

Throughout the text three points come through as essential components in the implementation of the integrated pest management concept of pest control—an interdisciplinary approach to research; a new packaging of training in both philosophy and content and an expanded role for extension.

The reviewer recommends the book for its content, but perhaps more so for the reason that it stimulates reflection and forces one to a personal analysis of the questions—where are we going in pest control—and why?

F. L. MCEWEN
 Department of
 Environmental Biology
 University of Guelph
 Guelph, Ontario
 Canada N1G 2W

WORLD FOOD, PEST LOSSES, AND THE ENVIRONMENT, ed. by David Pimentel, 1978. AAAS Selected Symposium 13. Westview Press, Boulder, Colorado, 206 pp., \$16.50.

The American Association for the Advancement of Science sponsored the Symposium at which papers comprising the chapters of this book were presented. As stated in an Introductory Note, "—the objective of the Symposium was to examine the magnitude of food losses due to pests and to explore the impact of various pest control strategies on pests and the environment." The headings of the nine chapters give a general perspective of the attempted coverage:

1. Dimensions of the World Food Problem and Losses to Pests—David Pimentel and Marcia Pimentel.
2. Insect Pest Losses and the Dimensions of the World Food Problem—Ray F. Smith and Donald J. Calvert.
3. Impact of Plant Disease on World Food Production—J. Lawrence Apple.
4. Weeds and World Food Production—William R. Furtick.
5. Animal Pests and World Food Production—Roger O. Drummond, Ralph A. Bram and Nels Konnerup.
6. Post-Harvest Food Losses: The Need for Reliable Data—John R. Pedersen.
7. Of Millet, Mice and Men: Traditional and Invisible Technology Solutions to Post-Harvest Losses in Mali—Hans Guggenheim.
8. Environmental Aspects of World Pest Control—David Pimentel.
9. Post-Harvest Losses: A Priority of the U.N. University—Max Milner, Nevin S. Scrimshaw, and H. A. B. Parpia.

Predictably, the first and bottom lines of the book reiterate the need for population control before our numbers exceed finite resources. We are also reminded that current supplies would go further if distributed more

evenly. At present, a great disparity in caloric intakes occurs, resulting in great human misery and premature deaths, particularly in developing countries. The promise of increased food production through advanced technology and greater utilization of land, water and energy is viewed with caution and skepticism. Most suitable land is now in use and is steadily being depleted by erosion and non-agricultural enterprises. Water and energy are rapidly becoming more limiting. The impact of wide climatic fluctuations and pest outbreaks are of greater significance in the light of dwindling food reserves. And concern has been expressed that world-wide crop yields are declining rather than increasing.

The Symposium participants attempt to brighten this grim picture through suggestions for alleviating pest losses. However, they are seriously handicapped by lack of accurate data, having to settle for "guesstimates." Currently, our view of pest losses is very diffuse, consisting of a mixture of fragmentary scientific reports and anecdotal information. World-wide losses are estimated as 45% in a prefatory statement and 35% in Chapter 1. On the basis of the former, 30% are preharvest and 15% post-harvest. Proportioning these losses among the various categories of pests (weeds, insects, plant pathogens, vertebrates, etc.) merely extends the speculation. This is not to depreciate the importance of the educated guesses presented, but is to emphasize the basic need for more scientifically acceptable information. The reader may wish that more attention had been given to specific recommendations and costs for obtaining such information.

As typical for proceedings of symposia, the nine chapters comprise a mosaic of individualized presentations rather than a well-integrated contribution to symposium objectives. On the basis of depth and breadth, chapters are uneven and most present little new information or insights. Chapter 7, by Hans Guggenheim, is a notable exception, addressing a specific problem (post-harvest losses of millet to pests in Mali) in a realistic yet innovative manner, and including specific recommendations for problem alleviation. While the importance of social, religious and political constraints (as well as those of economics and ecology) are given general recognition throughout the book, Guggenheim dealt with them at a high level of specificity. While his analysis of post-harvest losses was broad and rough in some details, it seemed penetrating and realistic. His specific suggestions as to the integration of traditional farm storage into a larger scheme including modern storage facilities and altered marketing practices might well exemplify an approach worthy of much wider application.

