S. HRG. 101-391

REVIEW OF THE SUBCOMMITTEE'S REPORT ON PESTICIDES AND TO CONSIDER THE REGULATION OF EBDC (FUNGICIDE)

HEARING

BEFORE THE

SUBCOMMITTEE ON
TOXIC SUBSTANCES, ENVIRONMENTAL
OVERSIGHT, RESEARCH AND DEVELOPMENT

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

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need to study this question of management practices and technologies applied to production agriculture, and the very real problems that the agricultural community has faced—economic problems in particular—over the past several years.

Because your invitation and this hearing focuses primarily on the pesticide-related issues, and the pesticide regulatory issues, what we thought we would do this morning in our oral testimony is to divide the task. Dr. Benbrook will make some remarks regarding the pesticide related issues, and I will then make some further remarks about the conclusions of this study and some of the other research and policy-related issues that your committee might want to consider.

Senator LIEBERMAN. Dr. Benbrook.

STATEMENT OF CHARLES M. BENBROOK, BOARD ON AGRICULTURE

Dr. BENBROOK. Senator, yes.

I would just like to reiterate the major points made in my last testimony which are drawn from our 1987 report on regulating pesticides in food.

Many of these same points appear again in this report. We recommend that a negligible risk standard be applied consistently to new and old pesticides, to herbicides, insecticides and fungicides, and to residues in both fresh and processed food.

We recommended that the EPA apply this standard to the risks associated with or following the use of a pesticide on a single crop, adding together whatever fresh or raw foods are derived from that crop, plus any processed foods.

In other words, the risk from the EBDCs on tomatoes would be the sum of exposure from fresh-market tomatoes treated with an EBDC fungicide plus ketchup and all processed tomato products made from treated tomatoes.

We recommended that when EPA has knowledge that a number of pesticides registered for the same use—for example, the six or eight fungicides registered for use on tomatoes to control a variety of plant diseases—that EPA weigh all potential risks before regulatory action and after, taking into account likely substitution of other pesticide products.

I am pleased to hear Linda Fisher again report that they are beginning to do this, but I think it is important to note that the EPA has a long way to go before they have really fully acted on this recommendation, and that the regulatory actions the EPA is about to take on the EBDCs will be precedent-setting. If they do not consider the probable switch of farmers to Captan and Benomyl, I think I can convince you in about three minutes that the end result of the action could be an increase in risk.

Senator LIEBERMAN. I think that is a very important point, and obviously all of us are going to be watching carefully what the result of EPA's actions are.

Dr. BENBROOK. And the last recommendation in our report was that EPA should focus on the "bad actors." I would like to return to the issue of where the greatest share of potential risk is.

In our current report, the committee asked itself the question:

Forget a regulatory program approach—what can farmers do now that will make them more money, help them use biology, genetics and ecology to control pests, rather than chemicals? Is it realistic to expect that farmers could more quickly work away from risky pesticide uses by preventing the need to use them on the farms, so that the pressure for action at the regulatory level can be much reduced?

Obviously a major recovery in the real estate market would have made your problem of bailing out the Savings and Loan industry much less onerous. And the question that this MAS committee asked itself was, is there something out there in production agriculture that can be done, given the emergence biotechnology and other new technologies, that could really substantially alter the sorts of technologies available and hence the kinds of risk that might have to be accepted in the food supply?

The committee's conclusion is quite strong in that there are a great many proven alternatives that are being used more and more regularly, and which show considerable promise both to improve the economic performance of agriculture as well as its environmental performance, and ultimately to improve the safety of the food.

With that, I will turn the tables back to Bob, who wants to describe some of these technologies.

Senator LIEBERMAN. I would just like to ask you one question that comes to mind, before we do that.

Did you make a conclusion about cost to the farmers of the alternative methods?

Dr. BENBROOK. In many cases, we did. The reason that many alternative practices are being adopted, and are being refined by innovative farmers all over the country is, as Commissioner Hightower pointed out, they make the farmer more money.

The selection of agricultural practices and technology is very much driven by the farmer's sense of what is going to do to his or her bottom line. The selection of technology and production system is also tempered in some very important respects by rules, regulations, program provisions that are embedded in Federal commodity programs and conservation programs.

