Programs on various aspects of integrated pest management (IPM) have been ongoing in most states for several years. Until fairly recently, however, the primary emphasis has been unidisciplinary and has centered around research activities. In 1972, implementation of state IPM programs began in an organized manner with the help of federal funds from the U.S. Department of Agriculture Extension Service. By 1979, USDA Extension provided over $5.4 million to new and expanding IPM programs in all 50 states (4). During this time, no parallel organized research effort was established to support this expanding implementation network. Thus, various Experiment Station and USDA groups began to examine planning and coordination mechanisms to provide for best use of research and extension resources, to seek methods of providing additional funds, and to ensure an interdisciplinary approach to IPM. The purpose of this paper is to record the events leading up to the formation of regional planning groups and describe briefly progress to date.

Commitment of USDA

It has only been about 3 years since the USDA officially announced its endorsement of integrated pest management. In a memorandum dated December 12, 1977 (3), Secretary of Agriculture Bob Bergland stated:

“It is the policy of the U.S. Department of Agriculture to develop, practice, and encourage the use of integrated pest management methods, systems, and strategies that are practical, effective, and energy-efficient. The policy is to seek adequate protection against significant pests with the least hazard to man, his possessions, wildlife, and the natural environment. Additional natural controls and selective measures to achieve these goals will be developed and adopted as rapidly as possible.”

Five months later, a USDA Science and Education Administration (SEA) IPM Coordination Team was formed with representatives from SEA-Extension, SEA-Cooperative Research, SEA-Agricultural Research, and SEA-Higher Education. Their charge was to examine existing IPM programs within USDA/SEA and then to develop a management mechanism for planning and coordinating future expansion of IPM activities.

Through a series of internal SEA reports, the Coordination Team clearly defined existing USDA resources in IPM. They developed a new program classification system that emphasized the interrelationships between basic research, control components research, systems research, extension programs, and higher education in IPM. Plans for future direction of IPM programs were presented, and considerable attention was given to overall management and planning of state, regional, and national IPM programs.

Commitment of states

The growing interest and increase in IPM activities within the state universities has been recognized over the past few years by the formation of the Extension Committee on Organization and Policy (ECOP) IPM Committee, and the Experiment Station Committee on Organization and Policy (ESCOP) Ad Hoc IPM Committee. Both ECOP and ESCOP have recently published reports of past activities and future needs in IPM (1, 2). In addition, the Resident Instruction Committee on Organization and Policy (RICOP) has a Committee on Plant Protection which recently compiled a status of planning and development of educational programs for pest management and plant protection.

Thus, the Directors of Extension, Resident Instruction and Agricultural Experiment Stations are aware of the need for planning and coordination of IPM programs.

Regional IPM planning

The genesis of a regional planning approach to coordination of teaching, extension, and state/federal research in IPM occurred on November 7, 1978. Dr. Anson Bertrand, Director of SEA, had picked this date for a meeting of interested USDA and State representatives to discuss a national-regional-state planning method for IPM. Attending the meeting were representatives of SEA-AR, SEA-CR, SEA-E, SEA-H, SEA IPM Coordination Team, ESCOP Ad Hoc IPM Committee, ECOP IPM Committee, RICOP, and USDA Office of Environmental Quality Activities. Agreement was reached that the primary planning and coordination of IPM research and extension should be at the state and regional levels, utilizing present administrative structures for this process.

The outcome of this meeting was a letter sent by Dr. Bertrand on November 27, 1978 to the chairmen of the regional associations of experiment station directors, extension directors, resident instruction directors, and the regional AR administrators. These 4 individuals from each of the 4 regions (northeast, north central, south, west) were asked to help in the development of “an effective and efficient system for planning research, teaching, and extension IPM programs at the State and regional levels.” It was suggested that the first step be the formation of a “planning committee of teaching, research and extension representatives to explore procedures for dealing with IPM.”

Reasons for regional planning

For many years, state agricultural experiment station scientists have been working with federal agricultural scientists on the planning, coordination, and execution of regional research. In fact, the Hatch Act, which is responsible for federal fund allocations to the experiment stations, specifically demands that 25% of a state’s allocation be spent on regional activities involving 2 or more states. Thus, many researchers are familiar with a regional planning process.

The purpose of regional research is to combine the scientific talent and expertise, facilities and equipment, and other resources of several states and federal laboratories to attack a common regional problem. In this way, unnecessary duplication is avoided and it is hoped that a synergism of activities will take place to the benefit of all the participating states in the region. Regional projects are planned and prepared by scientists and most are funded for periods of 5 years. Review and approval of the projects by various regional steering committees and by experiment station directors is needed before funds are allocated.

Basically the same mechanism for the same reasons is involved in regional planning of IPM programs. However, some important differences exist. First of all, much of the initial planning process has been from the top down, i.e., from directors to scientists. But as the Administrative Task Forces turned to the Working Groups, “grass roots” scientists have become more and more involved in the planning process.

