PREFACE

The goal of plant breeding is to induce desirable traits from different varities of plant to produce plants of superior quality. This approach to improve crop production has been very successful over the years. It was beneficial to cross a plant that bears sweeter fruits with one that exhibits increased disease resistance. It takes many years of crossing and backcrossing generations of plants to obtain the desired trait. Along the way, undesirable traits may be manifested in the plants because there is no way to select for one trait without affecting others. Another limitation of traditional plant selection is that breeding is restricted to plants that can mate sexually. Advances in scientific researches and laboratory techniques during the last half of the twentieth century led to the ability of deoxyribonucleic acid (DNA) in various organisms, which accelerated manipulation plant improvement through the biotechnological methods.

Plants are made of millions of cells all working together. Every cell of a plant has a complete "instruction manual" or genome inherited from the parents as a combination of their genomes. Genes are found within the genome and serve as the "words" of an "instruction manual". When a cell "reads a word", or, in scientific terms "expresses a gene", a specific protein is produced. Proteins are responsible for the form and function of an individual. DNA is universal in nature having all the four chemical bases in all living organisms. Consequently, a gene from one organism can function in other organism. The transfer of genes from any organisms into a plant subsequent acclimitization to produce new proteins, resulted in significant achievements in plant biotechnology which was altogether impossible using traditional breeding practices.

To modify a plant genetically, thousands of base sequences comprising of an individual gene are transferred into a cell where that new gene gets integrated to become a part of cell genome permanently to produce "transgenics". Transfer of a DNA into plant cells is done using various techniques discovered earlier.

Changes made in plants through biotechnology can be categorized into the inputs, outputs, and value-added traits. Agronomic or "input" traits create value by increasing production or reduce the application of other inputs like chemicals, pesticides or fertilizers. Our current products with input traits include potatoes, corn and soybeans with higher yield or fewer costly inputs through better pest and weed control. Quality or output traits that help create value for consumers by

enhancing the quality of the food and fiber produced by the plant has recently been introduced on the market. Similarily in future, we shall be able to produce potatoes consuming less oil when fried, corn and soybeans with increased protein contents, tomatoes with a fresher flavor, corn and sweet potatoes with high levels of lysine.

Plants and plant-derived products of biotechnological origin are increasing rapidly. Many transgenics, like herbicide resistant soybeans, have been adopted widely by producers while other products, like delayed softening "FlavrSavr" tomato, are no longer in the market. Some of the potential benefits of utilizing transgenic plants include : reduced crop production costs and increased yields; healthier, more nutritious foods; reduced environmental impact by farming and industry and increased food availability for underdeveloped countries.

For centuries, mankind improved crop plants through selective breeding and hybridization through controlled pollination. Plant biotechnology is an extension to the traditional breeding which allows the transfer of genetic informations in more precise manner. Unlike traditional plant breeding, which involves crossing of hundreds or thousands genes, plant biotechnology allows the transfer of only one or a few desirable genes and allows the plant breeders to develop crops with specific beneficial genes with an elimination of undesirable traits. These beneficial traits include pests, insects, disease and weed resistance. Others traits control quality, taste of fruits and vegetables; processing advantages nutrition enhancements etc. The benefits of biotechnology, today and in the years to come are enormous and it is being used as a tool to provide new traits that benefit agricultural production, environment, human nutrition and health.

The main objective of bringing out this update publication is to provide current knowledge in this specific area. This volume comprises of 19 chapters contributed by the internationally recognized experts from different parts of the world, who are known for their vast knowledge and experience in the field of plant biotechnology. The book covers current status of knowledge about Multiple gene transfer, RNAi technology, Whisker-mediated transformation, Unintended effects in transgenic plants, Chloroplast genome in crop improvement, Engineering of crops for abiotic stress tolerance, Chemical weapons used by plants against pathogens, Genetic transformation, Gene cloning and protoplast fusion in citrus. Biotechnological improvements in *Allium, Citrus,* Cotton, Sugarcane, *Phellodendron, Rhubarb, Soybean,* Cloning of Conifers, Engineering disease and pest resistance in crop plants and Advances in Detection of Apple Proliferation Phytoplasma. The information on various topics is advance and comprehensive with an incorporation of up-to-date researches. The volume is relevant and

timely in view of the rapidly expanding international trade of biotechnology for crop improvement. This will facilitate young researchers in handling various aspects of crop biotechnology at global level.

This compendium will be a valuable reference source for students, scientists, researchers and planners in plant biotechnology. We express our sincere gratitude to all the esteemed authors for their valuable contributions and inputs to this volume. We also acknowledge Ms. Reema, *LaPrints*, New Delhi, India for composing the text and Studium Press LLC, Houston, USA for publishing this book on schedule. We are confident that the book will be useful to everyone interested in botany, applied plant sciences, biotechnology, environmental biology and plant biology.

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