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Pesticides: How Safe and How Much?

John R. Schaub
(202) 219-0469

Pesticides are used extensively in agriculture to protect commodities from damage caused by insects, disease, weeds, and other pests. Their use in the production and storage of crops is profitable. They return more to farm income than they cost. However, people who are concerned about the environment question the safety of pesticides in relation to food, water quality, farm workers, and endangered species.

Changing the types and amounts of pesticides that can safely be applied requires thoughtful consideration to the costs, benefits, and risks involved, both to farmers and consumers. Costs can be considerable. For example, one study from USDA's Economic Research Service on the soil insecticides used on corn and soybeans states that a ban would cause an economic loss of \$2.2 million annually after 5 years. Another study shows that a ban on soil fumigants would raise consumer prices for fresh tomatoes 53 percent and for potatoes 11 percent.

These are some of the environmental issues:

- **Food Safety**—Studies continue to show that people rate pesticide residues as their top food safety concern. Reports by scientists that show pesticide residues in foods as insignificant health risks do not allay these fears. Even the Food and Drug Administration's residue surveillance monitoring program that showed that two-thirds of the food tested had no pesticide residues and that less than 1 percent were over established tolerances for pesticides are not dispelling consumer concerns. Nor are studies that show food-borne organisms, such as salmonella or aflatoxin, are far more critical health

concerns than pesticide residues, calming consumers fears.

- **Water Quality**—Increasingly, pesticides are being found in ground and surface water. More are being discovered, for a number of reasons, including more refined water testing. Also, large quantities of pesticides are currently being used—over 95 percent of corn and soybean acres are treated with pesticides annually. Pesticides have been used for long periods of time, which is why they may have reached receiving waters. The damage, if any, caused by various levels of contamination of ground or surface water with pesticides is not known, but the existence of pesticides in ground water often is sufficient reason to cause public concern.

- **Farm Worker Safety**—Workers entering fields where pesticides are used has been an issue of public concern for a number of years, especially in California. Farm workers who mix, load, or apply pesticides are exposed to potential health hazards when performing these operations. The Environmental Protection Agency (EPA) requires, for some pesticides, special procedures such as posting warning signs, restricting field reentry, wearing protective clothing, and using respirators or closed tractor cabs. Also, there are various educational efforts on the part of the extension services and the pesticide industry to instruct workers on how to avoid exposure to pesticides.

- **Endangered Species**—The Endangered Species Protection Act was established a number of years ago but has not been fully implemented by EPA. Currently, EPA is drafting and circulating for comment bulletins that contain information on specific endangered species. The bulletins include information on species'

habitats and pesticides that could adversely affect them. Proposals could involve restricting or eliminating the use of certain pesticides in habitats occupied by endangered species.

The implementation of this act raises a number of difficult problems. It is extremely complex to identify occupied habitat and the pesticides that could adversely affect species. Furthermore, it is not clear that pesticide use is a more detrimental factor than loss of habitat. While it is not expected that implementation of the Act will have a large negative impact on agriculture in aggregate, it appears it could negatively affect individuals who are farming in areas where endangered species live.

In the last Congress, a variety of legislative issues were raised but not resolved. It is possible that many, if not all, of these issues will be raised by future Congresses. Some of the issues included revising the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to more quickly address pesticide reregistration, dealing with pesticide export reform, mandatory recordkeeping and reporting of pesticide use, and replacing the Delaney Clause (which prohibits the presence of any known tumor-causing pesticide that concentrates in processed food) with a negligible risk concept.

These are some of the legislative issues:

- **Shorten Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) processing time**—FIFRA is the legislative authority that enables the EPA to register and regulate pesticides. It requires the EPA to periodically review pesticide registrations. In addition, FIFRA provides the mechanism to cancel or suspend a pesticide registration if cancer, birth defects,

The author is chief of the Agricultural Inputs and Production Systems Branch, Resources and Technology Division.



Farmers use pesticides in production as well as storage to protect crops from the damage caused by pests, weeds, and diseases.

mutations, etc., are discovered to be associated with the pesticide or its derivatives. Currently, when such a risk is discovered and confirmed it can take 4 years or more for EPA to remove the pesticide from the market. Amendments to FIFRA were being discussed that would shorten that time period.

