

# FRONTIERS of Plant Science

FALL 1995

Volume 48 No. 1



*Russell L. Brenneman  
delivers Johnson Lecture  
at Lockwood Farm*

The national debt

Analytical Chemistry expands analyses

## THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION,

founded in 1875, is the first experiment station in America. It is chartered by the General Assembly as an independent State agency governed by a Board of Control. Station scientists make inquiries and experiments regarding plants and their pests, insects, soil and water quality, food safety, and perform analyses for State agencies. Factual information relating to the environment and agriculture is provided freely and objectively to all. The laboratories of the Station are in New Haven and Windsor; its Lockwood Farm is in Hamden. Copies of this and other publications are available upon request to Publications; Box 1106; New Haven, Connecticut 06504



ISSN 0016-2167

## The National Debt

By Russell L. Brenneman

Attorney and President, Connecticut Forest and Park Association

As the new president of the Connecticut Forest and Park Association, I am deeply honored to be asked to say a few words to you. My association has enjoyed a close relationship with The Connecticut Agricultural Experiment Station for all of the one hundred years we have existed. I am acutely aware of my standing inadequately in the shoes of many of my distinguished predecessors. Unlike many of them, I am not a forester, scientist or academician, but an ordinary citizen who has been present at the birthing of what may be called the modern American environmental movement.

It is time for some very plain talk. Let me add at the outset that these thoughts are not necessarily the views of my Association, all of its members or our directors, but are solely my own.

When I was a high school boy in Columbus, Ohio, one of my springtime chores was to clean the wallpaper. You took a pink, spongy dough-like material and rubbed it on the walls. It absorbed the black, stringy soot like a pencil eraser. When its surface became covered with dirt, as soon happened, you kneaded and folded it until its outside was cleaner, and you continued swiping the walls. The soot came from the bituminous coal burned by the local electric utility, the railroads, and almost every home. The smoke painted our air the color of lead. It never occurred to me that this same soot was also coating my nasal passages and that finer particles were reaching my lungs and that oxides of chemicals I had never heard of caused our eyes and throats to burn.

Those were the good old days of Norman Rockwell, The Saturday Evening Post, and "traditional values".

Years later, I remember standing on Steamboat Dock in Essex with Dr. John Rankin, a distinguished marine biologist who grew up there. I was incredulous when he told me that he used to swim off that dock in the Connecticut River as a boy. At the time he recounted this, doctors advised sailors that if we had the misfortune of falling into the river, our first stop should be to get a hepatitis shot, and they were not joking. When we lived in Essex, the smoke from the burning garbage dump would drift down from Deep River, our only reminder that it was there since it conveniently plunged over the river bank so as not to offend passersby on the nearby highway.

Those were the good old days of open sewers, tossing industrial wastes out of the factory back door and DDT. Before *Silent Spring* cracked open our awareness like a sledgehammer from outer space.

Today these tales are only stories, and the generation that can tell them will be gone sooner than we would like. They are only stories because of what has been accomplished over the last twenty-five years.

The subject of my lecture, if these informal remarks can be so dignified, is "The National Debt." We hear a lot about it these days, as we should. We soon learn that the politicians are not talking about reducing the debt, but rather the rate of annual deficit spending; or, to say that more directly, the rate at which we are continuing to add to the debt. But don't worry: I'm not going to talk about that debt. I forgot to say that I am not an economist, either. Or a magician.

I shall be talking about a different kind of debt—the "national debt" looked at from an environmental perspective. We are, I believe, deeply indebted and continue to deficit spend on a global basis. Because of the ways in which the books are kept, we take little notice, and politicians are as loath to deal with deficit spending of environmental resources as they are the other kind.

But my subject is not this deficit, either (which, in any event, is whatever it is and cannot be wiped away by any juggling of the books or facile words). Instead, I shall speak of obligations of gratitude and commitment which arise out of the actions of individuals and institutions who have got us to where we are, and obligations that in my view arise from our citizenship in a national community in the emerging global civilization. That is a "national debt" that is owed to our fellow beings, to the past and, most importantly, to the future.

