The Connecticut Agricultural Experiment Station, New Haven

Pesticide Residues in Produce Sold in Connecticut

BY LESTER HANKIN

Bulletin 863

October 1988

A cooperative study by The Connecticut Agricultural Experiment Station and the Food Division of the Connecticut Department of Consumer Protection

Pesticide Residues in Produce Sold in Connecticut

BY LESTER HANKIN

Connecticut citizens are interested in pesticides and their use and especially the amounts that may be present in foods. The Experiment Station in cooperation with the Department of Consumer Protection each year tests produce sold in Connecticut. The produce was grown in this State, other States, and foreign countries.

Pesticides registered for specific crops may be legally used so long as the applications are not closer than the time specified on the label. Testing determines if pesticide residues are present and if they are above allowable tolerances established by the U.S. Environmental Protection Agency (EPA)(2).

In accordance with the charter of this Station to publish results of analysis (4), I now present information on pesticide residues detected in produce sold in Connecticut in 1987.

METHODS

Samples were collected at farms, roadside stands, and food stores by an inspector of the Connecticut Department of Consumer Protection and delivered to the laboratory within 24 hours of collection.

Products were tested for pesticide residues by official and recommended methods (6,7,9,10), which involve extraction, cleanup and quantitation using either gas chromatography or high performance liquid chromatography. The produce is first chopped or ground in a food chopper to a homogeneous mixture. A weighed portion is mixed thoroughly with an organic solvent and filtered. The filtrate, containing any pesticide residues, is concentrated to a small volume and placed on a column containing an adsorbant. The filtrate is moved through the adsorbant with a second organic solvent. Impurities are retained by the adsorbant while residues, if present, are eluted. The eluate is concentrated and a portion tested by gas or liquid chromatography. Residues present are identified and quantified. The method used identifies over 50 residues (6,7,9,10).

Sulfites were tested by the Monier-Williams method (9).

RESULTS AND DISCUSSION

A total of 283 samples of 44 different types of produce were tested for pesticide residues (Table 1). The Table lists the product tested, the number of samples examined, the number containing residues, residues found, the number of samples that contained that residue, and the concentration in parts per million (ppm) found.

Although traces of pesticides were found in 122 (43%) of the samples tested (Table 1), no samples contained residues above allowable tolerances. It should be noted, allowable tolerances for the same pesticide may vary from crop to crop. For example, the tolerance for Captan on strawberries is 25 ppm, 50 ppm on apples, and 2 ppm on carrots. Three samples, however, contained pesticide residues for which there is no allowable tolerance; in effect a zero tolerance. These were two samples of parsley that contained residues of DDT and DDE and one sample of McIntosh apples, all from Connecticut, that contained Dacthal.

Table 2 lists all the pesticides found on the crops tested, synonyms if available, their use, and number of times each residue was detected.

Imidan and Guthion were the most frequently detected pesticide residues on apples, whereas captan, kelthane, and thiodan were often found on grapes. On strawberries, Thiodan and Dacthal were common.

Two or more different residues were detected in 25 samples (Table 1). Four different residues were detected in two samples of McIntosh apples and one sample of strawberries. The number of times any one pesticide residue was detected on the samples examined is shown in Table 2. Thiodan was detected more than any other pesticide. Others frequently found were Captan, Imidan, Dacthal, and Guthion.

Sulfites are permitted by the Food and Drug Administration to be used on harvested grapes to prevent fungal and microbial growth. Not more than 10 ppm of sulfites is allowed. All grapes were tested for sulfites and met FDA standards.

Table 3 lists the number and source of the samples. Grapes, apples, and strawberries were the products most frequently examined. Overall, 8%, 19%, and 72% of the samples were from foreign countries, other states, and Connecticut, respectively. Produce from foreign countries included apples from France, bluberries from New Zealand, pears from Japan, squash from Mexico, and tomatoes, nectarines, plums, grapes, and apricots from Chile. Grapes were from California and Arizona, and carrots were from New York, California, Florida, and Massachusetts. There were no differences in amount or types of pesticides detected in crops grown in Connecticut or elsewhere.

I compared the percentage of samples with residues reported in my study with the latest data on pesticide residues in fruits and vegetables in the U.S. published by the U.S. Food and Drug Administration in 1983 covering the years 1969 through 1976 (3). In three of five categories (vine and ear vegetables, large fruits, and root vegetables) my results show that the percentage of produce samples sold in Connecticut with trace amounts of residues was less than or equal to FDA findings. The other two categories are leaf and stem vegetables and small fruits. The 8-year FDA study had 16,247 samples; thus one must use care in comparing results with a study of only about 1.5% of this number.

In a study of crops grown in Canada from 1980 to 1985 (5), 42% of the samples contained no detectable or low levels of pesticide residues as compared to 43% found in this study. In 1983 the Natural Resources Defense Council (NRDC), a private organization, tested 71 samples of fruits and vegetables grown in the U.S. and found that 44% contained detectable pesticide residues (8). Three products had residues of four different pesticides. Nineteen different residues were found. Their results appear similar to my data.

