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Risk in Perspective

How Should Pesticides Be Regulated?

"Any new pesticide legislation should specifically mandate risk benefit balancing in all phases of pesticide use."

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The Federal Fungicide, Insecticide and Rodenticide Act (FIFRA) along with the Food, Drug and Cosmetic Act (FDCA) govern how pesticides are used in the production of American food and fiber. FIFRA, recognizing the gains and dangers in pesticide use, is a risk benefit statute. The FDCA act, through the Delaney Clause, prohibits any food additive (including pesticides which concentrate in processed food) shown to induce cancer in humans or animals. It is a strict zero-risk statute. This issue of *Risk in Perspective* discusses why a coherent risk-benefit framework is appropriate for pesticide regulation. To achieve this goal, advances must be made in risk assessment of pesticides, benefit assessment of pesticides, and the delicate process of making value judgments about risk versus benefit.

Assessing Risks

Identifying the potential health risks of pesticide use is a function of risk assessment. The focus of most public debate about the risks of pesticide use is the hypothetical danger of eating foods with minute amounts of pesticide residues. Meanwhile, more important public health considerations, such as the health of workers, may be overlooked.

The predicted health risks from eating pesticide residues on foods are speculative. Cancer risk predictions are based on experiments where rats and mice are fed chemicals at or near the animal's "maximum tolerated dose" for their lifetime. There is a notable lack of scientific consensus about whether the tumors observed in such tests are relevant to predicting human cancer risks from consumption of small amounts of pesticide residues on foods. Noncancer effects of pesticides are also unlikely to be a major problem for consumers because doses are so tiny.

Often, predictions of cancer risk from eating pesticide residues are based on unrealistic assumptions about human exposure. Instead of basing risk estimates on measured amounts of pesticides in foods as eaten, EPA often uses the "theoretical maximum residue concentration" (TRMC). The TRMC assumes that (a) a pesticide is used on all acres of each crop for which it is registered, and (b) that pesticide residues are present at the tolerance level in every food for which the pesticide has a tolerance. Occasionally adjustment is made for the effect of washing or cooking food prior to consumption. Yet a recent study of eight "cancer–causing" pesticides found that actual human exposures in food had been overestimated by factors of 99,000 to 463,000 (and in five cases pesticide residues could not even be detected).

While the cancer risks to food consumers are speculative, the potential health risks for pesticide applicators and farm workers are better documented. Each year numerous poisonings occur to pesticide users, often due to application and harvesting practices that violate safety precautions. Interestingly, in California, the state with the most thorough system for reporting occupational disease caused by pesticides, many worker poisonings are caused by the use of sulfur, a pesticide widely used on "organic" farms. Recent studies suggest that the rates of some types of cancer among farmers may be associated with the frequency of herbicide use although farmers have a lower overall cancer risk than the general population. It is not yet known whether or not these associations reflect a cause–and–effect relationship. It is crucial that Congress examine whether EPA's occupational health program is adequate to protect the health of farm workers and applicators.

Regulators need to have the flexibility to consider risks to both consumers and workers, since new pesticide products that protect consumers may harm workers and vice versa. For example, we do not want to become so preoccupied with reducing the levels of pesticide residues in food that we encourage the development and use of products that pose greater dangers to farmers and applicators. As an example, consider the pesticide DDT, which was banned many years ago because of its toxicity to birds and fish. The substitutes to DDT, particularly certain organo-phosphate products, are less persistent in food and in the ecosystem but have proven to be more toxic to farmers. When these substitutes were introduced, a number of unsuspecting farmers were poisoned by the more acutely toxic substitutes for DDT.

Benefit Assessment of Pesticides

Most proposals to reform pesticide regulation and the Delaney Clause have embraced the distinction between negligible and significant risk, yet ignored the equally valid distinction between negligible and significant benefit. From a public health perspective, the benefits of pesticides to consumers are fundamental and need to be given a prominent role in new legislation.