You can swim in the Connecticut River today. There are no more burning dumps. Young boys no longer have to clean soot from the walls of homes in Columbus, Ohio. The residues from unwise past waste disposal are (very gradually) being cleaned up. The air is measurably cleaner. Much of what used to go into the garbage bin is being recycled. Industries are finding new ways to avoid producing troublesome waste streams.

These are only a few of the accomplishments that are more glowingly described in Gregg Easterbrook's optimistic

book, *Moment on Earth*<sup>1</sup>. All Americans should take pride in them. Therefore, the first of the obligations I hold up for your attention is our indebtedness to the architects of the modern American environmental movement, who are so casually demonized by some today. The onset of this movement may conveniently be dated from the signing by President Nixon of the National Environmental Policy Act of 1969 and the creation by that administration of the Environmental Protection Agency and the federal Council on Environmental Quality.

The accomplishments which I have mentioned and many others are largely the result of actions by local, state and federal government that have changed the behavior of individuals, enterprises and government itself. These actions have included basic research, education at all levels, technological development and significant public investments. They have also included laws and regulations imposing limitations on the private sector and government itself.

Honoring this indebtedness means to build on the foundation that they have laid. A cornerstone of that foundation is the proposition that environmental behavioral change is most effectively accomplished by the intervention of the community will, expressed through governmental action of some kind. In our constitutional system, that community will is expressed through laws and governmental agencies acting in accordance with law.

Honoring this indebtedness does not mean enslavement to techniques that have not worked well. Coercive regulation is not the only way to change behavior. As Tim Wirth, Vice-president Gore and the late Senator Heinz pointed out years ago, the most efficient way to change private sector behavior is to influence marketplace choices. While draconian liability rules may change behavior, they may not produce quick cleanup, as Superfund experience is showing. Providing transferable credits for beneficial actions seems like a good idea. Not all "wetlands" are equal, and wetlands protection laws can produce real private hardships which can and should be ameliorated by applying them more sensibly.

This learning comes out of our experience over the past 25 years, an experience that has been essential to our present perceptions. We have learned how to do things better, found out what works and what does not work. My point in honoring our indebtedness to all of those whose efforts have been part of this experience is to confront those who would, under whatever guise and for whatever purpose, undermine the very foundation upon which our environmental accomplishments have been built. These accomplishments are not abstractions. We are talking about health, clean air and water, safe waste practices.

Our indebtedness is not honored, in my view, by many of the proposals put before the Congress today. It was not honored by the passage of a bill by the House of Representatives July 31 cutting the budget of the Environmental Protection Agency by one-third, the biggest reduction of any major

federal agency.

It is not honored by a bill passed by the House this week that would prevent the Environmental Protection Agency from spending money to enforce wetland rules and which would bar the Environmental Protection Agency from enforcing water quality standards in the Great Lakes. It was not honored by forbidding the Environmental Protection Agency to adopt new rules on "toxic" air emissions from oil refineries.

It is not honored, I believe, by a proposal in the Senate, cosponsored by the chairman of what is curiously called the Clean Air, Wetlands, Private Property Rights and Nuclear Safety Subcommittee, to redefine sixty to seventy five percent of the nation's critical wetlands to be entirely outside federal protection.

It is not honored by attempts to exempt whole categories of industries from Clean Air Act rules adopted only five years ago. It is not honored by attempts to change environmental policies of government agencies through provisions of a spending bill, as was actually accomplished by the House Monday July 31, thus avoiding the inconvenience of a forthright debate on the merits of particular laws and programs.

Nearly all of these proposals run contrary to the will of the American people, as expressed in poll after poll. We do not want our environmental accomplishments compromised in the course of making much needed corrections. Only a Congress that is deaf to our wishes can proceed in this fashion. As a representative warned his colleagues before a critical House vote last week, before voting, "call your constituents," and another member said on the floor: "They [the voters] are going to remember what we are doing here." Indeed, I add, we shall<sup>2</sup>.

