Preface

Transgenic Plants – known also as Biotech Plants, Genetically Engineered Plants, or Genetically Modified Plants – have emerged amazingly fast as a boon for science and society. They have already played and will continue to play a significant role in agriculture, medicine, ecology, and environment. The increasing demands for food, feed, fuel, fiber, furniture, perfumes, minerals, vitamins, antibiotics, narcotics, and many health-related drugs and chemicals necessitate the development and cultivation of transgenic plants with augmented or suppressed trait(s). From a single transgenic plant (Flavr Savr tomato with a longer shelf-life) introduced for commercialization in 1994, we have now 13 transgenic crops covering 800 million ha in 25 countries of six continents. Interestingly, the 13.3 million farmers growing transgenic crops globally include 12.3 million (90%) small and resource poor farmers from 12 developing countries. Increasing popularity of transgenic plants is well evidenced from an annual increase of about 10% measured in hectares but actually of 15% in "trait hectares." Considering the urgent requirement of transgenic plants and wide acceptance by the farmers, research works of transgenic plants are now being conducted on 57 crops in 63 countries. Transgenic plants have been developed in over 100 plant species and they are going to cover the fields, orchards, plantations, forests, and even the seas in the near future. These plants have been tailored with incorporation of useful alien genes for several desirable traits including many with "stacked traits" and also with silencing of genes controlling some undesirable traits.

Development, applications and socio-political implications of transgenic plants are immensely important fields now in education, research, and industries. Plant transgenics has deservedly been included in the course curricula in most, if not all, leading universities and academic institutes all over the world, and therefore reference books on transgenic plants with a class-room approach are essential for teaching, research, and extension. There are some elegant reviews on the transgenic plants or plant groups (including a 10-volume series "Compendium of Transgenic Crop Plants" edited by two of the present team of editors C. Kole and T.C. Hall published by Wiley-Blackwell in 2008) and on many individual tools and techniques of genetic transformation in plants. All these reviews could surely serve well the purpose for individual crop plants or particular methodologies. Since transgenic plant development and utilization is studied, taught, and practiced by students, teachers, and scientists of over a dozen disciplines under basic science, agriculture, medicine, and humanities at public and private sectors, introductory reference books with lucid deliberations on the concepts, tools, and strategies to develop and utilize transgenic plants and their global impacts could be highly useful for a broad section of readers.

Deployment of transgenic crop plants are discussed, debated, regulated, and sponsored by people of diverse layers of the society, including social activists, policy makers, and staff of regulatory and funding agencies. They also require lucid deliberations on the deployment, regulations, and legal implications of practicing plant transgenics. More importantly, depiction of the positive and realistic picture of the transgenic plants should and could facilitate mitigation of the negative propaganda against transgenic plants and thereby reinforce moral and financial support from all individuals and platforms of the society. Global population is increasing annually by 70 millions and is estimated to grow to eight billion by 2025. This huge populace, particularly its large section from the developing countries, will suffer due to hunger, malnutrition, and chemical pollution unless we produce more and more transgenic plants, particularly with stacked traits. Compulsion to meet the requirements of this growing population on earth and the proven innocuous nature of transgenic plants tested and testified for the last 13 years could substantiate the imperative necessity of embracing transgenics.

Traditional and molecular breeding practiced over the last century has provided enormous number of improved varieties in economic crops and trees including wheat and rice varieties that fostered the "green revolution." However, these crop improvement tools depend solely on the desirable genes available naturally, creatable by mutation in a particular economic species, or their shuffling for desired recombinations. Transgenic breeding has opened a novel avenue to incorporate useful alien genes from not only other cross-incompatible species and genera of the plant kingdom, but also from members of the prokaryotes including bacteria, fungi, and viruses, and even from higher animals including mice and humans. An array of plant genetic engineering achievements starting from the development of insect resistance cotton by transforming the *cry* genes from the bacteria *Bacillus thuringiensis* to the present-day molecular pharming that enables the expression of *interferon-* gene from human in tobacco evidence for this pan-specific gene transfer.

Human and animal safety is another general concern related to transgenic food or feed. However, there is no reliable scientific documentation of these health hazards even after 13 years of cultivation of transgenic plants and consumption of about 1 trillion meals containing transgenic ingredients. Utilization of transgenic plants has reduced the pesticide applications by 359,000 tons that would otherwise affect human and animal health besides causing air, water, and soil pollution and also mitigated the chance of consumption of dead microbes and insects along with foods or feeds.

Gene flow from transgenic crop species to their cross-compatible wild relatives is a genuine concern and therefore required testing of a transgenic crop plant before deployment followed by comprehensive survey of the area for presence of inter-fertile wild and weedy plants before introduction of a transgenic crop are being seriously conducted.

Addition of novel genotypes with transsgenes in the germplasms is increasing the biological diversity rather than depleting it. Using the genetically engineered plants has also eliminated greenhouse gas emission of 10 million metric tons through fuel savings. In fact, 1.8 billion liters of diesel have been saved because of reduced tillage and plowing owing only to herbicide-resistant transgenic crops. Many transgenics are now being used for soil reclamation. Above all, cultivation of transgenic crops has returned $44 billion of net income to the farmers. Perhaps, these are the reasons that 25 Nobel Laureates and 3,000-plus eminent scientists appreciated the merits and safety and also endorsed transgenic crops as a powerful and safe way to improve agriculture and environment besides the safety of genetically modified foods. Many international and national organizations have also endorsed health and environmental safety of transgenic plants; these include Royal Society (UK), National Academy of Sciences (USA), World Health Organization, Food and Agriculture Organization (UN), European Commission, French Academy of Medicine and American medical Association, to name a few.