Society often purposely imposes health risks on its citizens because of desired benefits (*e.g.*, the disinfection of drinking water with chlorination, the mandatory vaccination of children against diseases, and the compulsory draft for military service). This process is true of pesticides as well. Pesticides have direct public health benefits. For example, the loss of a pesticide may cause increased consumer exposure to the fungi or microbial agents that grow on crops in the absence of the pesticide. Some of the toxins produced by fungi, such as aflatoxin, are known to cause cancer in animals and humans. Fruits that are inadequately protected against pests have also been shown to have lower nutritional value (e.g., less Vitamin C in apples) than are fruits that are protected by pesticides. Moreover, when farmers are unable or unwilling to use man–made pesticides, they employ natural pesticides that can be just as toxic and carcinogenic as synthetic pesticides, even though they are less thoroughly tested for toxicity.

Pesticides also make an important contribution to the public health of America's poorest consumers by lowering the cost of producing food and thereby reducing the price of food to consumers. Were farmers unable to use pesticides, their crop yields per acre would decline and more scarce land would be used to produce the same amount of food (or the costs of using alternative methods of pest control would increase). Either way, farmers would be forced to charge higher prices for their products. A recent study in the journal Science indicated that the increase in food prices from bans of pesticides could be quite substantial. For poor families and households on fixed incomes, higher food prices increase the risk of malnutrition and its associated illnesses. In short, banning numerous pesticides may have the same effect on poor people as reducing their food stamp payments!

The loss of available pesticides would be particularly difficult for growers of fruits and vegetables. The resulting increases in prices for fruits and vegetables would encourage consumers to shift to other foods, which is predicted to increase the risks of cancer, heart disease, and other diet–related diseases. These unfortunate outcomes of higher food prices are more likely in low–income households, where sensitivity to price increases is greatest and knowledge of the health benefits of poor nutrition is less. If use of many pesticides is restricted, any reduction in risk from fewer chemical residues on foods is likely to be outweighed by the increases in risk to consumers, especially children in poor families. Congress should require EPA to consider and weigh food–price impacts when making registration decisions.

In the long-run, it may be possible to reduce or eliminate the use of some chemical pesticides through alternative farming methods such as integrated pest management, use of biotechnology products, and organic farming. Some of these alternatives are proving to be economical for some crops in selected parts of the country. At the present time, however, there is no question that the loss of numerous pesticides would cause all of us to pay more for food at the grocery store.

We should not shy away from considering the benefits of pesticides simply because the analytic issues are difficult and uncertain. They are no more complex than the risk issues. There is certainly no sound justification for phasing out consideration of the benefits of pesticides or for restricting benefit assessments to only existing pesticides. A growing body of scientific literature is available to EPA and USDA to support benefit assessments. It is clear, therefore, that EPA and USDA should be required by Congress to consider and weigh the benefits of pesticides when making registration decisions.

Risk–Benefit Balancing: Pragmatics and Ethics

The medical and public health communities recognize that both the risks and benefits of pesticides should be considered in registration decisions. Any new pesticide legislation should specifically mandate risk benefit balancing in all phases of pesticide use. Pesticide products with significant risks and negligible benefits should be banned. Products with significant benefits and negligible risks should be approved. We should not give much attention to products whose risks and benefits are both negligible.

When the risks and benefits of a pesticide are both significant, the regulator faces a difficult value judgment. Before approving use of a pesticide, the regulator should certainly assure himself or herself that promising alternatives to the pesticide are not available. If they are not, a conditional use may be the best course of action — assuming that the benefits to the consumer are significant and the health risks are acceptable (even if non–negligible).

There is nothing unjust or unethical about a society that accepts some degree of involuntary risk from pesticide use in exchange for benefits. If possible, it is preferable to let each consumer make this judgment. But our society certainly accepts a considerable amount of involuntary risk from technologies such as automobiles, airplanes, and electric power production in exchange for the substantial benefits these technologies offer the consumer.

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Further Readings

Joseph C. Reinert, Susan G. Slotnick, and Donn J. Viviani, "A Discussion of the Methodologies Used in Pesticide Risk-Benefit Analysis," *The Environmental Professional*, vol. 12, 1990, pp. 94-100.

Carl K. Winter, James N. Seiber, and Carole F. Nuckton (eds), *Chemicals in the Food Chain*, Agricultural Issues Center, University of California, 1990.

David Zilberman, Andrew Schmitz, Gary Casterline Erik Licthenberg, Jerome B. Siebert, "The Economics of Pesticide Use and Regulation," *Science*, vol 253, 1991, pp. 518-522.

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