To turn to another topic of "indebtedness," when my grandfather was born, the entire public domain remained open to settlement and the development of mineral claims. The "privatization" of the public lands had been national policy for a number of decades. When he was quite young the first national parks came into being, a revolutionary idea at the time in a country that one British observer described as less a nation than "a vast commercial enterprise."

Through the influence of pioneers such as President Theodore Roosevelt, John Muir, Gifford Pinchot and, I suspect, the sorts of men (and I wistfully hope, women) who established The Connecticut Agricultural Experiment Station, the Connecticut Forest and Park Assoc. and the Yale School of Forestry, the emphasis shifted from alienation of the public land to retention and thoughtful management. It was recognized that what remains of the public domain belongs to all Americans and should be managed for all of their benefit.

To be fair, this notion has never been accepted by absolutely everyone. And by no means has there been general agreement on how these lands should be managed, or the relationship of that management to adjacent private property



and private inholdings. The Wilderness Act and the Endangered Species Act perhaps present the most stern issues.

It now falls to us—it is part of our “indebtedness” and responsibility—to take our turn as custodians of this inheritance, including the ongoing debate. The issues are not at all abstract. The value of huge investments rises or falls. Careers, jobs, traditional communities are at stake. Whether a particular species thrives or dies off may be at issue.

How do we honor our obligation? We honor it most effectively, in my view, by encouraging public forums where people of good will can discuss their often divergent views with as little divisiveness as possible. We should seek out institutions and situations where understanding and agreement can be nurtured and shun those which are overtly adversarial, deliberately ideological or single-interest based. I personally see much promise in the upcoming Seventh American Forest Congress, in the beginnings of which my Association is now participating.

I do not believe we honor our obligation by failing to amend our ancient national mining laws, which permit the acquisition of public land by private companies for a song, often by investor owned conglomerates who know how to fatten corporate profits at public expense. Nor do we honor it by failing to charge fair market value for grazing rights on the public land. Finally, we do not honor it by listening to those economists who argue that if the public wants a particular use of public land, the taxpayers should pay for it (because it might have an arguably higher value if put to another use). Ladies and gentlemen, we *own* it!

There is an indebtedness that goes farther back than that. When my earliest forebears came to North America, the United States of America did not exist. After Independence, a new national community was formed under a written Constitution pursuant to which the states granted to the federal government enumerated powers, among which was the power to regulate commerce among the states and to manage the public domain. A century later we fought a deadly war to establish finally that we are a nation and not a collection of federated regions or states. Over the years it has evolved that in dealing with “commerce” it is convenient for the federal government to oversee many issues that involve transboundary effects or benefits. Our economy could not prosper unless it did so. Waste disposal laws, such as those regulating emissions into the air and water present such issues, and thus we have the Clean Air Act, the Clean Water Act, laws governing pesticides, the “Superfund” statute, and many others.

Today, in some quarters, the national government and its authority to enforce laws that our representatives have enacted is questioned. Ironically, the “anti-government” crowd often claims to be acting under the banner of patriotism. To the contrary, it is these false “populists” who are in radical opposition to the national community and its will as expressed through laws properly enacted. And too often our political leaders are strangely silent.

Our obligation to the Founding Fathers, it seems to me, at the very least entails support for the necessity and authority of our central government. Not support for its every action, because, like we ourselves, government is often wrong. Not to defend it when it oversteps its legitimate powers, but to support its fundamental authority as the authentic repository of the national community’s will. It is impossible to imagine coherent environmental policies that do not recognize this principle. Our national will is unquestionably to preserve the health and safety of our citizens and assure a use of the public domain which benefits all citizens and not just an influential few.

Before leaving the Constitution, a word about private property rights. The Constitution gives the federal government the power to take private property for public use, but it must pay if it does so. For many decades it was uncertain whether the regulation of a person’s property for a public purpose could constitute a “taking” if the person continued to own it and the public had no right to use it. Many distinguished jurists believed that all property is held subject to the inherent right of the sovereign to protect the community and thus its regulation cannot be a compensable taking. However, it ultimately was decided that if a regulation goes so far as to take all or virtually all of an owner’s interest, a “taking” has occurred and compensation must be paid.

