Chapter 17

Evolutionary Aside 17.1--Evolution and GM Plants—Artificial Selection and Hybridization

Two aspects of evolution must be considered when evaluating the potential environmental impact of a GM crop. The first case is artificial selection. Repeated applications of herbicides to an agricultural field leads to herbicide-resistant weeds; whereas repeated applications of pesticides can lead to pesticide resistance in insects and other pathogens. Artificial selection acts in the same way as natural selection. A mutation arises in a gene that confers resistance to a pesticide or herbicide. If the trait is dominant, all individuals with at least one allele will be resistant. For recessive traits, only homozygous recessive individuals will be resistant. Resistant individuals will have increased fitness and, over a number of generations, will increase in number.

In the second case, a transgene moves into a wild relative through hybridization. Hybridization is a key process in the evolution of new plant species. We explore the role of hybridization of plant species in genome evolution in more detail in chapter 24. Barriers to hybridization between related species occur at many levels, from pollination to meiosis. Pollen must be recognized for reproduction to occur. Although a hybrid may be viable, it may be infertile. A hybrid plant will not be able to reproduce if pairs of chromosomes cannot align in meiosis. If hybridization is successful and the transgene increases the fitness of the hybrid, the frequency of the transgene will increase in subsequent generations.