Chapters 2 through 4 reiterate facts and views of general knowledge to pest control specialists, i.e., problems of unilateral approaches, negative interactions among interdisciplinary inputs, and promises of more effective results through integrated pest management (IPM). While heartening to hear prominent representatives of entomology, plant pathology and weed science together giving lip service to interdisciplinary cooperation, the reader may wonder if the presentations connote sufficient commitment to such cooperation.

This symposium comprised an excellent opportunity to (1) present IPM as but a conceptual component of

agroecosystem management; (2) to recognize the need for specialists to make their contributions within a common, sound framework of ecological as well as economic expertise; and (3) to make specific suggestions for obtaining a more adequate framework, i.e., a more scientifically acceptable understanding of the structure and function of agroecosystems in which to view each specialist's input. (Until the latter occurs, IPM will remain largely conceptual.) However, the opportunity was not utilized as effectively as desirable and thus leadership in IPM continues to flounder.

Chapter 5, dealing with interactions between primary and secondary consumers (animal pests) in contrast to the previous three chapters on plant-herbivore interactions, comprises an interesting and informative review (99 references) of the current status of animal pest control. Those readers who may question the wisdom of such all or non goals as "the elimination of diseases and pests" (p. 89) will perhaps take heart in the recognition on p. 81 that the potential repercussions of "eradication of tsetse from an area of Uganda and Tanzania have generally supported the view that tsetse eradication and the subsequent utilization of the land for livestock grazing must both be viewed in terms of a comprehensive plan of livestock development and land use." Hopefully, these and other plans for eradication will stem from an understanding of basic ecology as well as economic and sociological analyses.

In Chapter 8, David Pimentel again reminds us that pest control can backfire and can intensify, rather than alleviate, pest problems. While citing one example from biological control (the Indian mongoose introduced into West Indian Islands for rat control), the chapter is mainly devoted to the environmental impact of pesticides. Attention to this important matter is unquestionably appropriate; however, the problems involved might have been more effectively addressed if more attention had been given to ecologically acceptable means to use pesticides.

As serious as are the environmental insults from pesticide misuse, they do not appear more serious (and perhaps not as fundamentally disruptive) as various other managerial inputs. Pesticidally induced problems might be more objectively assessed in relation to specific agroecosystem structures which create the felt need for temporary alleviation from pest attack. While there is a great potential for reducing adverse environmental impacts from pesticides, a pragmatic analysis reveals that mankind needs all the tools at his disposal for both preven-

tion and temporary suppression of pest problems to meet current and projected demands on agriculture.

Understandably the problems of pesticides have been and are of great concern. However, the problems of no pesticides should also be addressed. Is it not time to take a reasoned, broad view of pests as their populations are influenced by current agroecosystem structures and seek optional agricultural systems even if these systems require some modification in current attitudes regarding temporary suppression tactics and perhaps substantial changes in geographical distribution of certain crops? It is this reviewer's judgment that the psychological effect of dwelling disproportionately on the negative aspects of pesticides has inhibited much needed research on the ecological impact of these chemicals, which are essential tools in agroecosystems as structured currently and for the foreseeable future.

The one-world theme runs strongly through all chapters and reaches its apogee in the final chapter devoted to the United Nations University's program addressing world hunger. As to be expected, the disparity among nations in food supplies is related directly to technological expertise. Four mechanisms for technological transfer as briefly discussed in Chapter 2 included (1) the International Plant Protection Center, (2) overseas centers in plant protection, (3) a consortium of crop protection institutions in the U.S. and (4) U.S. participation in the FAO/UNEP Cooperative Global Programme in integrated pest control. The United Nations University seeks not to duplicate these and other types of technological transfer programs but rather to identify and build a network of centers of competence in the developing world capable of developing and/or extending applications of technology to local problems. One of four areas selected for concentration is post-harvest food conservation and technology. One sign of maturity in these international efforts is the recognition of the importance of more effective use of traditional as well as the transfer of modern (foreign) technologies.

In summary, the symposium producing this book may be justified for its potential effect in stimulating greater and more effective interdisciplinary and international effort in the protection of food from pests. The book itself may prove a useful reference for those seeking to promote such efforts.

ROBERT L. RABB
Entomology Department
N.C. State University
Raleigh, NC 27650