How much is “too much” has been decided on a case-by-case basis by the courts. It is now proposed by some in Congress to pass, for the first time in American history, a law that would provide that where private property is regulated under the wetlands laws or the Endangered Species Act compensation must be paid if there is a diminution in value of ten percent or twenty percent (depending upon which bill you pick) and that compensation should be paid not from the national Treasury, as the Framers contemplated, but from the budget of the regulating agency. This would produce, and, one must conclude, is intended to produce a dampening effect upon agency action even where it is fully warranted. The ten/twenty percent is far less than the Constitutional standard. (There is no mention by the proponents of these bills, I might add, of the private property owner’s making a *payment* when the owner is benefited by some public expenditure or regulation. The value of property of my friends in Essex, for example, has gone up in value because of federal regulations and public expenditures upstream, but they have not been required to pay the federal government for these benefits.) In my view, the “taking” issue should continue to be left with the courts entirely, as at present, although I recognize that there is division on this issue.

There is a further obligation that I shall briefly mention. It is our obligation of gratitude to the scientists and educators who have contributed so much essential information during the formative years of American environmental and natural resource policy. Much of this information emerged from basic research. Notions that were mere suppositions 25 years

ago have been validated by science, and other ideas thought to be true have been proved wrong. The intuition that ecosystems are significant, the conviction that habitat management is essential, the development of new ways to assure productive and sustainable forests, discovering less toxic production materials and techniques, finding less troublesome energy resources; all are the product of endeavors of the scientific community. There is great need to continue basic research and information gathering and to supply the analysis of data that only science can provide. There is also a continuing need for scientists to participate even-handedly in the policy making process and not allow their information simply to be used as ammunition by one "side" or another. We do not honor our debt to science when we cut funds for basic research, information gathering and sharing and environmental education.

To conclude with a final debt of gratitude, which may be unpopular to some, we owe much to those who laid the foundation stones of the international community in the aftermath of the Second World War. Unanticipated by those who established the United Nations, probably, was the evolution within five decades of a global community interconnected by communication technologies undreamed of at that time. Within that community there has emerged a new awareness of our ecological interconnectedness as well as our human interconnectedness, as was evidenced by the Rio conference of a few years back. There are scores of environmental treaties, conventions and protocols in place, and the United Nations is proceeding with the UNCED "Agenda 21". The learning of the industrialized nations can be applied to help developing nations industrialize in less polluting ways. Progress is being made in the midst of all the tragic, unsolved political problems in many parts of the world.

But there are countervailing forces. The most potent one is economic expansionism that is heedless of its effect upon environmental resources. Each nation, including our own, wants to be richer and to compete profitably in world trade. It is widely believed that all nations will be benefited by agreements that promote international trade free of all constraints. In NAFTA and the new World Trade Organization, our nation has become party to two such agreements and seeks others.

The darker side of this commerce is that the market is blind to environmental values. If local pollution regulations impose a cost, capital will flow toward where they are absent, just as it flows toward those areas where living standards are poor and labor is cheap. Competition is fierce and unimpeded for resources that remain unallocated in the global commons, fisheries and the atmosphere being at particular risk. There is no mechanism to impose enforceable restraints on the economic activities of sovereign nations.

The United States influences the behavior of the international community in many ways. One is by our example. If we appear indifferent to the environmental standards that we

ourselves adopted as a community 25 years ago, or if our government and our multinational corporations take the position that those standards are unimportant "offshore", or if we allow trade agreements to be so administered that sensible environmental standards are regarded as simply another impediment to free trade, other nations will take our cue. International commerce, beneficial in so many ways, will become like the "dark Satanic Mills" of William Blake's imagining, as destructive to the environment as often were the mills of the Industrial Revolution to human lives and families.

Several years ago a journalist happened to be on one of those huge fish factories that catch and process fish right on the high seas. The species of fish they were catching was being caught in such numbers and so indiscriminately that it was threatened with extinction. The journalist asked a businessman on the ship what his company would do when the fishery was gone. The businessman replied: We will look for something else that has a great return on investment.