California probably has the most extensive pesticide monitoring program. In their routine monitoring of marketplace samples in 1987 they found that 1.5% of the produce tested either contained a residue above allowable tolerance or a residue with no tolerance established (1). In all, 18.7% of the samples contained a residue but within allowable tolerance. This percentage is less than half reported in my study, by the FDA (3), by Canada (5), and by the NRDC (8). The discrepancy might occur because of the large number of samples tested by California, 7010, compared to other studies. California also reported that 2% of the produce from foreign countries contained pesticide residues.

Overall, in my study, only 1% of the produce tested contained residues above allowable tolerances. Information in this Bulletin suggests to me that produce sold in Connecticut contains pesticide residues well within the standards set by the EPA.

ACKNOWLEDGMENTS

Samples were collected by John Wadhams under the direction of John McGuire, Chief of the Food Division of the Department of Consumer Protection. Analyses were by Ruth Barger and Kimberly Thomas.

TABLE 1--CONCENTRATIONS OF PESTICIDE RESIDUES IN PRODUCE SOLD IN CONNECTICUT, 1987. THE NUMBER OF POSITIVE SAMPLES FOLLOWS A PESTICIDE NAME IN PARENTHESIS

Produce Pesticide/(Number)	highest residue (ppm)	EPA tolerance
Apple, Cortland (4 tested, 3 pos.)		
Guthion (1)	0.02	2
Imidan (2)	≤0.4	10
Zolone (1)	0.1	10
Apple, Empire (2 tested, 1 pos.)		
Imidan (1)	0.3	10
Apple, for cider (1 tested, 0 pos.)		
Apple, Golden delicious (5 tested, 1 pos.)		
Thiodan (1)	0.02	10
Apple, Granny Smith (1 tested, 0 pos.)		
Apple, Ida red (1 tested, 1 pos.)		
Kelthane (1)	0.05	5
Apple, Macoun (1 tested, 1 pos.)		
Imidan (1)	0.07	10
Apple, McIntosh (24 tested, 16 pos.)		
Captan (1)	0.03	2
Dacthal (1)	0.003	0
Guthion (12)	≤0.01	2
Imidan (7)	≤0.2	10
Kelthane (3)	≤0.05	5
Thiodan (3)	≤0.01	2
Zolone (3)	≤1.1	10
Apple, Red delicious (12 tested, 5 pos.)		
Imidan (5)	≤0.04	10
Apple, Rome (1 tested, 1 pos.)		
Apple, Stayman (1 tested, 1 pos.)		
Guthion (1)	0.003	2
Imidan (1)	0.02	10
Zolone (1)	0.1	10
Apple, Winesap (1 tested, 1 pos.)		
Imidan (1)	0.02	10
Apricot (1 tested, 1 pos.)		
Bean, green (1 tested, 1 pos.)		
Bean, wax (1 tested, 1 pos.)		
Beet (3 tested, 2 pos.)		
DDT+DDE (2)	≤0.55	1
Thiodan (1)	0.01	0.1
Blueberry (2 tested, 0 pos.)		
Carrot (6 tested, 1 pos.)		
DDE (1)	0.05	1
Cider (31 tested, 0 pos.)		
Corn (15 tested, 0 pos.)		
Cucumber (3 tested, 2 pos.)		
Chlordane (1)	0.05	0.3
Thiodan (1)	0.03	2
Eggplant (2 tested, 1 pos.)		
Thiodan (1)	0.02	2
Escarole (1 tested, 1 pos.)		
DDE+DDT (1)	0.01	1
Grape, black (1 tested, 0 pos.)		
Grape, green (18 tested, 9 pos.)		
Captan (4)	≤3.4	50
Kelthane (3)	≤0.7	5
Thiodan (5)	≤1.0	2
Grape, purple (5 tested,4 pos.)		
Captan (2)	≤1.0	2
Kelthane (1)	0.04	5
Thiodan (2)	≤0.5	2
Grape, red (25 tested, 8 pos.)		
Captan (5)	≤1.0	50
Kelthane (4)	≤0.3	5
Thiodan (6)	≤0.03	2
Grape, seedless (4 tested, 0 pos.)		
Grape, Thompson seedl. (2 tested, 0 pos.)		
Lettuce (2 tested, 2 pos.)		
DDE (1)	0.04	7
DDT+DDE (1)	0.02	7
Thiodan (1)	0.04	2
Nectarines (7 tested, 2 pos.)		
Captan (2)	≤0.6	50
Parsley (2 tested, 2 pos.)		
DDT+DDE (2)	≤0.06	0