- Pesticide Export Reform—A bill was introduced, but not passed, that would have prohibited the export of pesticides not registered or that have been suspended or canceled in the United States. The intent is to protect foreign users of U.S. manufactured pesticides, to prevent U.S. farmers from competing against foreign farmers having access to less expensive pesticides, and to lessen the opportunity for commodities to be imported that have residues of undesirable pesticides. The cost of such a regulation is subject to debate and is being explored. There is a question, however, whether the bill, if adopted, would accomplish all its purposes. Technology associated with the production of banned or suspended pesticides is often well known and not

complex. Thus, the pesticides could be produced abroad. Also, to insure increased protection for U.S. consumers, monitoring and testing as well as other preventive measures would have to be increased with a likely high administrative cost.

- Mandatory recordkeeping and reporting—Several bills were introduced to include mandatory reporting and recordkeeping of pesticide use in the 1990 Farm Bill. The outcome of the debate was that pesticide users are to keep records of their use of restricted-use pesticides (RUP's) and that USDA, in cooperation with the EPA, will annually survey applicators about their use of RUP's. A restricted-use pesticide is one that cannot be applied except by a certified applicator or someone under the direction of a certified applicator. To obtain certification, an applicator must complete a 1-day course conducted by State Extension Services. From an informational and research viewpoint, mandatory recordkeeping for RUP's provides only a portion of the data base required for analysis.

- Negligible risk—Replacing the Delaney Clause with a negligible risk concept (see "The Delaney Clause: New Interpretations," elsewhere in this issue) would allow a tumor-causing pesticide to be present in processed food, providing the risk was negligible. Negligible risk is generally being defined as one additional incidence of contracting a tumor per one million people over a 70-year life span. Currently the probability of incurring cancer from any source over a 70-year life span is about 1 in 4.

The Need to Analyze Costs

In an analysis of the costs of dealing with pesticide issues, four items of information are basic: How extensively are specific pesticides used? How do alternative pest control methods affect yield and quality? How much do alternative pest control methods cost? How are product prices affected by alternative production methods and how willing are customers to pay such prices?

- Pesticide use data—It is important to know where and to what extent a pesticide is used in order to assess the cost and price effects associated with the use of an alternative. The most effective way to obtain this information is through a survey of users. Although other methods such as soliciting expert opinion have been used, they leave much to be desired. The major drawback to the survey approach is the high cost. Within USDA, this approach is being expanded.

- Yield and quality effects—If the solution to a pesticide issue, regardless of the cause for concern, is the use of an alternative pest control (another pesticide, biological or cultural control, or some combination of alternatives), it is necessary to compare yield and quality effects of the alternative with the original method. Analyzing the impact of total production requires more than information about yield per acre. Alternative control measures can achieve high yields per acre but may require a fallow period or time to grow a cover crop. Such practices reduce the quantities of crops that can be produced unless more resources of land, labor, and other inputs are devoted to the production process.

Information about how alternative pest controls affect agricultural production often is not readily available under actual growing conditions. Test plots provide some insight but are limited and require expert judgment to translate results to actual agricultural production. Expert judgment can be criticized as being subjective, which reflects on how people may view the credibility of the data, but good alternatives (including other pesticides) do not appear to exist for all pests. Test plot data are generated under carefully controlled circumstances, such as hand weeding. And harvest is often done by hand or with the use of small machines which enhance yields. Under actual growing conditions, test plot data may not allow for control of other important factors such as soil fertility and individual farmer ability.

- Cost of alternative methods—Costs of alternative pesticides and alternative forms of application can be obtained

from a variety of sources. Such information comes from surveys of pesticide prices conducted by government agencies or private sources that develop information in a variety of ways. This information is critical to an analysis and generally can be obtained. The costs, however, of non-chemical controls, such as rotations, may not be readily available.

- Demand relationship—The effect of alternative production levels upon prices (how prices respond to output changes and consumers' response to changing prices) is an important component of an analysis. In other words, how much will the price of a commodity change given a certain percentage change in output. Often this is referred to as a consumer effect and it usually is the largest impact. For many agricultural commodities, in the short run, small changes in output lead to large changes in price. Because the consumer effect is usually the most important impact, conclusions can often hinge on the values used. While the relationship between output and prices can be quantified, economists do not always agree on actual numbers.

Benefit Analysis Needs

FIFRA requires a risk/benefit analysis when a pesticide registration decision is made. FIFRA's "benefits" refer to those that come from the use of the pesticides or from the antithesis—the cost associated with not using the pesticide. "Risk" refers to the health or environmental impact of pesticide use, or benefits derived from not using the pesticide.