That all makes sense in this the Age of Commerce, in which getting the highest immediate economic return seems to sweep everything else away. Economics are important but they also can be fatal.

It is our national policy, it may surprise some in Washington to learn, to act as a trustee of the environment for future generations. That is authoritatively expressed in the National Environmental Policy Act proudly signed by President Nixon. That means taking our fair share but no more. It means thinking long-term and not short-term. It means that there are some other national obligations that are at least as important as a short term return on investment.

There is not a person here who is not concerned about his or her health, the quality of where you live, and the quality of life that you will leave for your children and your grandchildren. That makes you "environmentalists" in my book. Those who would have you forget who you are try to paint you in a corner, marginalize you as "enviros" and blame you for all manner of mistakes and injustices. But you know better than that.

Perhaps we owe a final debt of gratitude to those who have supplied us with values less impoverishing than just measuring returns on investments: The value of our connection to one another, to our families and all children, to our national community, to nature and the universe. Values that come from deep within the human experience. Values that emerge from "what transcends us", in the words of Vaclav Havel in Cambridge recently. I think of Emerson, George Perkins Marsh, Schweitzer, Gandhi, Einstein, Whitehead, President Havel himself. You have your own heroes.

We surely need them now, to help us push back against the raw tide of unabashed materialism. Otherwise, what sense does looking after the future make? Is it too much to ask our political figures to abandon government by soundbite, policy-making by pollster and clever "ideologies" that

only divide and confuse us? Too much to ask them to hear those of us who cannot buy lobbyists or make big campaign contributions? Too much to listen a little to our nation's heart as well as its pocketbook?

If our generation wishes to honor our debt to our forebears for all that we have received from them and to be faithful to our responsibilities to the global community and the future, politics needs to do more than simply reflect the views of particular pressure groups or special interests. In closing, hear the words of President Havel on politics at the recent Harvard Commencement:

After all, politics is a matter of serving the community, which means that *it is morality in practice*. And how better to serve

the community and practice morality than by seeking in the midst of the global (and globally threatened) civilization [the politicians'] global political responsibility: that is, their responsibility for the very survival of the human race?

That, it would seem, is our ultimate obligation.

#### Notes

1. Viking, 1995. Not everyone shares Mr. Easterbrook's optimistic view. Bill McKibben has provided a critique. "Not So Fast", The New York Times Magazine, July 23, 1995.

2. It gives me joy to tell you that all members of the Connecticut delegation, both Republicans and Democrats, voted against the bill to restrict E.P.A. that was passed July 31, 1995.

## Analytical Chemistry expands analyses for heavy metals, preservatives, and pesticides

By Harry M. Pylypiw Jr. and David E. Stilwell

The American consumer enjoys the most economical and plentiful food supply in the world. Nevertheless, the public is concerned with possible chemical contaminants in food and water. In response, the Analytical Chemistry Dept. has placed increased emphasis on its food safety program. We have significantly increased the numbers of samples of fresh produce tested and the number of pesticide residues which we test for; screen beverages for added preservatives; and we have begun to examine a variety of foods, both fresh and processed, for the presence of heavy metals.

### Heavy Metals

A recent recall of lead-contaminated juices imported from Mexico prompted the Experiment Station to evaluate lead levels in grapefruit juice packaged in the United States. Lead is widely recognized as a hazardous environmental pollutant due to its toxicity to many organisms. It has been estimated that up to 70% of the total human exposure to lead is through the diet. The majority of dietary lead results from environmental pollution and from the processing and storage of foodstuffs. Lead in fruit beverages can originate from plant uptake during growth, as well as from the subsequent processing and storage. Historically, a major source of lead in canned foods came from the chemical migration (leaching) of lead from the lead solder used to seal the side seam of the can. Consequently, American can manufacturers have voluntarily eliminated the use of lead-solder seams in canned food containers.

