

A PERSPECTIVE ON PEST MANAGEMENT^{1/}

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INTRODUCTION

When Bob Mills called this summer and asked if I could come to this conference and present a talk in honor of Professor Donald Wilbur I answered "You bet". I did not realize when I agreed to come how difficult it would be to prepare for the event. I wanted to do it because of my love and respect for Professor and Mrs. Wilbur but I soon realized that it has been nearly 30 years since I have done any work in stored products entomology. It would be a mistake on my part to talk to you, a group of international experts on stored products, about stored products entomology since you have written all the publications I have access to. Bob said I should talk on integrated pest management, and this is what I will attempt to do.

But first let me say a few words about Professor Wilbur. He was and remains one of the giants in the field of stored products. Many of his publications on stored products are just as relevant today as they were when they were written. Few scientists have had as great an impact on this field as Professor Wilbur. He offered me the privilege of studying in his laboratory and I am honored to be one of his former students.

All of you know of Professor Wilbur's scientific greatness but let me say a few words about the man. When I came to Kansas State University in September 1954, I had a good idea of what I wanted to do professionally and I had only one goal here and that was to complete the Ph.D. in as short a time as possible. I set a timetable for myself and I worked hard to accomplish it, including many nights and most weekends. Professor and Mrs. Wilbur made me a member of their family. On many Saturdays and Sundays Professor Wilbur would come to the laboratory. When he left, he would insist that I go home with him where Mrs. Wilbur would feed me a good home cooked meal. There was never a holiday that they did not include me in the events they had with their family. They didn't do this only for me but for all the single students who worked in his laboratory. I really appreciated the concern and generosity they showed me.

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Professor Wilbur is a warm, generous, humorous person. He provided me and other students guidance and counsel with our studies and professional aspirations, but he did more, he made us a part of his life. He provided us a role model for our science and for dealing with other people. He has had a profound influence on my life and success and I shall always remember and love him for that.

The Integrated Pest Management Concept

I was asked to discuss perspectives in integrated pest management (IPM) and how they might apply to the control of stored product pests. The term integrated control was coined by entomologists and first used by Smith and Allen (1954) to describe a system of crop insect pest control that utilized a variety of techniques. The commonly accepted definition is the one coined by the UN/FAO Panel of Experts on Integrated Pest Control (1970) and is as follows:

"Integrated pest control is a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible manner as possible and maintains the pest population at levels below the economic injury level."

The key word in this definition is the word integrated which conveys the idea that pest management is a system involving a variety of suppression measures directed towards the control of a particular pest, or pest complex. The integrated approach also places a major emphasis on management, as this type of control program involves a continuing series of management decisions as to the right time, right place and right manner to apply a control or suppression measure. The control measures may include indirect measures such as cultural practices in a crop or sanitation practices in an elevator, or direct measures such as the application of a chemical or a physical measure.

Integrated pest management has had its greatest use in the protection of crops from insects. IPM for crops must be based on a firm appreciation of the complexities of the agroecosystem, i.e., the use of one practice in a system most always causes disturbances or perturbations in some other part of the system. There almost must be an appreciation for economic thresholds, that is, a plant or animal species is not a pest until it has attained sufficient numbers to cause economic loss to the crops being produced within the system. At this point, direct control measures such as the application of a pesticide must be used to prevent loss.

The essential factors involved in the development of an IPM system then is a good understanding of the pest ecosystem and the establishment of economic injury levels against which the pest must be managed. One might say that IPM is a system for managing a commodity so that pest-inflicted losses are held to tolerable levels. In this sense, IPM could be used as well with stored commodities as field crops.

Application of Integrated Pest Management

IPM has had its greatest application in crop protection although there has been some application for protection of animals and stored products.

Successful IPM programs have been developed for suppression of pest insects and mites on a number of crops including sorghum, soybeans, alfalfa, cotton, corn, peanuts, apples and other tree crops. Typically, these programs involve an overall strategy of crop management using many tactics for suppressing pests. Tactics may include changes in cultural practices, the growing of pest-resistant varieties, changes in harvesting practices and the selective use of pesticides. The main rationale is to make conditions favorable for the crop and the natural enemies but unfavorable for the pest.

With crops, we are now evolving to a system of integrated crop management involving the development of ways for managing a crop to the detriment of all its pests, insects, diseases, weeds and nematodes.

With regard to stored products one could say IPM has been used for years even though it has not been called IPM. For a long time, stored product entomologists have been using a variety of techniques for controlling insects. This includes plant sanitation, drying, cooling, aerating, cleaning, turning and fumigating. In good plants, these are used with careful management in a systematic manner. To me, it is the results that count and not what you call the system of control. In fact, we should be concerned that some members of our profession are trying to find a way to put all pest control under the IPM umbrella.

The Future of IPM

What does the future hold for IPM? The IPM concept has been around for a long time and the foundations were laid by some of the earliest members of our profession. It is only since the late 1960's that the term IPM became prominent because of its promise in freeing us of the unilateral dependence on chemicals for pest insect control.

The first major prominence for IPM came in 1972 as a result of the Huffaker Project, which involved 18 universities and more than 250 scientists who were devoted to developing more effective, less chemically dependent methods for controlling insects and mites on cotton, soybeans, alfalfa, apples and citrus. This project, funded at about \$2.0 million per year, was to my knowledge the largest centrally managed and funded research project in agriculture ever. It certainly was in crop protection. This was followed in 1978 by an even larger project, the Consortium of Integrated Pest Management (CIPM) involving 16 universities and nearly 300 scientists. This project, funded at \$3.1 million per year, expanded research begun under the Huffaker Project but includes all pests on the crops of concern -- alfalfa, apples, cotton and soybeans.