Production, contributions, and socio-political implications of biotech plants are naturally important disciplines now in education, research, and industries and therefore introductory reference books are required for students, scientists, industries, and also for social activists and policy makers. The two book volumes on "Transgenic Crop Plants" will hopefully fill this gap. These two book volumes have several unique features that deserve mention. The outlines of the chapters for these two books are formulated to address the requirements of a broad section of readers. Students and scholars of all levels will obtain a lot of valuable reading material required for their courses and researches. Scientists will get information on concepts, strategies, and clues useful for their researches. Seed companies and industries will get information on potential resources of plant materials and expertise for their own R&D activities. In brief, the contents of this series have been designed to fulfill the demands of students, teachers, scientists, and industry people, for small to large libraries. Students, faculties, or scientists involved in various subjects will be benefited from this series; biotechnology, bioinformatics, molecular biology, molecular genetics, plant breeding, biochemistry, ecology, environmental science, bioengineering, chemical engineering, genetic engineering, biomedical engineering, pharmaceutical science, agronomy, horticulture, forestry, entomology, pathology, nematology, virology, just to name a few.

It had been our proud privilege to edit the 23 chapters of these two books those were contributed by 71 scientists from 14 countries and the list of authors include one of the pioneers of plant transgenics, Prof. Timothy C. Hall (one of the editors also); some senior scientists who have themselves edited books on plant transgenics; and many scientists who have written elegant reviews on invitation for quality books and leading journals. We believe these two books will hopefully serve the purposes of the broad audience who are studying, teaching, practicing, supporting, funding, and also those who are debating for or against plant transgenics. The first volume dedicated to "Principles and Development" elucidates the basic concepts, tools, strategies, and methodologies of genetic engineering, while the second volume on "Applications and Safety" enumerates the utilization of transgenic crop plants for various purposes of agriculture, industry, ecology, and environment, and also genomics research. This volume also deliberates comprehensively on the legal and regulatory aspects; complies to the major concerns; and finally justifies the compulsion of practicing plant transgenics.

Glimpses on the contents of this volume (Volume 2: Transgenic Crop Plants: Applications and Safety) will perhaps substantiate its usefulness. This volume enumerates the application of transgenic technologies in crop plants for particular objectives in the first ten chapters. Biotic stress resistant, specifically insect resistant, transgenics have been developed and commercialized in several crops. An example with *Bt*-expressing cotton and maize alone, with current market share of about $3.26 billion substantiates their success and popularity (Chap. 1). Abiotic stresses, particularly drought, salinity, and temperature extremes, have always been difficult to manipulate. Still success stories are pouring in recently from works mainly in cereals and vegetables (Chap. 2). Herbicide-resistant transgenic plants (in cotton and canola) were first deregulated in 1995 and in 2008 more than 80% of the transgenic plants grown globally possess a transgenic trait for herbicide resistance. Chapter 3 details the present and emerging herbicide-resistant transgenic plants. Although the first transgenic trait was developmental, shelf-life in tomato to be precise, transgenics research for these traits are yet to make significant commercial headway but started producing encouraging results (Chaps. 4 and 5). Deployment of transgenic plants for biofuel, pharmaceuticals, and other bioproducts has been enunciated in three chapters (Chaps. 6, 7, and 9). Transgenic plants have been labeled as a culprit for potential threats to ecology and environment by a few groups of social activists. Chapter 8 addresses these weird concerns with suitable examples of utilization of transgenic plants for phytoremediation, biomonitoring, and the production of bioplastics and biopolymers for amelioration of ecology and environment. Plant genomics has emerged fast within the last three decades and facilitated fine-scale view of the plant genes and genomes. Transgenic plants have provided enormous resources for functional genomics studies and expected to play their roles as more plants systems and genes are targeted (Chap. 10). Scientists practicing transgenics are no less aware of the potential risks of genetic engineering than the few people with antagonistic views. Neither are the regulatory agencies at institutional, state, national, and international level regulatory agencies unaware of the steps to be involved for inspection, monitoring, and approval of transgenic plants for commercial use. Chapter 11 delineates all these aspects with examples from US and other continents and countries. Any original innovation or effort deserves recognition and also an incentive. The scope of patenting and intellectual property rights for materials owned and generated and methodologies implemented have been appreciated and enforced legally. These aspects related to transgenic crop plants have been discussed in Chap. 12.

The concluding chapter (Chap. 13) briefs the contributions and concerns with the compliances and compulsion of practicing plant transgenics for science and society.

We thank all the 41 scientists from nine countries for their elegant and lucid contributions to this volume and also for their sustained support through revision, updating and fine-tuning their chapters. We also acknowledge for the recent statistics that have been accessed from the web sites of Monsanto Company on “Conversations about Plant Biotechnology” and “International Service for the Acquisition of Agri-Biotech Applications on ISAAA Brief 39-2008: Executive Summary” and used them in this preface and elsewhere in the volume.

We enjoyed a lot of our Clemson–Purdue–Texas A&M triangular interaction, constant consultations, and dialogs while editing this book, and also our working with the editorial staff of Springer, particularly Dr. Sabine Schwarz who had been supportive since inception till publication of this book.

We will look forward to suggestions from all corners for future improvement of the content and approach of this book volume.

Chittaranjan Kole, Clemson, SC
Charles H. Michler, West Lafayette, IN
Albert G. Abbott, Clemson, SC
Timothy C. Hall, College Station, TX

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