We highlighted in our report some of these federal policies for particular attention by the Congress, because it seemed to the committee that the last thing the U.S. Congress would want to do is spend scarce public dollars to prohibit or penalize farmers from acting upon promising new science and technology that public dollars have developed at our Land Grant universities.

So we felt quite strongly that that warranted strong attention.

Senator LIEBERMAN. I would like to hear more about that. Let us go to Mr. Goodman.

Dr. GOODMAN. Following up, actually, on that point, let me just call your attention to two tables on pages 344 and 345 of the report, which illustrate the significant reductions in per-acre pesticide applications on sweet corn grown under IPM regimes in comparison with non-IPM regimes in Florida.

On the economic side, there is documented here roughly $40 an acre difference in pesticide input costs that is saved in the case of IPM-based management.

We also highlight elsewhere in the report—I do not have the specific reference at hand—a dramatic decrease in the amount of in-

secticide that is today applied in the Cotton Belt as a consequence of IPM-based management.

Briefly, let me define, by quoting the report, what this panel is talking about when it talks about alternative agriculture.

The focus is on agriculture as a biological activity, and there is a scientific basis for that as well as the empirical or practical basis that Commissioner Hightower has remarked upon today, and has spent much of his career advocating.

Alternative agriculture refers to a group of systems of production that have as their features more thorough incorporation of natural processes, such as nutrient cycles, nitrogen fixation, predator-pest relationships, the ecology of what goes on in the agricultural ecosystem.

Reduction in the use of off-farm inputs, where the greatest potential to harm the environment and help the farmers and consumers; greater productive use of biological and genetic potential of plants and animal species; improving the match between cropping patterns and productive potential and physical limitations of agricultural lands, ensuring long-term sustainability of current production levels. In the opinion of the members of our panel, we must in our public policy seek ways of maintaining our current high level of productivity and quality of our food supply while decreasing economic costs of pesticides, and obviously avoiding both the environmental and potential food safety concerns of the use of pesticides.

So, we are not talking specifically about organic agriculture or organic farming, although that is a component, as is the case in Texas, California, and some other States. Organic agricultural practices and the market opportunity that, at least in the intermediate term organic agricultural practices have provided, is one of the incentives that can be sought, but certainly not the only one.

The conclusions that the committee came to, briefly, are that there are sufficient cases out there now of well-managed agricultural enterprises, farming systems, that nearly always use less pesticides, and nearly always use less synthetic chemicals of all kinds per unit of production than comparable conventional farms.

I have been asked, are these typical farms? And our case studies show that in many, many ways, their appearance from the road, the people actually doing the farming—these are typical farms. What is not typical about them is that for one reason or another—and there is a range of reasons why—entrepreneurial growers, usually outside the commodity programs, the farm support programs of the Federal Government, have sought new ways of producing a competitive, high-quality product and have done so successfully.

Alternative farming practices typically require more information, more management, more technology, but it is of a different kind. There is some focus in the agricultural research community, as there is the public discussion about this, about low input.

To some degree, that is a bit off the mark. It is a different input. It is inputs of genetic technology and it is inputs of management and tillage and other kinds of physical technologies that we are talking about.

As Chuck has remarked, Academy studies have previously pointed out that Federal grading standards are one of the public policies

that tend to promote the use of pesticides. We called for alterations in those grading standards, in order to reduce those incentives.

Senator LIEBERMAN. Talk a little bit more about that.

Dr. GOODMAN. Well, I am not an expert about that, but there are a number of marketing orders and other kinds of policies that call for cosmetic standards that result in farmers using pesticides to a degree that is well beyond what is required for achieving a satisfactory product with high nutritional quality.

The point here is that there are, in our case studies, several examples now of growers using what we define as alternative agricultural policies with fewer or no pesticides who are producing a highly-competitive product, even at a cosmetic level.

Senator LIEBERMAN. That was one of the problems with Alar. I gather that one of its major functions is cosmetic. I guess it keeps the fruit on the tree a little bit longer. But part of what it does is make the apple, for instance, look better.

Dr. BENBROOK. Well, it makes it possible to pick an orchard once. It holds all the apples on the tree so that one picking is sufficient. When farmers do not use Alar, they either suffer a fair amount of drop, and hence a reduction in income, or they have to pick the orchards twice. So there is an increased cost or reduced income.

Senator LIEBERMAN. What are other ways in which you think the Federal Government discoūrages what you have called alternative agriculture by its policies?