As a result of the publicity, the publications, and the grant funds generated by these projects, IPM became very popular and many people wanted on the bandwagon. The term IPM not only began to show up regularly in scientific literature, it became more prominent in grant requests and as budget items in state and federal appropriations for research. This caused many people to become interested in doing IPM research. Even the animal scientists have developed an IRM (Integrated Reproduction Management) project which they have been trying to get funded.

I am sorry to report that the term IPM is beginning to lose its appeal. The USDA budget-makers are looking for other areas to support and IPM funding is getting harder and harder to obtain. Even some of our directors are turning away from IPM to new priorities.

I believe we are near the end of an era of funding for the large consortium-type multidisciplinary projects involving IPM. This is a major disappointment to those of us who have championed this new and highly effective model for managing multidisciplinary research among the land grant universities on large national problems. The management technique used by the consortia differed from the traditional regional project in that the involved scientists were provided extra funding when they came into the project. Continued funding for each scientist was determined on the need for their contribution to the project and on an evaluation of their contribution by an outside panel of reviewers.

Grant funding in the near future for IPM research will go to individuals and small multidisciplinary teams. Hopefully, some funding will be obtained for regional research projects which will be funded and administered in a manner similar to that used by the consortium projects. It will be difficult under the present circumstances to gain large amounts of money in the federal budget for IPM research and extension activities. The IPM concept is as good as ever and I urge those of you employed in the USDA/land grant system to continue to stress to your research directors the importance of IPM. Funding for research and extension IPM programs should be maintained as high priority items but it will not without effort on our part and that of our colleagues in the pest-related disciplines.

An International Perspective for IPM

The importance of IPM will continue to grow in this country and abroad because first, it is a common sense strategy for controlling pests and secondly, the competition between man and pests for food is becoming increasingly more severe in many parts of the world. The problem is particularly acute in the lesser developed countries (LDC's) where food already is scarce.

There are more than 4 billion people in the world today and this number is being increased at the rate of more than 200,000 daily. Demographers predict that the human population will increase to more than 6 billion by the year 2000 and to 10 to 16 billion by 2100.

On the average, world food production is projected to increase more rapidly than the human population. However, most of this increase will be in the developed countries. In the LDC's, where the population is increasing at the greatest rate, food production per capita is not expected to increase and may even decline, as is happening in Africa.

The solution to the food production problem will not come from placing new land into cultivation. Instead it must come from the development and implementation of new technology that will increase the genetic potential for higher yielding varieties, reduce energy requirements for crop production, lessen the need for fertilizer and irrigation, and reduce preharvest and postharvest pest losses. If pest losses could be reduced by 80% or 90%, this alone would do much to alleviate food shortages in many LDC's.

Insects, diseases and weeds inflict losses to world crops that are estimated to average 35% per year. Worldwide, postharvest losses to pests are estimated to range between 10% and 20% annually. In the United States, the loss amounts to 15 to 23 million tons annually, with 7 million tons attributed to rats and 8 to 16 million to insects. In Latin America, 25% to 50% of the harvested grains are lost in storage. Losses to 30% to 50% are averaged in Southeast Asia and Africa. The combined pre- and postharvest pest losses to the world's food supply is estimated to be about 45% per year. This is almost half of the world food supply, and it may be more than half in many LDC's. It is a loss that is becoming increasingly intolerable in many countries. Within another generation or two, this level of pest loss will be intolerable to most countries. But put another way, if improved pest control practices could eliminate 50% of these losses it would increase the world food supply by 25% (Schwartz and Klassen 1981).

Many of the LDC's will never be able to produce sufficient food to feed their people. Their subsistence farmers need improved varieties and better production methods for producing crops and livestock. In addition, they need simple, economical and effective ways for protecting their produce after harvest. Pest protection is needed not only on the farm but as the products move through the markets to final consumption.

If strife and pestilence is to be averted, the major grain producing countries of the world -- U.S., Canada, Western Europe, Brazil and Argentina -- will have to supply much of the needs of the LDC's. As grain and food products are moved through international markets there is a great need for pest protection, and especially after the grain or food product is delivered to a port in an LDC. It is disheartening to visit some of these countries and see grain, flour and other food products unloaded in good condition from a U.S. ship and then placed in an environment where it is exposed to weather, insects, rodents and birds. Many times the products never make it in an edible condition to the hungry for which they were destined.

Clearly, the scientific disciplines represented here have much more to do in developing and implementing improved pest management systems for

protecting the world's food supply. There clearly needs to be greater effort made in teaching our colleagues in the LDC's how to better protect their food both in the field and in storage. As the human population increases, the competition for food between man and pest will become increasingly more important. We can not continue to let pests have so much of our food. Thus, our jobs as pest management specialists and protectors of the food supply will become even more important. A broad spectrum of research and developmental activities will be required ranging from the implementation of existing technology to the search for new scientific frontiers. The future prospects for all agricultural research and extension activities, and particularly pest management, are exciting. Perhaps, it may be the most exciting time ever. I look forward to participating, as the ability of the world to feed its people will depend on our success.

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