

BIOTECHNOLOGY IN AGRICULTURE: GOOD OR BAD?

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Lords of the Harvest. Daniel Charles. Perseus Publishing, Cambridge, MA, 2001. 368 pp., illus. \$27.00 (ISBN 0738202916 hardcover).

Many readers of *BioScience* will have heard Daniel Charles on National Public Radio; he is a technology correspondent for NPR and also reports for the *New Scientist*. The story of biotechnology in agriculture is one that Charles has followed for some years, and thus this book builds on his experience as a science reporter. The book is intended to provide a history of biotechnology in agriculture over the past two decades, including both the facts and the controversies surrounding genetically modified crops. Although it is an account that emphasizes

the human side of the story, Charles does provide enough coverage of molecular biology and the methods that are involved in creating genetically modified organisms to make clear how the techniques work and why. In fact, a number of Charles's explanations of the workings of DNA and of specific techniques are inspiring. For example, the explanation of codon usage through use of the metaphor of language is both apt and clear (pp. 45–46). As a result, the book is eminently accessible to the general reader and also very readable. I recommend it to both fellow scientists who seek an overview of developments in this field, as well as to nonscientists interested in technology, agriculture, the environment, and politics.

Lords of the Harvest is logically organized in a modified temporal order. Charles often pursues one particular facet of the story (or site of activity or major player) to a natural stopping point and then backtracks to pick up other facets. This inevitably produces some choppi-ness, but is no doubt better than a strict temporal ordering. Charles's recounting of the story emphasizes the enduring threads (i.e., those that remain with us today), but it also covers some of the more spectacular sidebars of genetic engineering (e.g., Calgene's efforts to bring long shelf-life tomatoes to commercial success). These are entertaining as well as highly informative: This tomato was fine in the lab, but a disaster in the tomato field.

Charles takes a laudably broad view of his subject, with the result that the reader develops an understanding of the broader context of agriculture and human affairs in general. Quite a bit of attention, for example, is devoted to traditional methods of improving crops (and other plants and animals) by artificial selection and controlled breeding. This provides a valuable perspective on how plants produced by modern biotechnology differ (and do not differ) from those that are produced by more traditional methods. Charles also treats the business context of agricultural biotechnology, making clear the impact that biotechnology (and biotechnology companies) has had on the seed industry. As a final example, the British

response to genetically modified organisms (GMOs) makes sense in the context of the tumult over mad cow disease that preceded it.

Charles's approach to the controversy over genetically modified organisms strikes me as quintessentially fair, and this is one of the book's great strengths. The author leads the reader to appreciate the higher motivations of some of those most actively pursuing the development of genetically modified crops, as well as of those who most strongly oppose them. He also makes clear, however, the inconsistencies of each stance and even the ulterior motives, when appropriate. Thus, we come to understand both that the leadership at Monsanto was convinced their products would improve the environment while feeding the world and that their opponents understood this as a thinly veiled cover for taking control of—and profiting from—the world's system of food production. Charles also does a very good job of capturing the stance of those (including, ultimately, himself) who find themselves somewhere in the middle: uneasy about the notion of corporate ownership of seeds and genes, but not quite convinced that GMOs spell the full catastrophe that their most vociferous detractors see as imminent.

The last chapter, "Epilogue: The Story," is a masterful essay that goes straight to the heart of the controversy. It is well worth reading even if one does not read the entire book. In it, Charles leads us through his own realization that, even as an unbiased reporter of the facts, he had to choose how to weave those facts into a story. The individuals whom he interviewed and on whose experiences the

book is based understood that this would be a vital choice. Would Charles present it as the story of better living through progress in science? As the story of unintended disastrous consequences because of faith in progress through science? Or as the story of agriculture as a close-to-nature enterprise being taken over by unnatural genetically modified organisms? To his credit, Charles conveys to readers the understanding that all of these stories are seriously flawed. He offers the valuable insight that, to some degree, the battle over genetically modified organisms in agriculture distracts us from the much larger-scale problem of agriculture's overall impact on planet Earth.

My one complaint about the book—and it is a small one—is that a number of introduced individuals who turn out to have only bit parts might well have been omitted. It is a complicated story to follow, and the plethora of names makes it a bit of a challenge to keep track of who is whom. On the other hand, Charles does a good job of making the individuals come to life as real people who bring their personal histories to the events that the book covers.

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