Mr. GOODMAN. Specifically, we find that there are significant research needs in the public agricultural sector, to better define why those farm enterprises that use these approaches are successful, and to attempt to find why those who have attempted to use these methods have failed. There are clearly people who have failed.

In fact, in a couple of our case studies, there are examples of attempts to go beyond a given stage in the use of conventional farming practices that has not been successful. One of those examples is in organic rice production in California.

There are both technological needs and economic research needs to understand and then to better promote the uses of technology to meet the alternative agriculture agenda.

I think that it is clear from our findings that the integration of our considerable knowledge base in ways that are readily adoptable by farmers in different environments is not yet sufficient to allow growers to confidently, in a short period of time, make the transition from their conventional practices to alternative practices.

And then there are a whole range of policy-related issues regarding the commodity programs which the Commissioner this morning referred to, and I agree with everything he said.

Senator LIEBERMAN. Okay, how about EPA? Does EPA do anything in its pesticide program that might hinder or block alternative agriculture?

Dr. BENBROOK. Yes, Senator, I think that there are two very important matters of policy that are addressed very clearly and forcefully in this report that you hopefully will be able to explore with Linda Fisher in future hearings.

They both relate to the fact that the FIFRA statute is a risk-benefit statute, and in its wisdom, the Congress envisioned years ago that science and technology and farmers would progressively figure

out better ways to control pests, and that as time went on, we probably would be able to have a cheaper, higher-quality food supply that poses progressively lower risk to the public.

In large part, that has come about. But there are two aspects of EPA's program that are fundamentally not working as Congress envisioned. One is the benefits assessment side of pesticide regulatory decision-making.

Nearly all the focus of the data call-in program, the reregistration program, and consumer concerns is on the risk side of the regulatory equation.

No one seems to ask the question "Do we really need all these materials?" It would suggest that in many instances we do not need as much pesticide as we have been using in the past.

So, as a matter of policy to implement and enforce the FIFRA law as written, EPA has got to do a more credible job of calculating pesticide benefits, taking into account more fully the non-chemical, genetic, biocontrol, IPM, kinds of options that farmers have available.

What EPA does now in estimating benefits involves a calculation at the returns to the grower with and without use of the pesticide, taking into account the likely prospect that the farmer will switch to another registered product. The EPA then calculates the difference in farmer income and calls that the "benefits" of the pesticide use.

But that calculation is not fully reflective of the range of options that are available to the farmer.

The second point that is very important is that Linda Fisher, as she discharges her responsibilities, has got to deal with both the old pesticides and the new technologies. Her office is responsible for putting in place the regulatory infrastructure for the next generation of genetic and biological technologies, many of which pose difficult policy and scientific questions about how to evaluate the potential risk from a genetically engineered virus that is going to control an insect that one of these pesticides is used on?

To the extent that EPA has been making very slow progress in facilitating the registration and easy market entry of this next generation of innovative biologically-based control technologies, they are holding back the future, which is going to change the risk-benefit equation. So that is another matter of considerable concern.

Senator LIEBERMAN. A very provocative answer. Sometime in the future, we might want to get everybody back and pursue those questions together with EPA.

While we are on this general subject, as you know, there have been various proposals around—at least around the Capitol and Washington, lately—to change FIFRA and other food safety laws.

If you have seen any of these, how fully, if at all, do you think they address the recommendations that you made in 1987 or the new report?

Dr. BENBROOK. I appreciate that question, Senator, because you are serving in an oversight capacity. Your subcommittee's challenge is to help identify areas where the FIFRA program, the statutes, the underlying regulations and the procedures are not really working cost-effectively, or using the best science, and serving the public's interest.

And you have identified a number of things in your subcommittee investigation that have been identified by many different committees of Congress in investigations over the last 10 years. These are not ad hoc problems that arise once in a while. They are structural problems that can be tied to the inconsistencies between the Food, Drug and Cosmetic Act and the FIFRA statute that almost certainly, will require legislation to correct.

I listened and was encouraged by the conviction of Senator Reid in wanting to provide EPA with additional resources. But Senator, I would ask you to share with Senator Reid my observation and firm conviction—in the current fiscal climate that this country is under—that it is incumbent on the Congress to fix some of these underlying problems with the agency at least at the same time additional resources are granted.

