Addressing Pesticide Residues

Lettuce Provides Indication of Pesticide Use and Residues

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Pesticides make an important contribution to high U.S. farm productivity and a low-cost, plentiful food supply. Some scientific evidence shows that pesticide residues are not a serious risk to the safety of the food supply. Yet there are widespread concerns based on contrary evidence about pesticide use and toxicity to humans, chronic health effects, food safety, water pollution, and threats to wildlife. Consumers frequently rank pesticide residues on food as the number one food safety risk.

These concerns, together with pressures to regulate and restrict agrochemical use in U.S. agriculture, are stimulating the search for alternative farming methods. Improved pesticide-application methods and techniques such as the close monitoring of pest populations, crop rotation, and developing a plant’s genetic resistance to specific pests offer the possibility of limiting pesticide use while preserving the productivity and economic viability of U.S. farms.

USDA’s Pesticide Data Program (see box) gathers information on pesticide residues remaining on produce and on growers’ use of pesticides. These data offer an opportunity to study the relationships between pesticide use on the farm and the residues found on produce. They will also help in examining the evolution of production practices in agriculture.

Lettuce Monitored for Pesticide Residues

Pesticide use and residues on lettuce are of particular food safety interest. Lettuce is consumed fresh, so residues that may remain on the harvested produce are not removed by processing. Pesticide nearly all lettuce acreage in four States surveyed received one or more applications of pesticides—a total of 62 chemicals were applied.

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USDA Surveys Pesticide Use

In 1990, USDA initiated the Pesticide Data Program, a new survey program focusing on chemical use in agriculture. The program responds to heightened public concern regarding the environmental and health consequences of chemical use by improving the quantity and reliability of available pesticide use and residue information.

Fruit and vegetables were among the first crops targeted for evaluations. Vegetable, melon, and strawberry producers were surveyed in Arizona, California, Florida, Michigan, and Texas. (To avoid duplication with State pesticide reporting rules, the California survey did not include questions on pesticide use. Therefore, California is not included in this study.) These States account for more than half of total U.S. vegetable production.

Four USDA agencies administer the program to collect and analyze pesticide use and residue data:

- The National Agricultural Statistics Service is responsible for collecting information on chemical use, other pest-control methods, and cost and return data from U.S. fruit and vegetable producers.
- The Economic Research Service collaborates with NASS in designing the survey program and uses these data to assess the economic effects of alternative pesticide regulations and of policies and practices which aim to reduce chemical use.
- The Agricultural Marketing Service implements a pesticide-residue monitoring program for specific fruit and vegetables at terminal markets and wholesale distribution centers.
- The Human Nutrition Information Service is developing methods to estimate chemical exposure through food consumption from the chemical residues found on food.

The Environmental Protection Agency, Food and Drug Administration, and U.S. Geological Survey also participate in the survey effort.

residues are detected in lettuce and other leafy vegetables more often than in other fresh vegetables. And lettuce is a major fresh-market vegetable crop.

In 1990, the Food and Drug Administration (FDA) found detectable pesticide residues in 55 percent of domestically produced lettuce samples. Two percent contained residues exceeding tolerance levels. (The tolerance level is the legal limit of a chemical residue, specified in parts per million, permitted on a food sold in interstate commerce. These limits are set by the Environmental Protection Agency (EPA) and enforced by the FDA for both domestically produced and imported food.) Residues were found in 50 percent of domestic spinach and Swiss chard samples, 70 percent of domestic mustard, and 67 percent of domestic turnip greens sampled. In contrast, only 38 percent of domestic tomato and 27 percent of domestic cucumber samples tested positive for residues.

In 1990, USDA’s National Agricultural Statistics Service (NASS) and Economic Research Service (ERS) designed a new survey program and began collecting data on the use of pesticides on vegetable and fruit crops. The following year, USDA’s Agricultural Marketing Service (AMS) began collecting data on pesticide residues on produce. These data allow us to compare pesticides used on crops with residues found on foods.

In the first year of testing, AMS monitored 13 pesticides used in lettuce production (table 1). Seventeen percent of the lettuce samples tested positive for residues, and 9 of the 13 chemicals were detected. Residue concentrations in seven of the nine cases were below the established tolerance levels. These were acephate, diazinon, endosulfan, permethrin, and methamidophos (insecticides); DCPA (a herbicide); and DCNA (a fungicide).

Residues of two chemicals not permitted for use on lettuce were also found. One of these chemicals, the insecticide chlorpyrifos, was applied in 1990 but is not registered...
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for use on lettuce. (Registration is the EPA regulatory process certifying the conditions under which a pesticide can be used on a particular crop without posing health risks to farmers or consumers. A chemical may not be legally applied to a crop unless it is registered for that use.) The other chemical, DDE, is a byproduct from the breakdown of DDT, a pesticide in common use during the 1950's and 1960's. Although DDE is not applied as a pesticide and DDT was banned in the United States in 1972, the persistence of DDT in the environment may account for the presence of low levels of derivatives such as DDE still being found on food.

