

# Pests and Their Control

W. C. SHAW<sup>1</sup>

The World's populations of humans, domestic animals, and wildlife cannot exist today in a static environment. Man's survival and his standard of living depend directly on the efficiency and safety with which he changes his environment and adjusts to it.

As the population of man and domestic animals increased, he had to replace the native vegetation with productive and economical plants for food and fiber.

The vegetative shifts and other environmental changes that were necessary to improve living standards changed man's environment irreversibly.

When native vegetation is converted to cultivated areas or when cultivated fields are abandoned, a sequence of events occurs that alters not only the plant life but the populations of other organisms. Diseases, insects, nematodes, weeds, parasites, predators and other organisms often are better adapted to large areas of specialized crops than to the conditions of undisturbed regions.

A significant part of man's environment includes more than 10,000 species of injurious insects, several hundred of which are highly destructive and require continuous measures of control. There are more than 600 species of weeds that compete with crops for water, mineral nutrients, light, space and other growth requirements. Many weeds must be controlled annually on every acre of agricultural land. There are more than 1,500 plant diseases, one or more of which affect almost every crop variety. Significant damage is also caused by more than 1,500 species of nematodes and hundreds of parasites, predators, and other organisms that attack plants, animals and man.

Thirty years ago one U. S. agricultural worker produced enough food and fiber for his own needs and nine others. Today one farm worker produces enough for himself and 31 others. One-fifteenth of our people on farms, operating only half as many farms as 30 years ago, feeds a population that has grown by 50%. Americans are fed better than ever before. Yet they use only about 19% of their take-home pay for food. These

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<sup>1</sup> Assistant to the Chief, Crops Protection Research Branch, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Maryland. Invitational paper presented at the American Society of Sugar Beet Technologists meeting February 21-24, 1966, Minneapolis, Minnesota. A set of 2 x 2 slides was used to illustrate the presentation.

levels of efficiency in production could not have been attained without the use of pesticides and other nonchemical methods of pest control.

One of the most important responsibilities of our Department is to develop more effective ways of protecting man, his food and fiber supplies and his forests from the ravages of pests. Pesticides are often the most effective, and in many instances the only weapons, that can be used to control certain pests.

In achieving these objectives, the Department has vital concern for—first—the health and well-being of people who use pesticides and of those who use products protected by their use, and—second—for the protection of fish, wildlife, soil, air, water and other values in man's environment. In keeping with this concern, it is the policy of the Department to design and implement research, regulatory, and educational programs that encourage the development and use of those means of effective pest control that provide the least potential hazard to man and his environment.

Through such programs, the Department has been a major force in the effective and safe use of pesticides by farmers. This is reflected in the productivity of our farms and forests and the excellent records of pesticide safety established by American agriculture.

The Department practices and encourages the use of biological, cultural, ecological, physical, chemical and integrated methods of control. In using pesticides, emphasis is given to non-persistent and low-toxicity chemicals, whenever such pesticides are practical, safe and effective.

### Scope of Programs

Recent congressional appropriations have made it possible to expand our research, regulatory and education programs (Tables 1, 2, 3 and 4).

Table 1.—USDA funds and areas of emphasis in all programs on pests and their control,<sup>1</sup> F. Y. 1965.

Program activities	Funds \$ thousands	Percentage of total
Research and education	61,262.4	54.9
Pest control	42,295.8	37.9
Regulation and registration	2,745.6	2.5
Facilities	5,198.0	4.7
Total	111,501.8	100.0

<sup>1</sup> The data reported in this table include all funds expended within the Department by all agencies, administered by the Department in cooperation with the States, and for extramural research, regulatory, extension and information programs on pests and their control.

Table 2.—USDA research and education areas of emphasis on pests and their control, F. Y. 1965.

Lines of work	Percentage of	
	Research and education funds on pest control	Total funds on pests and control
Conventional chemicals and equipment	20.8	11.4
Nonconventional chemical, biological, genetic	39.5	21.7
Basic ecology, physiology, biochemistry	24.8	13.6
Toxicology, pathology, fate, effects	6.5	3.6
Extension, Education	6.9	3.8
National Pesticide Information Center	0.3	0.1
Coordination	0.4	0.2

Table 3.—USDA registration and regulatory activities on pests and their control, F. Y. 1965.

Pesticide program activities	Percentage of	
	Funds for registration	Total funds on pests and control
Registration verification	48.8	1.2
Residue sampling and analysis	6.1	0.2
Enforcement activities	44.6	1.1

Table 4.—USDA pest control areas of emphasis, F. Y. 1965.

Methods of control	Percentage of	
	Funds for pest control	Total funds on pests and control
Conventional chemical	37.1	14.1
Nonconventional chemical and biological	9.3	3.5
Monitoring and effects on nontargets	1.7	0.6
Quarantine and Preventative	26.9	10.2
Survey, detection, methods imp.	25.0	9.5

### Research

In our search for practical and safe control *methods*, major emphasis is being given to—

- (1) improving conventional chemicals and ways of applying them so as to reduce pesticide residues.
- (2) developing and improving non-conventional chemical, biological, physical, cultural, and related methods of control . . . and
- (3) developing plant and animal resistance to pests through breeding.