It does not matter how many people are working at OPP, if they continue to be forced to follow the current process and deal with a statute that is so embedded with statutory encumbrances to speedy action.

I just think there will be a very small return to the dollar in terms of public health benefits without legislative reform, and this problem is going to become very much more severe because there is so much new data coming into the agency. This new ETU study is just the tip of the iceberg.

Basically, in the next two or three years, there is going to be new, modern, toxicology packages come in several dozen pesticides, Toxicologists with knowledge of pesticides, predict that at least a third of these, are going to result in heightened toxicology concern.

Right now, EPA can deal with Alar in the spring of 1989, and they are struggling with EBDC's in the summer and the fall, and maybe there will be a new pesticide on the agenda late this year. But they are going to have to be doing 30 of these a year—30 to 40 including new product registrations—and they just are not going to be able to do it with their current tools and processes, because it is just too complicated a process.

So various Members of Congress, Mr. Waxman and Senator Kennedy, have come forward with pieces of legislation that have addressed parts of the problems.

Let me just say that the legislation on the Food, Drug and Cosmetic Act side that has come out of Henry Waxman's subcommittee that Senator Kennedy has sponsored on the Senate side has gone through a process of evolution, and I understand that a markup is about to occur in the next month or so on the House side.

Some important amendments will be adopted which, I am told, will bring that legislation largely into conformance, if you will, with the principal recommendations of our 1987 report.

That leaves undone important changes that are needed in the FIFRA statute, which is what EPA has to follow in changing the registration of any pesticides. And here is where some of the more difficult political challenges await the Congress—when you try to amend FIFRA.

Just last week, a new bill was introduced in the House by Congressman Roberts and colleagues on the Committee on Agriculture that is a long, comprehensive effort to try and get at these prob-

lems. But I think that a careful study of that bill will point out that it really does fall short and does not address a lot of the key needs.

In an attempt to build into the process some additional scientific review as well as review by Federal agencies, it actually will probably slow down the process. So from my assessment of the legislation that has been proposed, there are pieces that can be used in a comprehensive bill. But there has to be amendments to the Food, Drug and Cosmetic Act. There have to be conforming amendments in FIFRA. You cannot fix this problem from just one side or the other.

The Congress is going to have to marry two bills on the floor to do it, and I think the critical missing ingredient in all the bills is new authority for EPA to substantially reduce risk in a case like the EBDCs or Alar. EPA needs a new mechanism to reduce risk on an interim basis from where it is now or where it could be under published tolerances, to either a negligible risk level or close to it, while the EPA and the registrants collect data and go through the two or three year process that it is going to take to determine exactly how low that tolerance has to be set to really be safe.

The problem is that EPA has a red light or a green light authority. It has no way on an interim basis to substantially reduce risk. This problem makes it more difficult for EPA to face tradeoffs in reading regulatory actions on the EBDCs, Captan and Benomyl, on a dozen or so major, common crop uses.

There is going to be a high degree of crop substitution, and really the best thing for everyone involved would be to see substantial reduction in the use and the residue levels across all three of those products, but probably all three of them have a role to play somewhere in the kind of integrated management strategies that our affirmative Agriculture report emphasizes.

Senator LIEBERMAN. Your answer is right on target, and I hope we can count on your counsel as these various proposals go forward. Certainly we on the subcommittee under Senator Reid's leadership want to play an active role in the rewriting.

Mr. Goodman, I think you wanted to add something?

Mr. GOODMAN. I just wanted to make a more philosophical comment about the question of resources, and I do not have a position and I am not an expert in terms of what the EPA should or should not do with more or existing resources.

But I think that the Congress and your committee should carefully consider the alternatives, which include promoting new technology development and promoting the expansion of and availability and accessibility of proven technologies as illustrated by some of these case studies, where you will get at the question of pesticide use at a much more fundamental level—without, though, regulating or attempting to legislate just how farmers farm.

So I think there is a trade-off here, or a philosophical question that goes well beyond just resources for EPA or for FDA, and the example that I might cite is the contrasting approaches that two States have taken to the issue of pesticide contamination in ground water and other public concerns—that of California and Iowa.

In Iowa, there is great concern but a very strong focus on supporting the development and the promulgation of practices on the

farm that will in fact reduce—and my bet is that it will reduce more quickly and more effectively and more durably—the demand for and the use of pesticides in agriculture than a purely legislative or regulatory approach.

