "Aizhao #1" was developed by crossing upland cotton (*Gossypium hirsutum* n=26) with asiatic cotton (*G.arboreum*, n=13). It has a short life cycle and can be sown after wheat harvest in summer and harvest in autumn, making a good use of land for both food crops and cotton with a yield ginned cotton of about 750 kg per hectare and good fibre quality. This new variety is now beginning to be cultivated in Shandong and Henan Provinces.