We are also expanding *basic knowledge* of the biology, ecology, physiology, and biochemistry of pests with the hope of establishing new fundamental principles in pest control.

In our research on pesticides, we are giving emphasis to developing and understanding of—

- (1) their toxicology and pathology . . .
- (2) their fate and the effects of their residues on soils, crops, and farm water supplies . . . and
- (3) their effects on the composition and nutritional value of our food supplies.

### *New Approaches*

Excellent progress is being made on new approaches to pest control. In these expanded programs, basic and applied research have been balanced. Let me mention some of our approaches.

Department economists have completed a nationwide survey on the use of pesticides in agriculture—the first ever undertaken. The results will soon be published.

In *weed control* research, scientists are developing highly selective chemical methods. To insure the safe use of conventional selective herbicides, researchers are emphasizing methods of application that avoid or minimize residues in the environment; the use of equipment and techniques for precision application of herbicides to weeds or soils . . . low-volume techniques . . . granular formulations . . . and band treatments. They are expanding efforts to develop practices that require minimum amounts of herbicides at minimum frequencies, and using mixtures of herbicides or combination treatments that include biodegradable, nontoxic surfactants to reduce herbicide residue potentials.

They are developing new formulations and herbicides that do not persist for excessive periods because plants metabolize them selectively, soil microorganisms degrade them, or other mechanisms in the soil deactivate them.

Scientists are also searching for new nontoxic, growth-regulating chemicals that will stimulate weed seeds to germinate uniformly and thus increase the effectiveness of control practices. They are emphasizing the use of such devices as flaming and the rotary hoe for mechanical control, and insects and diseases for biological control.

In research on *insects and other pests* of man, livestock, crops and forests, increasing emphasis is being given to the development of highly selective and low-persistence pesticides, and to the use of sterility techniques, sex and food attractants, and repellants. These approaches permit the control of insects without exposing much of the environment to chemical treatment.

Many crop varieties that are resistant to diseases, insects, and nematodes have been developed, and scientists are working to develop more. These breeding programs—often taken for granted

—are among the most effective pest control methods ever developed. If we did not have pest-resistant crops, the losses caused by pests would be much greater.

Soil-inhabiting bacteria have been isolated that produce antibiotic activity against fungi. Similar new approaches and expanded programs are being implemented on nematodes and their control.

Engineering programs to investigate the use of light, electricity, heat, and mechanical devices for the control of pests of all kinds are being expanded. Basic research on droplet size, spray distribution and drift control is being emphasized. Engineering principles to increase pesticide selectivity, reduce residue potentials, and restrict the amount of our environment exposed to pesticides are being investigated.

### *Pesticide Regulation*

The United States has the most comprehensive laws and enforcement procedures in the world—the most painstaking techniques ever devised—for insuring the effectiveness and safe use of agricultural chemicals and protecting man and his total environment. Our regulatory personnel are constantly reviewing and improving these procedures.

Through the Federal Insecticide, Fungicide, and Rodenticide Act, USDA is responsible for helping to assure the safety and effectiveness of pesticides shipped interstate. We work closely with the Department of Interior and Health, Education, and Welfare in activities involving pesticide registration and use. State agencies perform similar functions within their borders, and we cooperate with them.

A substantial expansion is under way in the registration effort and in enforcement activities to assure compliance with the law and to prevent misbranding and adulteration of pesticides.

A great deal of progress has been made in tightening up our registration and enforcement activities. Recent improvements in the labeling of pesticides require that key warning and caution statements on the label be more prominent, legible, and understandable. In addition, the Federal registration number is required on all labels, so the buyer can tell whether he's getting a Federally regulated product. Revised regulations also spell out precautionary labeling required for the protection of fish and wildlife.

### *Pest Control Programs*

In addition to its research and regulatory functions, the Department takes its place among the users of pesticides, in pest control and eradication programs carried out in cooperation with State agencies, growers and home owners.

In these programs, the Department is emphasizing the use of—

- (1) expanded quarantine programs to prevent the introduction of alien pests . . .
- (2) early survey and detection systems and improvement of control methods to reduce losses caused by pests . . .
- (3) conventional chemical control methods that do not leave excessive residues . . .
- (4) nonconventional chemical and biological methods such as sex attractants . . .
- (5) techniques to determine the effects of control practices on nontarget organisms . . . and
- (6) intensive monitoring programs in areas of high pesticide use.

In these monitoring programs, workers sample and analyze water, soil, crops and nontarget organisms for pesticides. Two types of programs are being conducted. First, all the Department's control programs that employ pesticides are being monitored. And second, we are monitoring representative areas of this country—such as the Mississippi Delta—that use large quantities of pesticides in normal farming operations. Our monitoring programs are planned and coordinated with related programs conducted by other agencies.

These expanded monitoring programs have introduced a new dimension into pest control. They are yielding important information on the impact of pesticides on man's total environment—information that will be invaluable in designing research programs and controlling pests in the future. The data will also be valuable in designing education programs on the safe use of pesticides and other pest control methods.