Senator LIEBERMAN. Let me ask one final line of questions having to do with EBDCs, and what you think about the manufacturers 'voluntary withdrawal, what you think the remaining risk is for the public, and what you hope EPA does.

I take it you take EBDC seriously?

Dr. BENBROOK. Absolutely. Lawful risk from EBDCs—risk the Government can not do anything about—is probably the highest risk from any pesticide now that Alar is on the way out, and that is very clear in our 1987 report.

Let me just take this opportunity, if I might, Senator, to address the question of the distribution of dietary risk from pesticides, because I really feel this is a very important point, and I want to make sure that you understand what our report did.

In 1987, we were asked to look at the regulation of pesticides with the potential to cause cancer. All of our findings about risk, and the report's recommendations related to the regulation of pesticides with potential to cause cancer, and did not look at the potential tradeoffs between cancer and neurotoxic and wildlife and other problems.

So, all the statements that I have made when I testified in April relate to what we know about the distribution of oncogenic risk in the diet from registered uses of pesticides, and I stand by those statements.

In terms of the allowable risk that Government has sanctioned through the establishment of tolerances, the estimation at "worst case" maximum permissible risk is a purely mathematical process. The distribution of risk, in our tables, which you have studied before, show that 10 pesticides account for 80-plus percent of this "worst case" risk.

There is no major dispute on this point, although questions remain about the accuracy of risk extrapolation methods. More important is the question: what about the actual risk? Our committee talked at length about actual risk, analyzed available data at great length, and in their report the committee acknowledges that it did not have access to complete reliable actual residue and actual use data on all the pesticides studied in depth. To this day, nobody has the data. It has not been generated.

So we cannot analytically answer the question in a comprehensive sense, But it was the committee's judgment—and it is stated clearly in the report—that as this data is developed, the same conclusions will hold true. The distribution of actual risk will also be heavily concentrated in relatively few pesticides and relatively few crops.

Senator REID. Could you say that again, please?

Dr. BENBROOK. The distribution of actual risk in the food supply will, when we have total knowledge, be found to be accounted for disproportionately by relatively few pesticides and relatively few uses.

Moreover, it was the committee's judgment—and again, it is stated in the report—that the committee is quite certain that the

ranking of theoretical "worst case" risks in the report will change some, but only modestly as more complete information becomes available. Some pesticides might drop off the list of the "top ten," a few might come on, but there will be a considerable degree of similarity between those two lists.

So I think that if EPA uses this new data, and the new analytical tools that they have, including the TAS system, I think they can identify a dozen or so pesticides—certainly with respect to oncogenicity—that potentially account, for the lion's share of risk is the food supply.

You know, it takes a lot of chemicals with a one-ten millionth risk to equal one use at one-one thousandth. So, I do believe that the basic scientific foundation of a strategy of targeting high-risk chemicals will be borne out.

But EPA still will face the task of having to balance all types of risk. Linda Fisher is exactly correct that when EPA deals with most of this oncogenic risk, there are still going to be a number of other regulatory problems that are brought about by immunotoxicity, neurotoxicity, wildlife effects, etc.

Now, to the EBDC voluntary cancellation request. I would point out that there is a public docket on the special review of the EBDC's. There is a letter in there on September 6—two letters on September 6 and one on September 15 that Rohm & Haas provided to me. They are a matter of public record, and they explain in great detail the logic of what they have done and why.

I am somewhat surprised that the agency has not provided these to you, because they are matters of the public record.

Senator REID. We will make that part of the record now.

[The letters referred to follow:]

Alternatives to Pesticides: Findings and Recommendations from the NAS Report Alternative Agriculture

Invited Testimony

by

Dr. Robert M. Goodman[1]
Dr. Charles M. Benbrook[1]

Mr. Chairman, thank you for the invitation to testify this morning on this complex and difficult subject. In May, 1987, the Board on Agriculture released an important report, Regulating Pesticide in Food: The Delaney Paradox. Our 1987 report highlighted problems in the current statutory and regulatory scheme governing pesticide regulation. Its basic recommendations were that:

* A negligible risk standard should be adhered to consistently in setting or adjusting tolerances for new and old pesticides.