Second, the important role of extension is evident in the regional IPM planning process. Although extension scientists have been involved with regional research planning in the past, there has never been a more appropriate or greater need for extension input than in our IPM programs. This is particularly true since each state has at least one federally funded extension implementation IPM project underway, and it would be poor judgment on the part of researchers to ignore these programs in their planning process. Thus, extension scientists and research scientists involved in state projects need to plan together so that the research tackled by the experiment stations can contribute immediately to implementation through extension activities. Although it is recognized that state extension programs tend to be much more independently developed because of different state needs and modes of operation, some duplication of effort and resources could surely be avoided by such a regional extension/research planning process.

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Third, the need for regional consideration of teaching and training of scientists is a relatively new concept for agricultural scientists. If IPM programs are to be implemented, people must be trained to conduct and expand the pilot projects existing. This training probably cannot and should not be done by every state in each region. The state universities need to be aware of the needs of the programs developed by research/extension, and should probably choose a few states in each region to develop a proper curriculum. Then, by some exchange process, all students in the region would be able to participate in the teaching/training program. The curriculum would be developed through planning and cooperation of all states in the region, but unnecessary duplication of effort and initiation of a teaching program in each state would be avoided.

Thus the regional IPM planning process is meant to be more than a regional research project, it is meant to include federal/state research, extension and teaching input to provide a total comprehensive IPM program for the region. The success of this regional effort depends heavily on good integration of teaching, research, and extension IPM activities at the state level. Good interaction and planning of extension and research IPM projects within the states makes regional planning a much easier process.

**PRACTICAL ASPECTS OF PEST MANAGEMENT**

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The concept of integrated pest management (IPM) has received widespread acceptance only within the past decade. Evidence of this is reflected in the increased number of articles dealing with pest management being published in scientific journals, and the increased number of papers presented at various scientific meetings. However, it is not all that new. A version of the IPM called supervised control was being practiced in alfalfa and cotton in California over 30 years ago and a sophisticated cotton insect scouting program was being used in Arkansas in the 1950s. Though these early programs were aimed at insect control, they demonstrated the advantages of extensive monitoring, which is the backbone of any pest management program.

A large number of monitoring devices and techniques are available for monitoring insects. Among the most widely used are pheromone traps. In a few cases, trap catches are utilized to determine treatment levels and chemical rates. However, the primary use for pheromone traps is to chart insect development, which tells a fieldman when he or she should be doing more extensive monitoring for a particular pest. Beating trays, sweep nets, brushing machines, and mechanical suction devices are all used to some extent. Phenology and simulation models have also been developed for a number of important pests. When used in conjunction with one or more of the above sampling methods, they can be extremely valuable as tools to aid in decision making.

Monitoring techniques and phenology models are also available for a number of plant diseases. Weed control decisions can be made based on the history of the weed species present in a particular field. Sampling methods for nematodes are also available, although little is known about treatment levels. In most situations, however, decision making is left up to the individual pest manager within the confines of broad guidelines established by experience gained in the field over the years.

Growers are becoming increasingly aware of the many shortcomings of relying on a single strategy for pest control and are demanding more extensive monitoring by their fieldman. In some cases, they are turning to private consultants for this purpose. This is not to say that chemical company fieldmen cannot do an adequate job of monitoring. Most of them do. However, in many cases, the amount of acreage they are expected to cover prevents them from doing the extensive monitoring necessary to conduct IPM programs. Despite the lack of well defined treatment levels for most pest species, and a lack of information concerning the impact of beneficial organisms, some fairly sophisticated pest management programs are now being practiced in the field.

To illustrate where we stand as far as implementation is concerned and regarding the needs and problems faced by pest managers in the field, I will briefly discuss a few programs that are currently being practiced in California.

Egyptian alfalfa weevil is the key pest of alfalfa in the Central Valley of California. Larval feeding can cause a decrease in yield and quality and heavy populations are capable of almost complete defoliation. The weevil has 1 generation per year, aestivating during the summer and moving into the fields in the fall. Mating and egg laying take place in November and December. Larvae begin appearing in late winter or early spring, reaching a peak in early March. Larval development is completed in late spring, and pupation takes place in the fields. When adults emerge, they leave the alfalfa in search of sheltered sites to spend the summer. Attempts to control Egyptian alfalfa weevil with parasites and predators have failed, and the application of chemicals to control larvae is more or less standard practice in many areas. This causes problems in some areas in the Central Valley because almonds and alfalfa are often grown side-by-side, and honeybees are necessary for almond pollination. Insecticides applied for alfalfa weevil often result in killing bees and disruption of biological control of worms and aphids.

Research has shown the best time to control the weevil is in late fall after adult weevils move into the fields and before egg laying begins. However, this program was not widely used because no economic threshold for adult weevils was established. This problem has been overcome by the use of a computer model. Using this temperature driven model allows one to: 1) sample adult weevils in the fall, 2) make projections as to what the larval population will be the following spring, 3) and to apply chemical controls during the winter when activity of honeybees, parasites, and predators is at a minimum.

This model has been field-tested for 2 years and, on the whole, has...