### *Education and Information*

Information has played a big part in the excellent safety record established by farmers in the use of pesticides.

In just the past two years, the Department has distributed millions of copies of safe-use literature to city dwellers. Its radio and television efforts for pesticide safety have been endorsed by the Advertising Council—support that has led to widespread and frequent use of these timely and important messages.

The award-winning motion picture, "Safe Use of Pesticides," is available from the lending library of every State Extension Service. A new film series covering many aspects of pests and their control is being prepared. Picture stories on the safe use of pesticides and on the regulatory responsibilities of the Department's Agricultural Research Service have been distributed to the newspapers, magazines and picture syndicates.

Without exception, every State Extension Service has conducted highly effective information and education programs at the State level.

Recently, the Department established a Pesticide Information Center in the National Agricultural Library in Washington, D. C., which publishes "The Pesticide Documentation Bulletin." This biweekly will inventory and summarize all literature—including related science and technology—on pests and their control.

### Coordination

The Department has developed mechanisms that will effectively coordinate, both within our Department and with other Federal Departments, our research, regulatory, control and educational programs on pests, pesticides and pest control.

Primarily, these mechanisms provide an opportunity for all the disciplines and agencies to plan, conduct and coordinate Departmental programs. The Department Committee also reviews and evaluates these programs to determine their adequacy for providing effective pest control practices that will insure adequate protection of the public health, wildlife, soil, water, forests and other values in man's environment. The committee also provides effective liaison with the interdepartmental coordinating mechanisms that have been established.

The Department has made significant efforts to coordinate programs on pests, pesticides, and pest control among Departments. The Secretary of Agriculture took the initiative in establishing the Federal Committee on Pest Control (FCPC), which was organized jointly by the Secretaries of four Departments—Agriculture, Defense, Interior, and Health, Education and Welfare.

As one of its primary responsibilities, the FCPC reviews Federal pest control programs to assure that the methods to be used are effective and safe. The work of this Committee is extremely valuable, and we are constantly reviewing our programs to determine ways and means of supporting it.

Our efforts to date represent only a start in the right direction. There is a critical need for improving cooperation within agencies, and departments of the Federal government.

Procedures for clearing and releasing new information on pest control and pesticides need to be improved, so that the public may be continuously and fully informed. A major problem here is the coordination of news emanating from one organization or agency that reflects on the responsibilities of other organizations or agencies.

At the Federal level, this difficulty is inherent in the pesticide and pest control responsibilities of the Departments of Agriculture, HEW and Interior. But we are making progress on the complex problems posed by interdepartmental release of information, through new mechanisms that have established closer worker relationships among the three agencies, and particularly through the actions of the Federal Committee on Pest Control and its Information Subcommittee.

### Future Needs in Pest Control Technology

It is known that chemical pesticides will be found in very small amounts in organisms and other components of the environment. This fact made it necessary to set tolerances for pesticides.

It is also known that some pesticides accumulate in organisms through food chains and other environmental mechanisms. These facts clearly identify two problems in pest control technology.

These problems also help to identify some of the research needs of the future. One is for a better understanding of the long-term effects of low levels of pesticides on human health and on other living organisms.

Highly specific and highly selective pesticides will also be needed. Techniques to keep rates of application at low levels are essential. Chemicals that are biodegradable and do not persist for excessive periods must be developed. Integrated control technology—including cultural, mechanical, ecological, chemical and biological methods—must be expanded as rapidly as possible.

We need to explore new approaches. More research is needed to pinpoint weaknesses in the life cycles of pests. The need will greatly increase for engineering research particularly on the engineering principles involved in pest control. Application equipment will require unusual precision. The appropriate pesticide will be applied in the minimum effective amount at the most effective time, at minimal frequencies and precisely on target organisms or areas.

If pest control methods of the future and their patterns of use are to possess the desired characteristics, State, Federal and industrial scientists will need to work together as a team in a well balanced and effectively coordinated program. If balanced programs, adequately supported, are maintained, the problems of the future can be solved and will not involve undue risk.

Thus, it seems that future progress will largely be determined by:

- (1) an understanding of the effects of chemicals on human health, plant and animal growth, soils, and the total environment of man, domestic animals, and wildlife . . .



- (2) an understanding of the limitations and risks of current practices . . .
- (3) the discovery or formulation of more selective, more specific, more efficient, safer, and more economical pesticides . . .
- (4) the development of new approaches and more effective biological, physical, cultural, ecological, and chemical techniques . . . and
- (5) ingenuity in modifying and combining these techniques and practices.

The rapid advances in pest control technology, and their acceptance by users, profoundly affect the production of crops, forests and livestock, the management of soil and water, and other values in man's environment. The significant changes in technology that are sure to come will necessitate a constant review of agricultural research, regulatory, and educational objectives and direction.

We must achieve and maintain a fine balance. On the one hand, we must protect our health and comfort, and our capacity for producing food and fiber, from the devastating hazard of pests. And on the other hand, we must protect all the important values in our environment against the potential hazards of pesticides.

I am confident that we can—and will—do both.

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