* The standard should be applied to the combined residues of a given pesticide on all fresh and processed foods derived from a given crop.

* When several pesticides registered for use on a given crop are known to pose risks above a negligible level, EPA should develop crop-wide risk-benefit assessments, both before and after potential regulatory actions, and on this basis move forward with actions--possibly affecting several pesticides simultaneously--that appear most promising, and justified, in terms of reducing public health risks below a negligible level.

* So-called "bad actor" pesticides should be acted upon as a first order of priority.

Over two years have passed since the release of the 1987 NAS report. Some modest progress has been made by the Agency in response to the report's recommendations. Several thoughtful legislative proposals have surfaced which attempt to resolve the underlying statutory incongruities which give rise to the Delaney Paradox. Given the current climate in the

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1Dr. Robert Goodman, Vice President for Research and Development at Calgene, Inc., Davis, California, is a member of the committee which authored the report Alternative Agriculture, and a member of the NRC Board on Agriculture. Dr. Charles Benbrook is Executive Director of the Board on Agriculture, National Research Council/National Academy of Sciences.

Congress, and the apparently wide range of views that persist within the Administration regarding what the key legislative issues are, it is hard to imagine speedy passage of corrective legislation. There is also little reason to expect that EPA will be able to markedly increase the pace of administrative actions, as long as the underlying statutory and procedural problems embedded within the core provisions of the FIFRA and FDCA statutes remain unaltered and unreconciled. The consequences of this stalemate include loss of consumer confidence in the safety of the food supply, unwarranted and unpredictable losses to producers and the food industry, lessened private sector investment in innovative pest control alternatives, complications in dealing with food safety in the context of GATT and in competing for key export markets, and a perhaps misguided skewing of regulatory agency science and fiscal priorities.

On September 7, the NAS released another important report entitled Alternative Agriculture. Our new report presents a comprehensive assessment of the challenges confronting American agriculture. We attach excerpts from the report showing the committee membership and breadth of the report's scope. The report addresses a wide range of issues, including crop and animal production costs, economic performance, resource conservation, animal care, food safety, research and regulatory policy, and the impacts of government farm programs and policies. Recommendations are offered in several areas. As requested in your letter of invitation, we focus this morning on findings and recommendations related to alternatives to pesticides, and government policies impacting farmers' selection of pest control systems and technologies.

Four conclusions warrant attention this morning:

> "Well-managed alternative farming systems nearly always use less synthetic chemical pesticides, fertilizers, and antibiotics per unit of production than comparable conventional farms. Reduced use of these inputs lowers production costs and lessens agriculture's potential for adverse environmental and health effects without necessarily decreasing--and in some cases increasing--per acre crop yields and the productivity of livestock management systems."
>
> "Alternative farming practices typically require more information, trained labor, time, and management skills per unit of production than conventional farming."
>
> "Federal grading standards, or standards adopted under federal marketing order, often discourage

alternative pest control practices for fruits and vegetables by imposing cosmetic and insect-part criteria that have little if any relation to nutritional quality."

"Current federal pesticide regulatory policy applies a stricter standard to new pesticides and pest control technologies than to currently used older pesticides approved before 1972. This policy exists in spite of the fact that a small number of currently used pesticides appears to present the vast majority of health and environmental risks associated with pesticides. This policy inhibits the marketing of biologically based or genetically engineered products and safer pesticides that may enhance opportunities for alternative agricultural production systems."

Based on these conclusions and the committee's extensive assessment of the scientific literature and emerging technologies, two recommendations for change in regulatory policy are offered:

"A set of guidelines for assessing the benefits of pesticides under regulatory review should be developed. This procedure must include a definition of beneficiaries as well as an assessment of the costs and benefits of other available pest control alternatives. Benefits of control methods must be assessed as they accrue to growers, consumers, taxpayers, the public health, and the environment. As a basic rule, the benefits of any pest control method should be characterized as the difference between its benefits and those of the next best alternative, which may involve an alternative cropping system that requires little or no pesticide use. The dollar costs of the health and environmental consequences of each pest control method should be weighed against its benefits."

"Public information efforts should explain to consumers the relationship of appearance to food quality and safety. Alternate means of controlling the supply and price of fruits and vegetables should be developed. Cosmetic and grading standards should be revised to emphasize the safety of food and deemphasize appearance and other secondary criteria."

