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What Are the Indirect Costs of Pesticide Use?

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Particularly over the past fifty years, pesticides (insecticides, herbicides, and other chemicals used to control pests) have become key tools in preventing losses of food and fiber and in stemming the spread of disease. A recent review by Cornell University researchers (D. Pimentel and colleagues) estimated that in the United States alone, we spend $4.1 billion each year in purchasing and applying roughly 500,000 tons of pesticides (of 600 types). The costs of pesticide purchase and application can be considered ***direct costs;*** these direct costs are estimated to save $16 billion in crops each year.

While a return of $4 for every $1 spent in direct costs may seem very favorable indeed, one must also consider the ***indirect costs*** of pesticide use. These costs arise, for example, from negative impacts of pesticides on public health and the environment; by and large, society as a whole must bear these costs.

In an article cited below (see ADDITIONAL READING), Pimentel and his colleagues have attempted to estimate these indirect costs accruing to society at large. Obviously, such an endeavor is extremely difficult, but it is also clearly of great importance as we search for balanced, rational policies of pesticide use. The authors' conservative estimate (i.e., likely an underestimate) is a staggering $8 billion annually in indirect costs of pesticide use. The brief summary given here of the estimates associated with particular indirect costs helps us sense the scope and magnitude of the complexities associated with pesticide use in our society.

Public health impacts of pesticide use are estimated by Pimentel and colleagues to cost $787 million each year. These impacts arise from human pesticide poisonings and illnesses, and include costs of hospitalization, outpatient treatment, lost work time, treatment of pesticide-induced cancers, and fatalities. Pimentel and colleagues stress that chronic (vs acute) health effects of pesticides are particularly difficult to assess. ***Deaths of domestic animals*** (particularly cats and dogs) and ***contamination*** of meat, milk and eggs cost at least an additional $30 million annually.

Application of pesticides generally has the unfortunate side-effect of killing large numbers of beneficial natural predators and parasites of insect pests (this can include reductions in populations of insect-killing fungi from application of fungicide application against plant pathogens). Such ***loss of natural enemies*** often leads to additional pesticide applications and increased crop losses; such indirect costs are estimated at $520 million.

Also of great concern is the development of pesticide resistance in insect pests, plant pathogens, and weeds, the appearance of which is generally hastened by extensive use of pesticides. ***Cost of pesticide resistance*** arises from the necessity of applying pesticides in greater quantities to achieve a given rate of kill and from crop losses arising from ineffective pesticide application; this cost is estimated at $1400 million per year.

Another $320 million in indirect costs arises from ***honeybee and pollination losses;*** in addition to losses in pollination of crops, these include losses of honeybee colonies from pesticides, losses of honey and wax, loss of potential honey production, and losses in bee rental for pollination. ***Crop and crop product losses*** contribute another $942 million in indirect costs. These include crop losses (e.g., when crop growth, development, and yield are adversely affected by the pesticide itself, and when pesticide drift leads to injury on neighboring crops), crop applicator insurance, destruction of contaminated crops (e.g., watermelons in California in 1985), and government and private investigations and testing.

Additional indirect costs are associated with environmental aspects of pesticide use. ***Groundwater contamination*** is of major concern; monitoring and cleaning up such contamination costs $1.8 billion annually. As groundwater contamination illustrates, pesticides find their way into aquatic ecosystems all too frequently, where they directly kill fish and fish fry, and indirectly harm fish by eliminating essential foods such as insects. An additional indirect cost arises when fish are unmarketable because of high pesticide residues. ***Fishery losses*** are estimated at $24 million annually.

Wild birds are also subject to pesticide contamination and poisoning; one study cited by Pimentel and colleagues reports that more than 5000 ducks and geese died in five instances when carbofuran was applied to alfalfa. In 1985 alone, hunters spent $1.1 billion to harvest 5 million game birds ($216 per bird killed). These and other sources of information are used by Pimentel and colleagues to estimated indirect costs associated with ***bird losses*** at an astounding $2.1 billion. Finally, ***government regulations to prevent damage*** lead to indirect costs, which are estimated at $200 million annually.

Pimentel and colleagues stress that their efforts to estimate the social and environmental costs of pesticide use are conservative. For example, they are unable to even guess at any indirect costs associated with destruction of soil microorganisms. But even the conservative estimate of $8 billion annually in indirect costs is eye-opening; it is roughly double the estimated direct costs of pesticide use. This certainly bolsters the contention of many that we as a society are receiving far less return on dollars spent on pesticides than is generally acknowledged. More judicious use of pesticides by well-educated and informed applicators, of course, could substantially reduce these indirect costs.

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Additional Reading

Pimentel, D., H. Acquay, M. Biltonen, P. Rice, M. Silva, J. Nelson, V. Lipner, S. Giordano, A. Horowitz, and M. D'Amore. 1992. Environmental and economic costs of pesticide use. BioScience, Volume 42 (No. 10, November), pages 750-760