The Case for Organic Farming

Organic Agriculture. Economic and Ecological Comparisons with Conventional Methods. ROBERT C. OELHAF. Allanheld, Osmun, Montclair, N.J., and Halsted (Wiley), New York, 1979. xii, 272 pp. $18.

Organic Agriculture is a critique and an espousal. It is a critique of chemical-intensive farming and the larger food system of which it is a part. It is an espousal of organic farming, understood as a method of producing crops and livestock, as a metaphysical connection between the human species and nature, and as a social philosophy. The book is best seen in contrast with two other kinds of widely read publication that undertake similar critiques or espousals. First there are those written in what might be called the Rodale Press style. Although their arguments are generally backed by research and empirical evidence, their references to organic methods of farming are popularized and tend to be uncritical, anecdotal, and testimonial (see for example *1*). This approach is not credibile to most natural and social scientists, nor to many commercial farmers. Oelhaf too addresses a lay audience, but he works from a more systematic framework and is more honest and circumspect in interpreting scientific and economic evidence. Another type of publication argues the positive aspects of organic agriculture or criticizes specific aspects of conventional agriculture by way of case studies (for example, the study of Klepper *et al.* on the economic and energy efficiency of organic vs. conventional farms [*2*] and that of Pimentel on implications of pesticide use [*3*]). In his well-documented book, Oelhaf incorporates such narrow-focus studies in a portrayal of the larger food system.

He sets the stage by devoting over one-third of the book to a critique of the prevailing mode of food production and distribution. (Two of these chapters also serve as useful primers on soil fertility and pest control.) He acknowledges the enormous production capacity of agriculture in the United States and its efficiency, narrowly defined. But from a wide range of evidence he builds an effective summary of the serious negative consequences of chemical-intensive farm technology. (Much of the evidence is controversial, since neither side in the "organic vs. chemical" debate holds a brief for the other's methods or findings.) These consequences can be summarized as: sharply diminishing returns (on the use of additional increments of soluble chemical fertilizers, for example); heavy dependence upon inputs that are becoming scarcer and more expensive (such as acidulated phosphate fertilizers); resource depletion (such as topsoil runoff and gene-pool deterioration); and "negative externalities" (such as groundwater pollution and the human and animal health effects of toxic pesticides).

Oelhaf's assessment of causality is on the right track. The dominance both of chemical-intensive farming and of industrially processed food is rooted in the functioning of the capitalist market system. The foremost factor in his account is market failure: consumers are poorly informed (for example, about long-term health effects of diet), and food prices do not reflect full social costs (for example, the pollution, health, and long-run resource depletion "costs" of chemical-intensive monoculture). Second, the logic of market competition has induced technological innovations that substitute relatively cheap inputs (such as chemical herbicides) for relatively expensive ones (such as labor and machinery for weed control). Impermanent price relationships (such as exist for fossil fuels, for example) or anomalous pricing (such as high labor costs coexisting with massive rural unemployment) induce technological biases that may not readily be reversed when conditions (or social objectives) change. A third factor is competition within the industrial sectors that develop and sell technologies (in the form of farm inputs) and in farming itself. Oelhaf emphasizes the farm level, where continuous innovation and a preoccupation with short-term profitability are necessary for survival (though obviously most American farms have not survived). While his explanation is compelling, it is incomplete. Two dimensions should be added. First, "Promethean ideology," an attitude that assumes human domination over nature, oblivious to the long-term consequences of human actions, has characterized American culture and economy virtually from the beginning (*4*). Second, the corporate industries on both the input and the output sides of the U.S. farmer have pursued profit through continuous capital accumulation, market expansion, and attempts to control the business environment (*5*). These attempts at control include the political environment, and one weakness of Oelhaf's account of the causes of chemical-intensive farm technology is its scanty treatment of the web of connections between "agribusiness" and government, for example in land-grant college research (*6*).

Organic agriculture differs in kind, not merely in degree, from conventional agriculture. But there is not one organic agriculture, there are several. Oelhaf identifies four traditions, each with distinct methodological and philosophical emphases. They are organic (in continental Europe, "biological"), biodynamic, French intensive, and eco-agriculture (the last is uniquely American and the most closely related to conventional large-scale commercial farming). All four are based on a holistic and biological conception of soil-crop-livestock relationships (as opposed to a reductionist, physical-chemical conception). The conception is popularly summarized as "Feed the soil life and it will feed the crops." All stress the avoidance of certain agricultural chemicals, conveniently (if not completely accurately) summarized as synthetic chemical pesticides, herbicides, and soluble chemical fertilizers. The diversity of these movements is such, however, that even their catalogs of forbidden methods differ significantly.

Oelhaf's description of diverse organic movements, his assessment of their major similarities and differences, and his recounting of recent efforts to establish a common ground through IFOAM (the International Federation of Organic Agriculture Movements) are well done, avoiding factional bias. But the key to the book is the last 80 pages, in which Oelhaf assesses the comparative economic efficiency of organic and conventional food production. He begins (perhaps with excessive formal economic apparatus, given the presumed lay audience) by reminding readers that economic efficiency involves an optimizing relationship between resource inputs and the resulting outputs. If organic methods produce qualitatively superior food and greater environmental "outputs" (less

soil depletion, lower medical costs due to the use of toxic chemicals) then a simple "dollars-per-bushel" cost comparison will understate the relative efficiency of organic methods vis-à-vis conventional methods (no empirical estimate of nonquantity "outputs" is made). To compare costs per physical unit of output, Oelhaf disaggregates to specific commodities and employs two different estimation techniques. He first argues that, under rather complex and not entirely credible assumptions, farm prices for organic produce should approximate production cost per unit. He mobilizes an intriguing array of original survey data for commodities ranging from organic rice to beef. For most of the observed commodities, organic growers receive 5 to 15 percent more than conventional producers. (Cases where differentials fall outside this range are noted and briefly explained.) The figures are heuristic; there is no claim to a perfect correspondence between observed prices and the true unit cost. (There is no obvious bias in his estimates.)