Our new report contains detailed assessments of the current status of IPM systems (pages 175-188); the economic

consequences of adoption of IPM, (pages 208-214); the economics of biological control (pages 219-224); the prospects for genetic engineering and other biotechnologies to advance less chemical-intensive and animal drug intensive production systems. A few key points warrant emphasis this morning:

* In general, farmers have the broadest array of chemical and non-chemical control options to address weed problems; a moderate array of options is available, in most cases, to control insects; and, limited non-chemical control options exist for many important plant diseases. The limited choice of non-chemical alternatives is of great concern because of the difficult choice farmers must make among registered fungicides, most of which are both costly and of toxicological concern.

* In terms of balancing risks and benefits, EPA's most difficult analytical task--and the challenge very much on this committee's mind-involves the major registered fungicides used in some regions on about two dozen important fruit and vegetable crops.

* The reliance on pesticides varies greatly across the country, and by cropping patterns. In general, IPM and biocontrol alternatives are more effective in dry, hot climates than in humid, wet regions. Hence, the benefits to a given pesticide registered for use on a given crop may be very high in one production region, but very low--or irrelevant--in another. Indeed, the local economic, environmental, and food safety consequences of pesticide use are remarkably variable. This has major implications as the Congress considers imposing new national regulatory standards and procedures.

* The problem of pesticide resistance is rapidly growing more pervasive and troubling. (See pages 123-126.) It is vital that EPA take the potential for resistance into account when assessing the impact of regulatory actions. In the case of fungicides, strict regulatory actions on the EBDC's, for example, will increase benomyl use on some crops. Sole reliance on benomyl, however, could accelerate the emergence of benomyl-resistant plant diseases, forcing farmers to make more frequent, heavy pesticide applications. The net result

may be an increase in risk and increase in pest control costs.

* The tools of biotechnology are revolutionizing the ability of scientists to understand the biology and ecology of plant-pest interactions. Many exciting new pest control technologies are moving closer to widespread commercial applications (see case studies six and eight for two examples), yet for many crops in many regions, a great deal of both basic and applied field research must be undertaken to devise resilient, effective, and affordable genetic and biological control options. In the meantime, most of us will choose to keep eating, and prudent use of pesticides will help make our culinary experiences more satisfying nutritious, and affordable.

In your letter of invitation Mr. Chairman, you asked about plant disease control alternatives. Case study number 7 (pages 336-349) focuses on four large fresh-market vegetable farms in south Florida. All four farms have employed the services of Glades Crop Care, Inc., the largest private pest scouting service in south Florida, and have substantially reduced insecticide use through a variety of IPM techniques. The case study states:

> "Regarding the direct costs of a pest control program with and without the IPM scouting, H.C. Mellinger reported that, for a fresh-market tomato crop, an average routine pesticide program applied preventatively every 2 to 5 days (without scouting) will cost the grower between $450.00 and $700.00 per crop acre for control products alone. Using IPM, a grower's direct pest control costs range from $200.00 to $300.00 per crop acre for average insect stress years. Much of this cost reduction results from the proper timing of insecticide use, which often eliminates the need for repeat applications; reduced rates of use because insecticide is applied to the early instars and stages; and the application of products only when necessary, that is, for those insects present at economic threshold levels. Another major benefit of IPM is reduced stress on the environment. Finally, there are the other benefits of reduced pesticide use, including less exposure for workers, less

demand for and wear of spray rigs, fewer pesticide containers to dispose of, and fewer supervisory hours."

The case study does not assess in great detail plant disease control alternatives. The degree of reliance of mancozeb, an EBDC fungicide, in the production of sweet corn is contrasted before and after adoption of IPM (see Tables 3 and 4 attached). Using conventional methods of disease control, farmers were typically applying one pound of mancozeb per acre 11 times, with the last application about two weeks prior to harvest. Using IPM, growers were able to achieve adequate control with just two applications, the second occurring nearly 5 weeks prior to harvest. The consequences of this reduction on residue levels will be very significant, although data on actual pesticide residue levels following adoption of IPM has not been routinely developed, nor taken into account by EPA in shaping regulatory actions or policies. As noted earlier, our report recommends that IPM and non-chemical control alternatives should be more systematically assessed and taken into account.

Thank you for the opportunity to present this testimony this morning.