In this study we evaluated the lead content in 52 grapefruit juice samples packaged in glass, waxed paperboard,

and tin-coated carbon steel. From each of 10 brands, 1-3 lot numbers were randomly chosen, and the lead content was determined from duplicate samples of each lot number. In addition, leaching studies determined if the lead levels increased with time in juice that was refrigerated and stored in open containers. This leaching information helped to identify the major source of lead in the juice, and to estimate lead exposure from juices stored in opened original containers. The lead content was determined using a Graphite Furnace Atomic Absorption Spectrophotometer.

Lead levels in freshly-opened grapefruit juice in glass,



Figure 1. Harry M. Pylypiw Jr. (left) and David E. Stilwell doing a preservative analysis on an HPLC system.



Table 1. Lead concentration in freshly opened grapefruit juice

Type of Container	Brands	Number of		Lead Concentration ( $\mu\text{g/L}$ )	
		Lots	Samples	Range	Mean
Tin Coated Carbon Steel	5	15	30	<1-27	7.7
Glass	4	7	14	<1	<1
Waxed Paperboard	2	4	8	<1	<1

waxed paperboard and metal containers are shown in Table 1. These data show that only juices packaged in tin-coated metal cans contain measurable lead. In general, these levels (<1-27  $\mu\text{g/L}$ ) are much lower than those reported for juice in lead-soldered cans.

Since lead was found only in canned samples, the container itself seemed to be a probable source of lead. To test this hypothesis, leaching experiments were carried out on opened cans to see if additional lead would leach into the juice. One leaching experiment was designed to simulate storage of an opened can in the refrigerator for several days. For this study, we randomly picked duplicates of three lot numbers from five brands, totaling 30 canned juice samples from 15 lots. These 1.36 liter cans were opened and stored in the refrigerator for 14-30 days. In all samples the lead content increased significantly after opening, but there was a wide range of values for the lead leached.

The leaching study continued for 30 days on lot 1 for each brand. The results, given in Figure 2, show that an initial increase is followed by a leveling off of the lead content in the juices, which suggests a finite source of leachable lead near the contact surface.

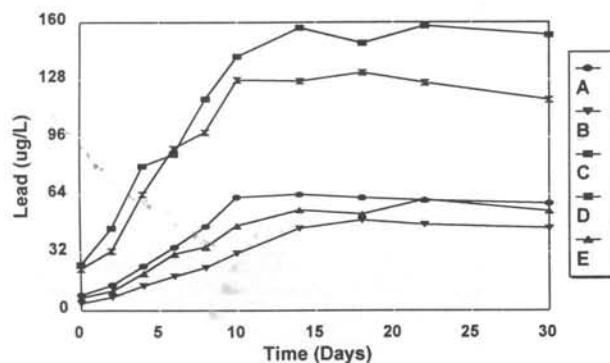


Figure 2. Thirty Day Leaching Study of Brands A to E.

To determine the source of lead in the cans, different portions of 10 cans (both freshly opened and leached) were surveyed for lead. The results suggested that impurities in the tin-coating were the major source of lead in the juice. Accordingly, tin samples from cans used in the leaching

study were analyzed for their lead content. These samples were obtained by scraping the uncorroded upper side surface of the cans. The concentrations of lead ranged from 7 to 102 mg/Kg. When these values were compared to the amounts of lead found in the juice, there was a clear trend towards higher amounts of lead in the juice with increasing lead content in the tin-coating. To reduce lead intake it is essential that juices, packaged in tin-coated metal cans, be immediately transferred to glass or plastic containers after opening.

#### Preservatives

Our food safety program includes testing of processed foods, such as apple cider, fruit juices, and other beverages that often contain additives to prevent spoilage. Typically, sodium benzoate and/or potassium sorbate are the preservatives used in juices. Under the provisions set forth by the U.S. Food and Drug Administration (FDA), food additives can be used if they are generally recognized as safe and declared on the label. Sodium benzoate, used as a preservative in juices, should not result in levels exceeding 0.1% in the beverage. Similar guidelines are suggested for potassium sorbate.

