AREAWIDE MANAGEMENT OF INSECTS BY THE STERILE INSECTS TECHNIQUE AND OTHER BIOLOGICAL MEANS

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Science achieved a breakthrough in the discovery and development of many highly effective synthetic chemical insecticides that makes it possible to control most of the insect pests that attack agricultural production and the comfort and health of people. These developments during the past 50 years have been of great benefit to humankind throughout the world.

But the intensive use of these synthetic chemicals, most of which have broad-spectrum activity has been a matter of grave concern to many people over the potential hazards they create to food and the environment.

Therefore, pest management scientists throughout the world began intensive investigations to develop ways to control insect pests that do not create such hazards. Many of the scientists concentrated their efforts on safer ways to use the insecticides available, while others concentrated their efforts on alternative but safer ways to control insects. Renewed efforts were made to develop various kinds of insect attractants and to develop resistent host plants. Special attention was given to biological control procedures such as the use of insect microbial agents, parasites, and predators. They also explored new approaches such as the sterile insect technique.

The spectacular success of the sterile insect technique for the eradication and management of the screwworm, a serious animal parasite, was achieved in the late fifties and sixties and led to considerable research to develop this new insect control procedure for other important insects. The technique proved to be effective for eradicating or preventing the spread of the medfly and other fruit flies in various parts of the world. Scientists in Japan eliminated the melon fly, an important pest of vegetables, from Okinawa. The technique is being used in a limited way in Africa to eliminate tsetse flies after high populations are first reduced by the use of insecticides. The technique also has limited use or looks promising for other insect pests. But when viewed from a broad perspective, this environmentally desirable control procedure thus far has not been used against a wide range of insect pest problems.

However, the same can be said for other alternative control methods. Biologists have obtained a wealth of new information on insect parasitism and insect pathogens. Research on insect attractants has been outstanding. But the use of broad-spectrum insecticides has continued to dominate insect pest control procedures. Safer and more judicious use of insecticides has come into being by a system of management referred to as Integrated Pest Management(IPM). But the system that has evolved is largely a defensive-reactive procedure that is used on a farm-by-farm and crop-by-crop basis at the discretion of individual farmers. But, this procedure has fundamental weaknesses when related to the dynamics of insect pest populations. It gives the more dynamic species every opportunity to reproduce successfully until they reach their normal population levels. Unfortunately, most of the more promising and environmentally acceptable alternative procedures are either impractical to use after the pest populations have reached high levels, or they do not give dependable results because of slow action or insect movement factors. Thus for the most part

the advances that have been made on other more ecologically desirable ways to control insects have remained largely stagnated.

"New Strategies Needed"

I have long had the view that preventive measures would offer more rational ways to deal with major insect pest problems if practical and safe methods of regulating insect populations could be developed. The sterility technique offered possibilities, but its density dependent suppression action and the necessity to use the technique on an areawide basis were regarded by many scientists as serious limitations. The pest management community in general and many of the agricultural and environmental leaders in both the public and private sectors seemed not to see the necessity of undertaking large scale areawide programs so long as farmers have the means of dealing with most insect pest problems by the use of insecticides. Thus, the concept of areawide preventive control procedures for the most part has been rejected. Nevertheless, I have continued to analyze the suppression characteristics of various alternative insect control methods when used alone and when integrated. The results of these investigations have convinced me that we have all the basic technology needed to rigidly manage populations of many major insect pests on an areawide basis by environmentally benign and economically sound procedures.

The sterility and other genetic manipulations and the parasite augmentation techniques in particular offer outstanding opportunities for managing insect pest populations on an areawide basis at low costs. The two techniques have a number of similar suppression characteristics. They both involve the use of mobile biological organisms, which virtually rules out their practical use on a small scale in unisolated areas. But this is one of the most desirable characteristics when used on an areawide basis. Both techniques have density-dependent suppressive actions. This limits their usefulness when pest populations have already reached their damage levels, but this makes them highly effective and practical for maintaining pest populations below significant damage levels. This is the very objective of preventive pest management systems. Most importantly both techniques are virtually target pest specific. To achieve pest management by pest specific means has been the primary goal of pest management scientists since the new broad-spectrum insecticides came into being and the hope of those concerned over the environmental consequences of non-selective pest control methods.

"Outlook for the Future"

The time will come - and very soon - when agriculture worldwide will be faced with the monumental task of producing enough food for the expanding world population. And this will have to be accomplished on diminishing agricultural lands. Nevertheless, people will - and should - demand that this be accomplished without undue risks to the safety of the food we eat and the safety of the environment in which we live.

To accomplish this, we must change from reactive pest management procedures based on the use of insecticides to low cost proactive

preventive systems designed to keep pest populations below significant damage levels using biological means. This will require development of efficient procedures for mass producing and releasing the needed biological organisms. Fortunately, Nature has already given us the basic tools - the pests themselves and hundreds of parasite species - that can be used in augmentation systems. Admittedly, producing the many organisms required will be a major challenge for insect rearing scientists. However, based on their past achievements, I am confident they will experience few obstacles, given appropriate resources. The investment in such research will be minimal compared with the large economic and environmental benefits that will be realized.

In conclusion, effective, efficient and safe ways to control our major food competitors is the challenge that insect pest management scientists worldwide must meet in the years ahead. Based on years of research and investigations into the principles and concepts of biological insect pest control procedures, it is my conviction that science already has or can readily develop the information and basic technologies that will be needed to manage most of the world's major insect pests in an effective, environmentally safe and economically sound manner.