TABLE 1--Continued

Produce Pesticide/(Number)	highest residue (ppm)	EPA tolerance
Peach (2 tested, 2 pos.)		
Captan (1)	0.2	50
Thiodan (1)	0.07	2
Pear (1 tested, 1 pos.)		
Captan (1)	0.1	25
Pea (1 tested, 0 found)		
Pepper (6 tested, 3 pos.)		
Dacthal (3)	0.01	2
Plums (2 tested, 0 pos.)		
Squash, butternut (1 tested, 1 pos.)		
Dacthal (1)	0.01	1
Squash, green (5 tested, 4 pos.)		
Chlordane (3)	≤0.05	0.3
Dieldrin (3)	≤0.04	0.1
Thiodan (1)	0.03	2
Squash, lufa (1 tested, 1 pos.)		
Dacthal (1)	0.01	1
Thiodan (1)	0.03	2
Squash, yellow (11 tested, 6 pos.)		
Dieldrin (5)	≤0.02	0.1
Thiodan (3)	≤0.3	2
Strawberry (47 tested, 35 pos.)		
Captan (5)	≤2.0	25
DDE (1)	0.01	0.5
Dacthal (7)	≤0.1	2
Ronalin (5)	≤0.3	10
Thiodan (7)	≤0.45	2
Tomato (19 tested, 7 pos.)		
Captan (1)	0.04	25
DDE (1)	0.01	7
Dacthal (2)	≤0.02	1
Diazinon (1)	0.05	0.75
Thiodan (5)	≤0.04	2
Vinegar, cider (1 tested, 0 pos.)		

The symbol ≤ denotes equal to or less than.

TABLE 2--PESTICIDES FOUND IN PRODUCE, THEIR USE, AND TIMES DETECTED

Common name	Synonym	Use[a]	Times detected
Captan		F	22
Chlordane		I	4
DDT (and DDE)		I	10
Dacthal		H	15
Diazinon		I, N	1
Dieldrin		I	8
Guthion	Azinophos-methyl	I	14
Imidan	Phosmet	I	18
Kelthane	Dicofol	A	12
Ronalin	Vinclozolin	F	5
Thiodan	Endosulfan	I, A	39
Zolone	Phosalone	I, A	5

[a] From Farm Chemicals Handbook '88, 74th edition. Meister Publishing Co., Willoughby, OH 44094

A= Acaricide, F= Fungicide, H= Herbicide
I= Insecticide, N=Nematicide

TABLE 3--SOURCE OF PRODUCE TESTED

Produce	CT	US	FOR	Total
Apple	52	1	1	54
Apricot	0	0	1	1
Bean	2	0	0	2
Beet	3	0	0	3
Blueberry	0	0	2	2
Carrot	0	6	0	6
Cider	31	0	0	31
Corn	15	0	0	15
Cucumber	3	0	0	3
Eggplant	2	0	0	2
Escarole	1	0	0	1
Grape	0	48	7	55
Lettuce	2	0	0	2
Nectarine	0	0	7	7
Parsley	2	0	0	2
Pea	1	0	0	1
Peach	2	0	0	2
Pear	0	0	1	1
Pepper	6	0	0	6
Plum	0	0	2	2
Squash	17	0	1	18
Strawberry	47	0	0	47
Tomato	18	0	1	19
Vinegar, cider	1	0	0	1
Total	205	55	23	283
% of total	72	19	8	

REFERENCES

1. California Department of Food and Agriculture. 1987. Release #88-45, J. Wells, Chief, Pesticide Enforcement Branch, Sacramento, CA.

2. Code of Federal Regulations, revised as of July 1, 1986, Title 40, parts 150-189. U.S. Government Printing Office, Washington, DC.

3. Duggan, R.E. et al. 1983. Residue Monitoring Data - Pesticide residue levels in foods in the United States from July 1, 1969 to June 30, 1976. Food and Drug Administration, Washington, DC. 240p.

4. General Statutes of Connecticut, revised to January 1, 1987, Section 22-81.

5. Frank, R. et al. 1987. J. Assoc. Official Analytical Chemists 70:1081-1086.

6. Guide To Chemicals Used In Crop Protection. Publication 1093, Canada Agriculture Research Branch, London, Ontario N6A 5B7 (1982).

7. McMahon, B. and J.A. Burke. 1978. J. Assoc. Official Analytical Chemists, 61:640-652.

8. Mott, L. 1984. Pesticides in Foods, Natural Resources Defense Council, San Francisco, CA. 123p.

9. Official Methods Of Analysis, 14th edition, S. Williams, ed. Assoc. Official Analytical Chemists, Arlington, VA (1984).

10. Pesticide Analytical Manual, Vols I and II. U.S. Dept. HHS, Food and Drug Administration, FDA Public Records and Document Center HFI-35, Rockville, MD 20857.

The Connecticut Agricultural Experiment Station, founded in 1875, is the first experiment station in America. It is chartered by the General Assembly to make scientific inquiries and experiments regarding plants and their pests, insects, soil and water, and to perform analyses for State agencies. The laboratories of the Station are in New Haven and Windsor; its Lockwood Farm is in Hamden. Single copies of bulletins are available free upon request to Publications; Box 1106; New Haven, Connecticut 06504.

ISSN 0097-0905