There are, however, concerns about preservatives, since an allergic reaction can occur. To address this concern the Station, along with the Connecticut Dept. of Consumer Protection, tests beverages from Connecticut and other states and countries obtained at local grocery stores and supermarkets to determine the presence of declared and/or undeclared preservatives. All samples were tested for sodium benzoate and potassium sorbate. Our procedure utilizes a high performance liquid chromatograph with an ultra-violet detector that can quantitate preservatives. Juice, cider, and beverage samples are prepared by a dilution of one milliliter of sample with ten milliliters of a buffer solution. Samples of processed and raw fruits are first blended and then treated like a juice sample. The percentage of preservative in the sample is calculated using authentic standards of sodium benzoate and potassium sorbate. Juices spiked at 0.1% for both sodium benzoate and potassium sorbate yielded recoveries of 98% and 96%, respectively. Our method can detect 0.0002% (2 ppm) of either preservative in a juice matrix.

Over the past 2 years we have tested over 150 apple cider, orange juice, lemonade, and various other juices and

nectars. We have also tested other beverage concentrates, vinegar, fruits, and sauces. Only about 6% of the products that we tested were found in variance with label claims.

Cranberries contain a natural amount of benzoic acid at approximately 0.0150%, when calculated as sodium benzoate. Thus, all products that contain cranberries or cranberry extracts will have detectable amounts of benzoic acid. The levels of sodium benzoate vary depending upon the amount of cranberry or extract in the product. Due to the natural occurrence of benzoic acid in cranberries, juices and other cranberry products tested were not in violation of labeling regulations.

### Pesticides

Our food safety program also involves testing of fruits and vegetables for pesticide residues. Pesticides are applied to a broad variety of agricultural crops to control plant pests such as fungi, insects, and weeds. The U.S. Environmental Protection Agency (EPA) registers pesticides and sets tolerances for amounts that may remain on the produce after harvest. The determination of pesticide residues in fruits and vegetables is not straightforward because the actual chemicals used on a crop are seldom known. The Experiment Station, in cooperation with the Connecticut Dept. of Consumer Protection, tests fruits and vegetables collected at various producers, retailers, and wholesale outlets in a random market-basket manner to determine if residues are within EPA tolerances. Samples include produce grown in Connecticut, other states, and foreign countries. We test all produce for pesticides using a multi-residue method developed in our laboratories. The method consists of a solvent extraction and cleanup of the sample, followed by compound separation

and quantitation by capillary gas chromatography. Our method has a general sensitivity limit of 0.002 ppm for organohalogen pesticides in most fruit or vegetable matrices.

In 1994 almost 550 samples representing a wide variety of produce were tested. Pesticide residues were found in 24% of the samples, although only 6 samples were found to contain a pesticide residue exceeding EPA guidelines. The pesticides that are most often found in our survey are shown in Figure 3. Endosulfan is the most frequently detected residue in all fresh commodities tested. Other pesticides that occurred significantly in the study were iprodione, captan, and permethrin. As in previous years, our findings continue to show that the residues of pesticides found in fruits and vegetables sold in Connecticut are generally well within the safety limits established by EPA.

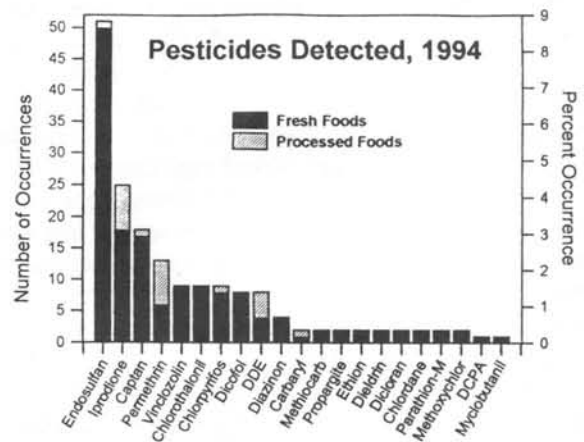


Figure 3. Pesticides most often detected, 1994.

*The Experiment Station is  
an Equal Opportunity/  
Affirmative Action Employer*

The Connecticut Agricultural  
Experiment Station  
Box 1106, New Haven, CT 06504

BULK RATE  
U.S. POSTAGE  
PAID  
NEW HAVEN, CT  
PERMIT No. 295