Risks may take many forms including residue levels in food, contamination of water, and effects on non-target species. Generally risks are hard to quantify. It may be relatively easy to identify a residue or water contamination level, but it is much more difficult to identify what the residue or contamination level means in terms of life span, health, days of work missed, or other factors. It is unlikely that definitive risk data will become available in the near future. Consequently, the risk element will continue to be the weak link in any risk/benefit analysis.

Economic Analysis of Specific Pesticides

Over the past 10 to 15 years, a large number of studies have been conducted on the potential economic implications of pesticide regulatory actions. The results have been highly variable, ranging from little economic impact in the case of a pesticide such as toxaphene, to large impacts for the herbicide trifluralin (Treflan). Briefly, these are the results of three recent studies:

- Potential bans on corn and soybean pesticides—ERS researchers Craig Osteen and Fred Kuchler found that the loss of certain corn and soybean pesticides could increase U.S. agricultural production costs, crop prices, farm incomes, and consumer expenditures. In this study, the losses to consumers outweigh gains by producers. The greatest losses would result from banning all triazines, such as atrazine—\$3.3 billion to \$3.8 billion annual loss, banning acetanilides (*Dual* and *Lasso*)—a \$2.1 to \$2.7 billion annual loss, and banning soil insecticides—a \$2.2 billion annual loss. These losses of \$2 to \$4 billion compare with the average farm value for both corn and soybeans of \$26 billion.

- Banning Phorate and Terbufos—Phorate and terbufos are soil insecticides used to control various soil insects. The following statement is in the executive summary of a draft report of USDA's Phorate and Terbufos Assessment Team. "The economic impact on producers and consumers of agricultural products in the United States caused by the cancellation of phorate would be an annual loss of \$21 million. Corn and potato producers would sustain the greatest economic loss if phorate was no longer available. Losses would be less than 1 percent of the value of farm production for these crops. The economic impact caused by the cancellation of terbufos would be \$127 million, including a loss of \$118 million to corn producers and consumers. The aggregate economic effect on producers and consumers caused by the cancellation of both phorate and terbufos would be an annual loss of \$168 million."

• Banning soil fumigants—Joseph R. Barse and Walter Ferguson, ERS researchers, reported, “Producers who formerly used fumigants to control soil-borne pests would be worse off by \$100 million to \$200 million per year, despite higher prices, if soil fumigants were banned for citrus fruit, potatoes, tomatoes, tobacco, and a few other crops, because crop output would decline sharply. Producers who did not use fumigants would be better off by \$400 million to \$800 million per year because of higher product prices received. Consumers would pay \$3 billion to \$5.1 billion more, annually, in the short run. Average annual consumer prices would rise 53 percent for fresh tomatoes, 11 percent for potatoes, 8 percent for canned tomatoes, and 4 percent for cigarettes. Loss of fumigants would have no effect on prices of cotton products, citrus fruit, or frozen juice. This report estimates the economic effects on producers and consumers of certain crops if the use of all soil fumigants were lost because of EPA cancella-

tion, suspension, or manufacturer withdrawal.”

Future Events

Over the next few years, environmental and health concerns will be receiving public attention, and demands will be placed on the public and private sector to address these concerns. Environmental concerns will focus on water contamination by pesticides and nitrates, and the effects of pesticide use on economically viable pest management options and adverse impacts on non-target species, especially the endangered. Human health concerns will be for food safety with attention given to pesticide residues, food-borne organisms, and natural toxicants. Worker safety also will be an issue.

Public concerns will lead to new programs. Already within the USDA, water quality and food safety initiatives are being developed in cooperation with other government agencies. The Water Quality Initiative researches water contamination and ways to reduce it. The Pesticide Initiative measures pesticide

residue levels in food and develop ways to reduce them. The initiatives also will study the economic implications of these measures. Both water quality and food safety concerns will place pressure on the pesticide regulatory process. It can be expected that the National Agricultural Pesticide Impact Assessment Program (NAPIAP), a cooperative Federal/State program to generate information and analyses for pesticide assessments, will be revitalized in some form, and ties with EPA will be strengthened. Public awareness of environmental quality and human health has heightened and will continue to be strong in the future. ■

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- Osteen, Craig and Fred Kuchler. *Potential Bans of Corn and Soybean Pesticides: Economic Implications for Farmers and Consumers*. AER No. 546, ERS, USDA, April 1986.