Survey Finds Pesticide Use Widespread, Varied

U.S. lettuce production is concentrated in a handful of States on a relatively small number of large operations. California is the Nation's leading producer, followed by Arizona and Florida (fig. 1).

In the NASS/ERS survey of agricultural chemical use on vegetable crops, growers in Arizona, Florida, Michigan, and Texas indicated which pesticides they use in growing lettuce. Because State regulations require growers in California to periodically report all of their pesticide use to that State's Environmental Protection Agency, these growers were not asked to participate in the pesticide use portion of the survey. Michigan and Texas, relatively minor lettuce producing States, were included in the survey because of their importance to overall vegetable production and value.

Nearly all lettuce acreage in the four States surveyed received one or more applications of pesticides, but chemical use varied widely (table 2). Growers there applied a total of 62 chemicals to control pests on lettuce. Arizona growers were the primary users of acephate, diazinon, and endosulfan. Only Texas growers applied DCPA. Florida growers relied heavily on methamidophos. Permethrin was used in all four States. None of the surveyed growers applied the fungicide DCNA, which was detected in AMS residue testing. However, California State records show that DCNA is applied there.

This diversity of chemical use patterns suggests that applying the same restrictions to particular chemicals in all States could change where lettuce is produced and its seasonal price and availability. As pest problems differ by region, so does the availability of effective and economically feasible alternatives should one chemical be removed. And, because the growing season for lettuce varies across regions, restrictions on chemical use also may affect seasonal supplies.

Among the pesticides detected as residues by AMS, permethrin was applied to the most lettuce acreage—over three-quarters of the area planted. Endosulfan was applied in the largest quantity. Most of this was applied in Arizona (42,199 pounds), where 58 percent of the lettuce crop was treated. Other pesticides used in large quantities were diazinon and acephate, most of which were applied to the Arizona crop. Farmers applied diazinon on more acres than acephate, but they applied acephate at higher rates per acre.

Chlorpyrifos was applied to a small percentage of total lettuce acreage in the four States, in apparent violation of EPA regulations. (It is registered for use on other vegetable crops, such as broccoli, sweet corn, onions, and cabbage.) The greatest use of this chemical on lettuce occurred in Texas and Michigan.

With few exceptions, these applications data are consistent with AMS pesticide-residue findings. The grower surveys confirmed the application of most of the pesticides detected as residues in the AMS testing program, including chlorpyrifos. Lettuce producers in Arizona, Florida, Michigan, and Texas applied all but one (DCNA)
of the chemicals used and detected as residues.

**Growers Experiment with Alternatives**

Vegetable producers in the survey used 30 different practices in addition to pesticides to control pests. Virtually all lettuce producers used some conventional non-chemical practices, such as mechanical cultivation or hand hoeing for weed control. An estimated 30 percent employed at least one other nonchemical alternative to control pests.

Growers reported some innovative approaches to pest control on vegetables, such as using a tractor-mounted sweeper to vacuum bugs off the crop. Farmers also reported using cultural methods such as crop rotation; biological methods such as releasing “beneficial” insects which prey on insect pests, planting pest-resistant crop varieties, and applying various microbial agents; and nonconventional chemical options such as applications of insecticidal soaps, placing pheromone traps to keep track of pest populations and disrupt mating insects, and pest scouting to determine treatment thresholds for the application of traditional pesticides.

Some alternative pest-control methods have become so popular that they are no longer considered “alternative,” but rather are accepted as part of the conventional pest treatment relied upon by most growers. Bacillus thuringiensis (Bt, a bacterial insecticide) is one example of such a success story. The most widely used biocontrol agent, Bt accounts for an estimated 71,759 acre-treatments in lettuce in the four survey States. Because this bacteria is toxic to insect pests and not to humans or beneficial insects, Bt is an alternative to conventional chemical pesticide materials. Its use has become so widespread that it is now considered a conventional pest-control material by most farmers.

**Alternative Methods Complement Pesticide Use**

It is frequently asserted that adoption of alternative pest-control practices will reduce the level of chemical use in agriculture. Alternative practices are in many cases intended to substitute for chemical controls. The expected reduction in expenditures on pesticides provides the farmer with an incentive to adopt the alternative because, if yield remains constant, adoption will increase farmers’ profits.

However, chemicals and alternative methods are being used to complement rather than substitute for one another in lettuce production, according to survey results.

This is particularly evident among the large farms. Large farms applied more total pounds of pesticides per acre than did smaller farms. At the same time, these farms were more likely to have adopted alternative pest-control practices.

Larger farms may be experimenting with new methods of pest control without taking the next step of reducing pesticide use. Greater cash-flow and easier access to capital among large farms may explain their tendency to innovate in this way.