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Consequences of Intensity

In many ways, the evolution of agricultural practice makes for a great success story. Thanks in large part to intense agricultural cultivation, the average person alive today has access to a great variety of affordable food despite living on a crowded planet.

Robert Sprinkle, a physician and an associate professor of public policy at the University of Maryland, is a longtime observer of issues at the intersection of politics and the life sciences. "We're a generally healthy population. There are millions of people eating, and they seem satisfied," says Sprinkle, but he cautions, "There are consequences to food production at such a high level with such intense methods."

Sprinkle points out that aspects of food production may simultaneously benefit large numbers of people and harm a subset of individuals in ways that may be subtle. For instance, a wide

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John Sherman

array of man-made chemicals is used in agricultural practice. Sprinkle compares how individual people might respond to exposure to such chemicals to the way patients respond to medicines: A dose of medicine that helps heal some people may harm others. When individual responses vary widely and the risks of exposure are relatively small, Sprinkle argues that looking at whole populations to analyze risks may not be enough.

Intense agricultural practices also raise questions about long-term sustainability. “There’s a pattern of producing food in regions that are comparatively unappealing for other things,” says Sprinkle. In the United States, people tend to live in the more temperate and wetter parts of the country, while much of the country’s cropland relies on water transported from the Colorado River or tapped from the giant Ogallala aquifer beneath the plains states, an aquifer whose water level has slowly fallen in recent decades.

Intense cultivation methods—in particular, concentrating large numbers of animals in small areas—raise potential risks “from the microbial point of view,” an area of particular attention for Sprinkle. In this area, he sees a large gap between what life scientists know about risks and everyday agricultural practice.

For example, life scientists showed in 1998 that the prevalence of deadly strains of *E. coli* in food is a direct consequence of feeding cattle grain. Grain is not a natural food source for cattle and ferments in the animals’ colons, making their guts more acidic. In response, *E. coli* can become temporarily—but impressively—acid-tolerant. If such *E. coli* contaminate food, and assuming they then escape cooking, these bacteria are more likely to survive the onslaught of acid in the

human stomach. Researchers showed that cattle fed hay, even after a grain diet, have less acidic colons and *E. coli* populations that are not as dangerous to people. “People have known this for a long time, but it hasn’t affected practice,” Sprinkle says.

Agricultural practices are typically not questioned until they

cause actual harm even if the practices are predictably risky. Practices that become outlawed in one species after a disaster are cheerfully continued in other species. Sprinkle points to “edgy practices,” such as allowing sick animals to be rushed to slaughter as long as their presumed illness is not known to affect human consumers. Another example is the use of bone meal in animal feed. The latest best guess for how bovine spongiform encephalopathy, or mad cow disease, arose in the United Kingdom is that a dangerously misfolded protein passed in bone meal first from species to species and then from cow to cow. Yet a wide range of animals in the United States are still permitted to consume bone meal, tallow derived from cattle, and other animal parts. “You get the impression when there’s a food safety issue that, however commonplace, the practices underlying it are a little risky all the time,” says Sprinkle. “It’s amazing how *seldom* we have a problem.”

International trade of animals is a time-honored way of increasing genetic diversity in livestock populations. But this, Sprinkle points out, is “a standard agricultural practice that is actually very dangerous. It’s not usually a problem but it could become a great problem.” For instance, avian influenza can spread among poultry flocks through trade. Especially when large numbers of animals live in close quarters, a virus can spread easily and, Sprinkle infers, have the chance to evolve into a version that could spread to humans. In fact, scientists have found that over the years mild forms of avian influenza viruses have infected poultry workers more often than realized.

“What we most should do is to think creatively about the risks we’re creating and make prudent choices,” says Sprinkle. “Intensity of agricultural practices has fed many people, but it introduces vulnerabilities that have to be understood biologically and politically—simultaneously.” —Karin Jegalian



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