The second estimation technique is more conventional—direct observation of production costs. Oelhaf supplements the Klepper study (*2*) with his own (rather spotty) sample of U.S. producers of several commodities. However sound the methodology or details of the findings, it is intriguing that cost differentials measured from the production side correspond quite closely to those estimated from market price.

The skeptic might put little credence in these calculations, especially when Oelhaf extrapolates from the minuscule number of existing organic farms to an entire farm economy run on organic principles. (Which specific organic practices are involved in his calculations is unclear.) Certainly Oelhaf is aware of weaknesses in his case. Still, his findings reinforce other information to make a strong case for moving away from chemical-intensive agriculture and toward ecological agriculture. Virtually the entire thrust of U.S. agriculture research and public policy has been toward refinement of technologies grounded in the pesticide-herbicide-fertilizer nexus. The resource commitment to organic methods has been tiny. And yet a sizable and apparently growing number of organic farm operators have been able to compete, with only small price premiums. Meanwhile, the chemical-intensive technology has demonstrably contributed to health and environmental problems that are of increasing social concern. And the rising input costs and diminishing returns of such technology are clearly linked to the sharp rise in food prices of the past decade. There is no need to take the claims of any of the various organic movements as gospel. But perhaps it is time for the scientific and public policy establishments to commit resources to a serious and open-minded investigation of the claims of the movement. This is Oelhaf's concluding message. It is delivered without the self-righteous sermonizing that has limited the credibility of the movement up to now.

Although Oelhaf's policy recommendations (on research priorities, pollution taxes, and so on) make sense, he does not address basic political-economic questions whose answers are crucial for the prospects of conversion toward the organic future he espouses. Among those questions: In view of the power, objectives, and past behavior of the industries (and government agencies) that have shaped and promoted chemical-intensive technology, is it reasonable to expect a transformation of priorities just because it would be in society's long-run interest?

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References

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3. D. Pimentel, *Environment* **15**, 18 (1973).
4. W. Berry, *The Unsettling of America* (Sierra Club Books, San Francisco, 1977), chapter 1.
5. M. Perelman, *Farming for Profit in a Hungry World* (Allanheld, Osmun, Montclair, N.J., 1977); see also U.S. Department of Agriculture, Economic Research Service, ERS No. 542, 1974.
6. J. Hightower, *Hard Tomatoes, Hard Times* (Schenkman, Cambridge, Mass., 1973).

Marine Life Histories

Settlement and Metamorphosis of Marine Invertebrate Larvae. Proceedings of a symposium, Toronto, Dec. 1977. FU-SHIANG CHIA and MARY E. RICE, Eds. Elsevier, New York, 1978. xii, 290 pp., illus. $25.

The settlement of marine invertebrate larvae includes those events that lead to the termination of a pelagic life and the assumption of an attached or sedentary bottom existence. Settlement is a behavioral response initiated through tactile and chemosensory perception by larvae. Metamorphosis, on the other hand, is the morphological and physiological change that adapts the animal to a new way of life—that is, from a pelagic to a benthic existence and not uncommonly also from a herbivorous to an omnivorous or carnivorous diet.

The volume under review is concerned with the phenomena of both settlement and metamorphosis and consists of 20 papers originally read at a symposium held to honor Robert L. Fernald, former director of the University of Washington Friday Harbor Laboratories, on his retirement.

Somewhat over half of the contributions are reviews of recent work, five are reports of research heretofore unpublished, and those remaining combine some new observations with a summary of previous knowledge.

A wide assortment of marine bottom invertebrates are considered, including coelenterates, platyhelminthes, annelids, sipunculans, echiurids, phoronids, gastropod mollusks, bryozoans, cirripedes, echinoderms, enteropneusts, and tunicates. There are, however, some conspicuous omissions; for example, the decapod crustaceans are completely neglected, and the bivalve mollusks are only briefly mentioned. Oddly, notwithstanding the illustration of a lingulid iarva on the cover of the volume, brachiopods also are not considered.

The contributions concerned mainly with metamorphosis are largely or entirely descriptive and deal principally with morphological changes. This is not to suggest that these contributions do not sometimes deal with concepts or make inferences of more general or theoretical interest. Bonar's paper on opisthobranch mollusks, for example, presents an interesting and provocative discussion of developmental patterns, and Zimmer relates his findings on the structure of the preoral coelom in the phoronid actinotroch larva to the preoral body region of other deuterostomes.

There are several general summaries of morphological changes at metamorphosis in circumscribed taxa, such as those by Woollacott and Zimmer on cellularioid bryozoans and by Ruppert on turbellarians, a discussion of the fate of larval structures in echinoderms by Chia and Burke, and finally Cloney's long review and analysis of ascidian metamorphosis. There are also detailed original descriptions of metamorphosis of particular species, such as that of Reed on the ctenostome bryozoan *Bowerbankia gracilis*, Hermans's study on the opheliid polychaete *Armandia brevis*, and Potswald's description of several species of the genus *Spirorbis*. These descriptive papers are abundantly illustrated with either line drawings or electron micrographs. Particularly striking are some of Eckelbarger's scanning electron photomicrographs of whole sabellariid polychaete larvae.