

# Preface

The beginning of the 20th century saw the rediscovery of Gregor Mendel's work on the inheritance of phenotypic traits in plants. Mendel's work laid the foundations of modern, scientific plant breeding by enabling plant breeders to predict how traits brought into breeding lines would be inherited, and what had to be done to ensure that the lines would breed true. As a result, scientific plant breeding from the early part of the 20th century onwards brought huge increases in crop yield, without which current human population levels would already be unsustainable.

In the following decades, science made great strides in the elucidation of the molecular processes that underpin inheritance; genes, the units of inheritance, were linked with proteins, DNA was shown to be the material of inheritance, the structure of DNA was resolved, DNA polymerases, ligases and restriction enzymes were discovered, recombinant DNA molecules were created and techniques for determining the nucleotide sequence of a DNA molecule were developed.

Plant scientists were quick to exploit the new tools for manipulating DNA molecules and also made the astounding discovery that a naturally occurring bacterium, *Agrobacterium tumefaciens*, actually inserted a piece of its own DNA into that of a plant cell during its normal infection process. As a result, by the mid-1980s everything was in place to allow foreign genes to be introduced into crop plants and scientists began to predict a second green revolution in which crop yield and quality would be improved dramatically using this new technology.

All plant breeding involves the alteration of plant genes, whether it is through the crossing of different varieties, the introduction of a novel gene into the gene pool of a crop species, perhaps from a wild relative, or the artificial induction of random mutations through chemical or radiation mutagenesis. However, the term 'genetic modification' was used solely to describe the new technique of artificially inserting a single gene or small group of genes into the DNA of an organism; organisms carrying foreign genes were termed genetically modified or GM. Another decade passed before the first GM crops became available for commercial use. Since then, genetic modification has become an established technique in plant breeding around the world and, in 2004, GM crops were grown on 81 million hectares in 17 countries.

With the first decade of GM crop cultivation drawing to a close, it seemed appropriate to assess the successes and failures that have marked that decade, and the prospects of new GM crop varieties reaching the market in the coming 10 years. This book is intended for students who are studying plant biotechnology at degree level and for specialists in academia and industry. It covers the impact of GM crop cultivation in two leading